

The Module Descriptors

1.1 Semester-I

The module descriptor of the semester-I are found in this section.

Module Code and Title	:	MAT101 Engineering Mathematics-I
Programme	:	BE in Civil Engineering
Credit	:	12
Module Tutor	:	Mrs. Jyoti Lakshmi S & Ms. Tshering Denka
Module Coordinator	:	Mrs. Jyoti Lakshmi S

General objectives:

To develop the student's abilities in mathematics, in particular the concept of Differential Calculus, Integral Calculus and Differential Equation that finds applications in various fields of Engineering.

Learning outcomes:

On completion of the module, students will be able to:

1. Differentiate a function successively and also able to apply Leibnitz's theorem to find the nth derivative of the function.
2. Apply appropriate Mean Value Theorems to expand the given function.
3. Identify the indeterminate form and evaluate the Limits.
4. Use Partial Differentiation to find the Jacobians of functions of two or more variables and expand the two variable functions by Taylor's series.
5. Choose the appropriate application of partial differentiation to find the Maxima and Minima of functions of two variables.
6. Employ Reduction formula to find the Integral and Definite Integral of functions. They will also have knowledge of geometric applications of the methods presented.
7. Apply appropriate methods to test the Convergence and Divergence of different infinite series.
8. Solve Differential Equations of first order first degree and first order higher degree.
9. Find the Rank of a Matrix.
10. Solve Simultaneous Equation by Matrix method.
11. Use the problem solving skills through the subject material.

Learning and Teaching approach used:

Approach	Hours per Week	Total Credit Hours
Lecture	4	60
Tutorial	1	15

Independent study/self-directed learning	3	45
Total		120

Assessment approach:

<i>SL. No</i>	<i>Mode of Assessment</i>	<i>Nos.</i>	<i>Marks Allocated</i>	<i>Marks (%)</i>
1	Continuous Assessment (Theory)			
1.1	Term Test: Closed Book, One hour duration in 5 th Topic: Mean Value Theorem	1	10	30
1.2	Term Test: Closed Book, One hour duration in 10 th week Topic: Differential Equations and Matrices	1	10	
1.3	Class Test: Closed Book, One hour duration in 12 th week Topic: Integral Calculus	1	5	
1.4	Assignment I in 7 th week Topic: Mean Value Theorem	1	2.5	
1.5	Assignment II in 13 th week Topic: Infinite Series	1	2.5	
2	Semester End Examination: Closed book, 3 hr duration	1	70	70

Pre-requisite: None

Subject matter:

Unit I: Differential calculus

- 1.1. Successive differentiation
- 1.2. Leibnitz's Theorem

Unit II: Mean Value Theorem

- 2.1. Rolle's Theorem
- 2.2. Geometrical Statement

- 2.3. Lagrange's Mean value Theorem, Geometrical statement of the theorem;
- 2.4. Cauchy's mean value theorem;
- 2.5. Higher mean value theorem or Taylor's development of functions in a finite form With Lagrange's form of remainder, Maclaurin's development of $f(x)$ with Lagrange's form of remainder, Taylor's development of a function with Cauchy's form of remainder;
- 2.6. Indeterminate form and Evaluation of limits $0/0$ form, ∞/∞ , $0 \times \infty$, other forms;
- 2.7. Expansions Taylor's Infinite Series, Convergence of Infinite series, Maclaurin's Infinite Series;
- 2.8. Partial Differentiation- Functions of two variables. Continuity in a domain, Limit of a function, Limit of a continuous function, Partial derivatives and partial derivatives of higher order.
- 2.9. Homogenous functions and Euler's theorem of Homogeneous functions, Choice of Independent variables, Theorem of total differentials, Composite functions and theorem of composite function, Implicit functions(Typical cases), Error determination, Jacobian's, Taylor's series of two variables.
- 2.10. Applications of Partial Differentiation - Maxima and Minima- Lagrange's method of undetermined multipliers, Differentiation under the Integral sign- Leibnitz Rule.

Unit III: Integral Calculus

- 3.1. Definite Integral as the limit of sum
- 3.2. Reduction formula
- 3.3. Application of Length, Area, Volume, Surface area of revolution.

Unit IV: Infinite Series

- 4.1. Introduction, Definitions
- 4.2. Convergence, Divergence, and Oscillation of a series
- 4.3. General properties of a series
 - 4.3.1. Series of positive terms
 - 4.3.2. Comparison test, Integral test, Comparison of ratios
 - 4.3.3. D'Alembert's ratio test
 - 4.3.4. Raabe's test Logarithmic Test, Logarithmic Test, Cauchy's root test

- 4.4. Alternating Series, Leibnits Rule, Series of positive or negative terms, Power series, Convergence of Exponential, Logarithmic and Binomial series,
- 4.5. Procedure for testing Series for convergence
 - 4.5.1. Uniform convergence, Weirstrass's M-Test,
 - 4.5.2. Properties of uniform convergence of a series

Unit V: Differential Equations

- 5.1. Introduction, Definition, degree, Order and solution of a differential equation
- 5.2. First order First Degree Equations
 - 5.2.1. Variable separable
 - 5.2.2. Homogeneous Equation,
 - 5.2.3. Equation reducible to Homogeneous
 - 5.2.4. Linear differential equation
 - 5.2.5. Bernoullis form, Exact differential equation, Equation of first order and higher degree.

Unit VI: Matrices and Determinants

- 6.1. Definition and elementary operations, Addition, subtraction and multiplication of matrices
- 6.2. Determinants
 - 6.2.1. Expansion of determinants
 - 6.2.2. Properties of determinants by counter examples
 - 6.2.3. Minors and co-factor of a determinant
 - 6.2.4. Determinant of a square Matrix
 - 6.2.5. Adjoin of a square matrix, Matrix inverse
 - 6.2.6. Solution of simultaneous equation by Matrix method
 - 6.2.7. Rank of a matrix, Elementary transformation of a matrix

Reading List:

Essential Reading:

1. Kreyszig, E. (2002). *Advanced Engineering Mathematics* (8 ed.). Singapore: John Wiley & Sons (Asia) Pvt Ltd.
2. Grewal, B.S. (2001). *Higher Engineering Mathematics* (36 ed.). New Delhi: Khanna Publishers.
3. Dass, H.K. (2005). *Advanced Engineering Mathematics* (14 ed.). New Delhi: S.Chand & Company Ltd.

Additional Reading

1. Jain, R. K., & Iyengar, R.K. (2003). *Advanced Engineering Mathematics* (2 ed.). New Delhi: Narosa Publishing house.
2. Prasad, I. B. (1982). *Practical Mathematics Vol I and Vol II* (6 ed.). New Delhi: Khanna Publishers.
3. Rao, S. B., & Anuradha, H. R. (1996). *Differential Equations with Application and Programmes* (1 ed.). Hyderabad: Universities Press (India) Ltd.
4. Vasishtha, A. R. (2002). *Matrices* (32 ed.). Meerut: Krishna Prakashan Media (P) Ltd.

Date: March 31, 2016.

Module Code and Title	:	PHY101 Engineering Physics – I
Programme	:	BE in Civil Engineering
Credit	:	12
Module Tutor	:	Mr. Rajesh Subedi / Mr. KelzangDorji
Module Coordinator	:	Mr. Rajesh Subedi

General objective:

This module will provide students with fundamental understanding of physics and the engineering knowledge work for a variety of technical position. This will also facilitate student learning through problem solving skills related to engineering field.

Learning outcomes:

On completion of the module, students will be able to:

1. Convert units from one system to other system
2. Apply vectors in plane and polar co-ordinates
3. Calculate the position, velocity and acceleration (graphically and numerically) in 2D and 3D
4. Calculate the forces related to position, velocity and acceleration using Newton's law.
5. Analyze the formation of waves on stretched string
6. Analyze the results of observed practical experiments
7. Analyze the relationship between graphs and equations and how they represent physical situation.
8. Analyze the motion under gravity in relation to the value of 'g'.
9. Relate motion of projectile with escape velocity.

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	4	60
Practical	2	30
Independent study/self-directed learning	2	30

Total	120
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Assessment approach:

Sl. No.	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
1	Continuous Assessment (Theory)			
1.1	Term Test: closed book, one hour duration in 5 th and 10 th week.	2	20	25
1.2	Assignment: One week duration for each assignment, 4 th and 8 th week.	2	5	
2	Practical			
2.1	Lab Record/Regular Laboratory assessment (weekly assessment).		10	25
2.2	Practical Exam: Closed book, 2 hour duration in 14 th week.	1	10	
2.3	Viva-Voce: Closed book during the practical exam.	1	5	
3	Semester Examination: 3 hrs duration, closed book.	1	50	50

Pre-requisites: None.

Subject matter:

Unit I: Revision of Mathematical Tools Applied to Physical Problem

- 1.1. Units and their conversion.
- 1.2. Vector operations in Cartesian and plane polar co-ordinates with physical examples.
- 1.3. Function plotting with physical examples; No derivation of the equations to be done.
- 1.4. Analysis of force-2D and 3D by vector method
- 1.5. Moment by vector method

Unit II: Kinematics

- 2.1. Need of frames of reference in describing motion
- 2.2. One Dimensional motion
- 2.3. Two dimensional motion
- 2.4. Velocity and acceleration in polar coordinates.
- 2.5. Relative velocity
- 2.6. Motion with uniform velocity and uniform acceleration
- 2.7. Motion with varying velocity and varying acceleration
- 2.8. Motion under gravity
- 2.9. Projectile

Unit III: Dynamics

- 3.1 Introduction to Survey of common forces in nature
- 3.2 Newton's laws of motion; The need of First law in defining inertial frames;
- 3.3 Variable mass problems

- 3.4 Central forces; Inverse square force
- 3.5 Oscillations; General potential with stable equilibrium point, Solution of Differential equation with emphasis on initial conditions, Damped and forced oscillation.

Unit IV: Waves

- 4.1 Waves on a stretched string,
- 4.2 Differential equation of wave
- 4.3 Description of general solution $f(s \pm vt)$
- 4.4 Longitudinal and transverse waves;
- 4.5 Superposition of waves,
- 4.6 Plane monochromatic waves, $v = n\lambda$
- 4.7 Plane, spherical and cylindrical wave fronts

Unit V: Optics

- 5.1 Introduction to nature of light
- 5.2 Interference of light; Coherent sources
- 5.3 Young's double slit
- 5.4 Thin films
- 5.5 Michelson's interferometer
- 5.6 Diffraction
 - 5.6.1 Fraunhofer single slit diffraction resolving power
 - 5.6.2 Two slit diffraction plane diffraction grating
- 5.7 Spectrum resolution
- 5.8 Polarization of light

List of Practical:

- 1. Measurement of length and diameter of wire using screw gauge
- 2. Measurement of length and thickness using slide/ vernier callipers
- 3. Measurement of diameter of a capillary tube using travelling microscope
- 4. Study of oscillatory systems of a mass spring oscillator to determine 'g'.

- 5. Measurement of wavelength of light using Interference of light from (a) Sodium source and (b) Helium-Neon source by 1. Newton' ring and 2. Air wedge methods
- 6. Study of diffraction of light using sodium and mercury source to find the wavelengths of primary colours of light

Reading List:

Essential Reading:

- 1. Verma, H. C. (2009). *Concepts of Physics Part-I*. New Delhi: Bharati Bhawan (P&D).
- 2. Halliday, D., Resnic, R., & Walker, J. (2014). *Fundamentals of Physics* (10 ed.). New York: John Wiley & Sons Inc.

Additional Reading:

- 1. Gaur, R. K., & Gupta, S. L. (2001). *Engineering Physics* (8 ed). New Delhi : Dhanpat Rai Publication (P) Ltd.

2. Arumugam, M. (2002). *Engineering Physics*. New Delhi: Anuradha Agencies.
3. Kleppner, D., & Kow, R. J. K. (1986). *An introduction to Mechanics* (4 reprint). New York: McGraw Hill Book Inc.
4. Jenkins & White (1984). *Optics*. New Delhi: McGraw-Hill Book Company.

Date: March 31, 2016

Module Code and Title : CHE101 Engineering Chemistry
Programme : BE in Civil Engineering
Credit Value : 12
Module Tutors : Mr. Basant Pradhan & Mr. Bharat K Humagai
Module Coordinator : Mr. Basant Pradhan

General Course Objectives:

The objective of the module is to enable the students to understand the basic concepts, theories and principles of chemistry as a base of building and testing theories and practical involving in engineering chemistry. Also to apply the basic chemical concepts to problem solving and applying chemical knowledge to personal decisions involving chemical products and the development of the student's abilities to make observations and carry out measurements in the laboratory and to draw conclusions based on those observations or measurements.

Learning Outcomes:

On completion of the module, students will be able to:

1. Explain the concept of atoms.
2. Describe the principle of thermodynamics.
3. Compare addition polymerization reactions with condensation polymerization.
4. Suggest the right metal/alloys for the right purpose.
5. Illustrate the working of the electronic devices using the concept of nanochemistry and its applications.
6. Interpret the concept of rusting and its control.
7. Calculate the calorific value of the fuels.
8. Use analytical skills and techniques in carrying out experiments in the laboratory.

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	3	45
Practical	2	30
Tutorial	1	15
Independent study/self-directed learning	2	30

Total	120
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Assessment approach:

Sl. No.	Mode of Assessment	Nos	Marks Allocated	Marks (%)
1	Continuous Assessment (Theory)			
1.1	Term Tests: Closed book, one hour duration in 5 th and 10 th week Two units will be covered for term I and five units for term two.	2	20	25
1.2	Assignment: In 2 nd and 5 th week Focus will be given to applied Chemistry Two units will be covered.	2	5	
2	Continuous Assessment (Practical)			
2.1	Regular Practical Class: 2 hrs each every week	8	10	25
2.2	Practical Exam: 2 Hrs at the end of the Semester	1	10	
2.3	Viva-Voce: At the end of the Semester	1	5	
3	Semester End Examination: 3 hrs duration, closed book	1	50	50

Prerequisite: None

Subject Matter:

Unit I: Atoms

- 1.1. de Broglie's formula
- 1.2. uncertainty principle
- 1.3. Wave mechanics,
- 1.4. Schrodinger equation
- 1.5. Particles in one dimension, degeneracy
- 1.6. Radial probability distribution functions

Unit II: Molecules

- 2.1 LCAO method of diatomic
- 2.2 Hybridization (sp^3d , sp^3d^2 , sp^3d^3) and molecular orbital theory

Unit III: Physical Chemistry

- 3.1 Energetic of chemical reaction and effect of temperature.
- 3.2 Application of thermodynamic principles to chemical reactions.
- 3.3 Feasibility and prediction of chemical reactions.
- 3.4 Thermodynamic calculation of equilibrium constants.

3.5 Gibbs Helmholtz equation.

Unit IV: Polymer Chemistry

- 4.1 Introduction
- 4.2 Classification of polymers and polymerization.
- 4.3 Addition and condensation polymerization.
- 4.4 Chain growth and chain transfer polymerization.
- 4.5 Free radical, cationic and anionic polymerization and their mechanism.
- 4.6 Coordination polymerization and copolymers.
- 4.7 Tacticity of polymers.
- 4.8 Synthesis, properties and application of: polyethylene, polyvinyl chloride (PVC), polystyrene, phenol formaldehyde, epoxy resins, acrylonitrile butadiene styrene.
- 4.9 Compounding of plastic (natural rubber and synthetic rubber).
- 4.10 Synthesis, properties and application of: Styrene-butadiene rubber, Neoprene, butyl rubber, silicon rubber.

Unit V: Metals and Alloys

- 5.1 Introduction
- 5.2 Physical properties of metals, Cast iron, wrought iron, steel, heat treatment of steel
- 5.3 Definition of alloys, purpose of making alloys, classification of alloys, alloys of steel and its application, nonferrous alloys and its industrial application.

Unit VI: Fuels and Combustion

- 6.1 Classification of fuels
- 6.2 Calorific value-LVC, HVC
- 6.3 Measurement of calorific value using bomb calorimeter (Numerical problems).
- 6.4 Knocking and anti-knocking for petrol and diesel (Octane number and cetane number).
- 6.5 Petroleum, refining of petroleum by fractional distillation.
- 6.6 Diesel index. LPG, natural gas, CNG-composition and application.
- 6.7 Biodiesel and Biogas-composition and application.

Unit VII: Nanochemistry

- 7.1 Introduction – properties (electrical, mechanical and vibrational)
- 7.2 Carbon nano tubes – applications in fuel cells,
- 7.3 Catalysis and use of gold nanoparticles in medicine.

Unit VIII: Corrosion and its Control

- 8.1 Corrosion
- 8.2 Consequences of corrosion

- 8.3 Types of corrosion (galvanic corrosion, concentration cell corrosion, pitting corrosion, crevice corrosion, stress corrosion, erosion corrosion, selective leaching)
- 8.4 Theories of corrosion (chemical/dry corrosion, electrochemical corrosion)
- 8.5 Factors influencing corrosions.
- 8.6 Protection against corrosion.

List of Practical:

1. Preparation of one organic compound.
2. Preparation of one inorganic complex.
3. Estimation of metal by complexometric method.
4. One number of acid base titration.
5. One number of redox titration.
6. Estimation of iron in Haematite ore.
7. Estimation of copper in brass alloy.
8. Estimation of ferrous ion in ferrous sulphate solution.
9. Determination of rate constant for chemical reactions.

Reading List:

Essential Reading:

1. Dara, S.S. (2004). *Engineering Chemistry*. New Delhi: S. Chand and Co. Ltd
2. Jain, P.C., & Jain, Monika. (1993). *Engineering Chemistry* (10 ed.). New Delhi: Dhanpat Rai Publishing Company.
3. Ahluwalia, V.K., & Parashar, R. K. (2009). *Organic Reaction Mechanisms*. New Delhi: Narosa Publishing Chemical.
4. Murthy, N. K., Vallinayagam, P., & Madhavan, D. (2009). *Engineering Chemistry* (2 ed.). New Delhi: PHI publishing company.
5. International Council of Associations; *Addressing the Avoided Emissions Challenge (2013)* Dr. Kurt Bock.
6. Springer, Retrieved from website;
https://www.google.bt/?gws_rd=ssl#q=free+ebooks+on+nanochemistry+pdf

Additional Reading:

1. Lee, J. D. (2008). *Concise Inorganic Chemistry* (5 ed.). London: Chapman and Hall, Blackwell Science Ltd.
2. Glasstone, S. (1996). *Physical Chemistry* (4 ed.). USA : Hardcover Krieger Publishing Company.
3. Negi, A.S., & Anand, S. C. (2008). *A Text book of Physical Chemistry*. New Delhi: NGLI publisher

Date: March 21, 2016

Module Code and Title : EGP101 Engineering Graphics
Programme : BE in Civil Engineering
Credit : 12

Module Tutor : Ms Yeshi Choden & Mr. Gom Dorji

Module Coordinator : Ms. Yeshi Choden

General Objective:

To introduce the students to the importance of graphics in engineering, facilitate geometrical constructions and projections and appraise the importance and scope of engineering graphics.

Learning Outcomes:

On completion of the module, students will be able to:

1. Illustrate drawing layout and templates.
2. Use scales and dimensions in geometrical constructions.
3. Sketch the projections lying in different quadrants and orientations.
4. Illustrate practice perspective orthographic and isometric views of objects.
5. Demonstrate project points, lines, planes and solids.
6. Draw simple components using Computer Aided Design (CAD)
7. Interpret engineering drawings.

Learning and Teaching Approach:

Lectures are used as the basic method of introducing new concepts and engineering drawings. The time allocated for these activities are given below:

Approach	Hours per Week	Total Credit Hours
Lecture	1	15
Practical	6	90
Independent study	1	15
Total		120

Assessment Approach:

<i>Sl. No.</i>	<i>Mode of Assessment</i>	<i>Nos.</i>	<i>Marks Allocated</i>	<i>Marks (%)</i>
1	Continuous Assessment (Theory)			
1.1	Term Test: Closed book, two hour duration in 5 th (Unit: I-III) and 10 th week (Unit: IV-VII)	2	20	50
1.2	Assignment: One week duration for each assignment i.e. pencil drawing in 3 rd & 7 th week and one AutoCAD drawing in 10 th week.	3	30	
2	Semester Examination: Four hours duration pencil drawing closed book	1	50	50

Pre-requisites: None

Subject Matter:

Unit I: General

- 1.1 Importance, significance and scope of engineering drawing, lettering,
- 1.2 I.S. drawing conventions- line symbols, kinds of line, drawing sheet lay-out, rules of printing, sense of proportioning.

Unit II: Size Description

- 2.1 Tools of dimensioning, size and location dimensions.
- 2.2 Principles and conventions of dimensioning, types of scales and their construction and uses, preferred scales.

Unit III: Projection of Points and Lines

- 3.1 Introduction to planes of projection, reference and auxiliary planes.
- 3.2 Projections of points and lines in different quadrants, traces, inclinations, and true lengths of the lines.
- 3.3 Projections on auxiliary planes, shortest distance intersecting and non-intersecting lines.

Unit IV: Projections of Planes

- 4.1 Different cases of plane figures (of different shapes) making different angles with one or both reference planes and lines lying in the plane figures making different given angles (with one or both reference planes).
- 4.2 Obtaining true shape of the plane figure by projection.

Unit V: Projection of Solids

- 5.1 Projection of simple solids - prisms, pyramids, cylinders, cones and spheres with simple cases when solid is placed in different positions w.r.t. axis, faces and lines lying in the faces of the solid making given angles.

Unit VI: Sections of Solids

- 6.1 Importance of sectioning, principles of sectioning, types of sections, cutting plane representation, section lines, and conventional practices.

Unit 7: Projections

- 7.1 Perspective, orthographic, isometric and oblique projections, isometric scale, isometric drawing.
- 7.2 Representation in first and third angle systems of projections.

Unit VIII: Computer Aided Drafting:

- 8.1 Introduce basic concepts and use of Computer Aided Design (CAD).

Reading Lists:

Essential Reading:

1. Bhatt, N.D. and Panchal, V.M. (2002). *Engineering Drawing- Plain and Solid Geometry*. New Delhi: Charotar Publishing House.

2. Narayana, K.L. and Kanniah, A. (2006). *Text Book on Engineering Drawing: Engineering Graphics*. New Delhi: Tata McGraw Hill Publishing Company Ltd.
3. Venugopal, K. (2006). *Engineering Drawing and Graphics*. New Delhi: New Age International Publishers.

Additional Reading:

1. Shah, P.J. (2009). *Text Book of Engineering Drawing*. New Delhi: S. Chand & Company Ltd.
2. Dhawan, R.K. *Text book of Engineering Drawing*. New Delhi: S. Chand & Company Ltd.
3. IS: 696 – 1972, *Code of Practice for General Engineering Drawing*. New Delhi: Bureau of Indian Standards.
4. Jolhe, D.A.(2007). *Engineering Drawing: with an Introduction to CAD*. New Delhi: Tata McGraw Hill Publishing Company Ltd.

Date: March 5, 2016.

Module Code and Title : CPL101 Introduction to Programming

Programme : BE in Information Technology

Credit : 12

Module Tutor : Yeshi Jamtsho/Karma Wangchuk/ Manoj Chhetri

Module Coordinator : Manoj Chhetri

General objectives:

This module will provide students with programming concepts and programming language fundamentals. It will also enable students to formulate and design solutions to solve basic mathematical problems

Learning outcomes:

On completion of the module, students will be able to:

1. Identify computer logical and hardware units.
2. Perform number system conversion.
3. formulate solutions to basic arithmetic and logical problems
4. write algorithms, flowcharts and pseudo codes
5. Write programs
6. Compile programs
7. Debug programs
8. Solve basic science and engineering mathematical problems
9. Use software tools available for programming.

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	3	30
Tutorial	1	15
Practical	3	45

Independent study/self-directed learning	2	30
Total		120

Assessment Approach:

<i>Sl. No</i>	<i>Mode of Assessment</i>	<i>Nos.</i>	<i>Marks Allocated</i>	<i>Marks (%)</i>
1	Continuous Assessment (Theory)			
1.1	Term Test: Closed book, one hour duration in 5 th and 10 th week of the semester. Term 1(Unit I-III) & Term II (Unit IV-VI)	2	20	25
1.2	Assignments: To encourage student centred learning and to determine the students ability in solving the problems using the concepts covered in the class. Unit I-III(Assignment 01) after term I & Unit IV-VIII (Assignment 02) in the 12 th week	2	5	
2	Continuous Assessment (Practical)			
2.1	Practical Test: 2hours duration, closed book in 13 th week of the semester.	1	10	25
2.2	Lab report: Students must submit a report for every laboratory classes based on the format given by the tutors	Every after practical class	5	
2.3	Laboratory Assessment: Students will be assessed based on their performance in every the laboratory class	Every practical class	10	
3	Semester End Examination: 3hours duration, closed book			
		1	50	50

Pre-requisite: None.

Subject matter:

Unit I: Introduction

- 1.1. Define software, hardware, system software, application software, program,
- 1.2. Machine language, assembly and high level languages, assembler, compiler, interpreter, editor, operating system.
- 1.3. Storage units: bits, bytes, kilo, mega, Giga bytes.
- 1.4. Number system: Decimal, binary, hexadecimal, octal conversions.

Unit II: Solution Formulation

- 2.1. Defining the problem; structuring the solution using the top down approach.
- 2.2. Algorithm: Definition, characteristics, examples.
- 2.3. Flowchart :concept of selection(if, nested if, if else, if else if) and iteration(entry controlled and exit controlled loop)
- 2.4. Pseudo-code: selection (if,nested if,if else,if else if) and iteration(entry controlled and exit controlled loop)

Unit III: Representation of Data and Basic Data Types

- 3.1. Integer, characters, Endian, IEEE 754 floating point representation,
- 3.2. ASCII, Unicode port representation.

Unit IV: Basic constructs

- 4.1. Constants, variables, Identifiers, Keywords, Header files, basic data types, operators, different types of operators, operands Expressions, Statements, Macros
- 4.2. The basic format of C program; input and output Selection statements(if ,nested if, if else, if else if, switch)
- 4.3. Iteration statements(for, while and do while loop)

Unit V: Functions

- 5.1 Concept of a function; programming a function; passing data to and from a function.
- 5.2 Predefined function, user defined functions scope,
- 5.3 Call by value and call by reference, visibility and lifetime of variables and functions,
- 5.4 Recursive function, C reference.

Unit VI: Arrays

- 6.1 Concept of an array; writing and reading to 1-D array, 2-D array and multi-dimensional arrays; passing arrays to and from functions.
- 6.2 Strings: Concept of string ,string related library functions

Unit VII: Pointers

- 7.1 Concept of a pointer; simple applications of a pointer.
- 7.2 Array and pointer,
- 7.3 Function and pointer, Pointer to a pointer, Null pointer,
- 7.4 Dynamic memory allocation: Malloc and calloc

Unit VIII: Structures

- 8.1 Concept of a structure; simple applications of structures.
- 8.2 Array and structure ,pointer and structure,
- 8.3 Self-referential structure

Unit IX: Files

- 9.1 Opening & Closing a file – Writing to and Reading from a file –
- 9.2 Processing files – Library functions related to file – fseek(), ftell(), ungetc(), fread(), fwrite()

List of Practical:

1. Demonstration of PC Hardware parts
2. Use of various IDE Compilers
3. Sequence implementation
4. Selection implementation
5. Iteration implementation
6. Function implementation
7. Array implementation
8. Structure implementation
9. Pointer implementation

Reading list:**Essential Reading**

1. Balagurusamy, E. (2011). *Programming in ANSI C* (4th ed.). New Delhi: Tata McGraw Hill Education Private Limited.
2. Kernighan, B. W. & Ritchie, D. M. (1998). *The C programming language* (2nd ed.). Delhi: PHI Learning Private Limited.
3. Kanetkar, Y.P. (1991). *Let us C* (5th ed.). New Delhi: BPB publications.

Additional Reading

1. Xavier, C. (2008). *Introduction to computers and basic programming* (3rd ed.). New Delhi: New Age International (P) Limited.
2. Ravichandran, D. (1996). *Programming in C* (1st ed.). New Delhi: New Age international Publishers.
3. Bronson, G. J. (2006). *A first book of ANSI C (Introduction to Programming)* (4th ed.). Canada: Course Technology.

Date: March 31, 2016.

Module Code and Title	:	ACS101 Academic Skills
Programme	:	University-wide module
Credit	:	12
Module Tutor	:	Chencho Dema, Pema Choezom
Module Coordinator	:	Pema Choezom

General Objective:

The Academic Skills module is designed to support students in their learning and provide generic skills that are required for university study. The focus will be on developing the skills of academic writing, oral presentation, and research skills, which will be delivered through classroom instruction, as well as through course work.

Learning outcomes:

On completion of the module, students will be able to:

1. communicate effectively in both spoken and written academic forms
2. select relevant information from a range of textual formats and synthesize through note taking, summarizing and paraphrasing and reformulate it in written and spoken form.
3. read texts at a variety of levels by applying skimming and scanning techniques, and reading for detailed understanding
4. evaluate the credibility of sources (i.e. by author, publisher or website)
5. organise writing according to purpose of writing and text types through planning, organizing ideas, structuring, synthesizing, editing and proofreading.
6. develop own arguments and integrate these appropriately with source material in written and spoken form in line with the concepts of academic integrity
7. cite sources and create a reference list using APA style
8. deliver a formal academic oral presentation
9. critically reflect on their own learning by organizing their learning and monitoring its progress by maintaining a portfolio
10. appreciate and develop personal skills such as cooperation, negotiation, group work, and leadership.
11. develop an independent approach to studying.

Learning and teaching approach:

Tutors will employ an interactive, student-centred approach, integrating language and critical thinking skills using the following strategies over the 60 hours of contact time.

1. Demonstrations/Modelling (3 hours)
2. Practical exercises and activities/Task-based learning (18 hours)
3. Individual, pair and group work (e.g. Discussions, problem-solving activities, collaborative and individual tasks, peer feedback, debates, role-plays, etc.) (18 hours)
4. Process learning, with diagnosis, feedback and remediation (e.g., with portfolio tasks) (15 hours)
5. Presentations (6 hours)

Assessment approach:

Since this module is entirely assessed through coursework, a student must complete all 4 components of the assessment outlined below (portfolio; 2 class tests; presentation; essay) and get an aggregate mark of 50% in order to pass.

Sl. No.	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
1	Continuous Assessment (Theory)			
1.1	A Portfolio of work done in class and as homework	1	25	100
1.2	Class Tests	2	30	
1.3	An Oral Presentation	1	15	
1.4	A Researched Assignment (essay)	1	30	

Pre-requisite: None

Subject matter:

Unit 1: Academic Standard Ethics (5 hours)

- 1.1. Purpose of academic activity
- 1.2. Features of academic writing
- 1.3. academic argument and academic integrity

Unit 2: Note-taking (6 hours)

- 1.1. Basics of note-taking
- 1.2. Types of notes, strategies and activities
- 1.3. Listening and note-taking

1.1.1.1.1.1 Unit 3: Academic Reading (13 hours)

- 3.1. Identify text features & organization
- 3.2. Reading Techniques (skimming/scanning, SQ3R)
- 3.3. Locating, evaluating and selecting information
- 3.4. Summarising / paraphrasing academic texts
- 3.5. Critical reading (author viewpoints/biases, reading for detail)

1.1.1.1.1.2 Unit 4: Academic Essay Writing (14 hours)

- 4.1. Introduction to the Writing Process
 - 4.1.1 pre-writing (gathering information; brainstorming; planning and outlining); drafting (writing);
 - 4.1.2 revising & editing/proofreading;
 - 4.1.3 publishing
- 1.2. Understanding & analysing assigned topics/directions (BUG); using the writing process
- 1.3. Essay Format / Structure
 - 1.3.1 Introduction & Thesis statement
 - 1.3.2 Body paragraphs (topic sentences; supporting sentences with evidence / examples/ explanation/ etc.; concluding sentences / transitions; cohesive devices)
 - 1.3.3 Conclusion

Unit 5: Referencing Techniques and APA format (10 hours)

- 5.1. Introduction to using source materials what are sources?, relevant terms, introduction to paraphrasing source material
- 5.2. Academic integrity and referencing
- 5.3. Locating, Evaluating and Selecting Sources
- 5.4. Using source materials for in-text citation
- 5.5. Making end-text/reference lists
- 5.6. Avoiding plagiarism

Unit 6: Oral Presentations (10 hours)

- 6.1. Introduction to academic argument in oral settings and presentations
- 6.2. Strategies for delivering an effective presentation structure, signposting

Unit 7: Types of Writing (2 hours)

- 7.1. Reflective writing or Report writing
- 7.2. Or any other writing genres relevant to colleges: e.g., proposals/business plans, lab reports, and other technical writing types

Reading list:

The “additional reading” list for this module includes books that have been distributed to the constituent colleges of the RUB. Students should be encouraged to use these references to enhance their study of the module.

Essential Reading:

1. Teacher materials for the Academic Skills module (January 2013).
2. Student Materials for the Academic Skills module (January, 2013).

Additional Reading:

1. American Psychological Association. (2010). Publication Manual of the American Psychological Association. (6th ed.). Washington, DC: American Psychological Association.
2. Anderson, K., Macclean, J., & Lynch, T. (2007). Study speaking: A course in spoken English for academic purposes (2nd ed.). Cambridge: Cambridge University Press.
3. Bailey, S. (2011). Academic writing: A handbook for international students (3rd ed.). Abingdon, Oxford: Routledge.
4. Blerkom, D.L. V. (2011) College study skills: Becoming a strategic learner. (7th ed.). Boston, MA: Wadsworth.
5. Butler, L. (2007). Fundamentals of academic writing. New York: Pearson Longman.
6. Cottrell, S. (2008). The study skills handbook (3rd ed.). New York: Palgrave Macmillan.
7. Cottrell, S. (2011) Critical thinking skills: Developing effective analysis and argument. (2nd ed.). Basingstoke: Palgrave Macmillan.
8. Cox, K., & David, H. (2007). EAP now!: Preliminary student book. N.S.W., Australia: Pearson Longman.
9. Cox, K., & David, H. (2010). EAP now!: English for academic purposes. Teacher's book. (2nd ed.). N.S.W., Australia: Pearson Longman.
10. Cox, K., & David, H. (2011). EAP now!: Preliminary teacher's book. N.S.W., Australia: Pearson Longman.
11. Cox, K., & David, H. (2011). EAP now!: English for academic purposes. Students book. N.S.W., Australia: Pearson Longman.
12. Craven, M. (2008). Cambridge English skills real listening and speaking 3 with answers and audio CD. Cambridge: Cambridge University Press.
13. Eastwood, J. (2005). The Oxford Guide to English Grammar. Oxford: Oxford University Press.
14. Gillet, A., Hammond, A., & Martala, M. (2009). Inside track successful academic writing. England: Pearson Education.
15. Gillet, A. (2013, January 15). UEFAP (Using English for academic purposes): A guide for students in higher education. Retrieved from <http://www.uefap.com>
16. Groarke, L.A., & Tindale, C.W. (2008). Good reasoning Matters!: A constructive approach to critical thinking. Oxford: Oxford University Press.
17. Hogue, A. (2007). First steps in academic writing. New York: Pearson Education ESL
18. Open University (2011, July 15). Learning to change: 1.4 Study skills, other skills. Retrieved from <http://www.open.edu/openlearn/education/learning-change/content-section-1.4>
19. Oshima, A., & Hogue, A. (2005). Writing academic English (4th ed.). White Plains, NY: Pearson Education.

20. Oshima, A., & Hogue, A. (2006). Introduction to academic writing. (3rd ed.). New York: Pearson Longman
21. OWL at Purdue (2013). Online writing lab: APA style. <http://owl.english.purdue.edu/owl/section/2/10/>
22. OWL at Purdue (2013) Online writing lab: General writing resources. <http://owl.english.purdue.edu/owl/section/1/>
23. Pears, R., & Shields, G. (2010). Cite them right: The essential referencing guide. (8th ed.). Basingstoke: Palgrave Macmillan.
24. Philpot, S., & Curnick, L. (2007). New headway academic skills: Student's book Level 3: Reading, Writing, and Study Skills. Oxford: Oxford University Press.
25. Ramsey-Fowler, H., & Aaron, J.E. (2010). The little brown handbook. (11th ed.). New York: Pearson Longman.
26. Renn, D. (2005). Strategies for college success: A study skills guide. Ann Arbor: University of Michigan.
27. Royal University of Bhutan. (2010). Guidelines for teaching academic skills. (Electronic Version Available)
28. Sebranek, P., Meyer, V., & Kemper, D. (2007). Write for college: A student handbook. Wilmington, Mass: Write Source, Great Source Education Group.
29. Thomson, A.J., & Martinet, A.V. (2007). A practical English grammar Exercises
30. II. New Delhi: Oxford University Press.
31. Thomson, A.J., & Martinet, A.V. (2009). A practical English grammar. (4th ed.). New Delhi: Oxford University Press
32. Thomson, A.J., & Martinet, A.V. (2009). A practical English grammar Exercises
33. New Delhi: Oxford University Press
34. Turtor, N.D., & Heaton, J.B. (2011). Longman dictionary of common errors.
35. New Delhi: Pearson Education.
36. University of New South Wales (2012, June 19). Online academic skills resources. <http://www.lc.unsw.edu.au/olib.html>
37. University of Southampton (2009, November 6). Academic Skills. Retrieved from <http://www.studyskills.soton.ac.uk>.
38. Waters, M., & Waters, A. (2010) Study tasks in English: Student's book. Cambridge: Cambridge University Press.
39. Waters, M., & Waters, A. (2010) Study tasks in English CDs (2). Cambridge: Cambridge University Press.
40. www.owl.purdue.edu

Teacher References:

Note: Useful books for module tutors while providing feedback on student work.

1. Brookhart, S. M. (2008). How to give effective feedback to your students. Alexandria, Va: Association for Supervision and Curriculum Development (ASCD).
2. Burke, D., & Pieterick, J. (2010). Giving students effective feedback written feedback. England: Open University Press
3. Frye, H., Ketteridge, S., & Marshall, S. (2008). A handbook for teaching and learning in higher education: Enhancing academic practice. Abingdon, Oxford: Routledge.

Date Revised: January 19, 2013

1.2 Semester-II

This section contains module descriptor of all modules offered in semester-II.

Module Code and Title : CPL103 Object Oriented Programming
Programme : BE in Information Technology
Credit : 12
Module Tutor : Pema Galey, Monaj Chhetri
Module Coordinator : Pema Galey

General Objectives:

This module focuses on an introduction to Object-Oriented programming using Java programming language and also to teach the basic concepts & techniques which form the Object Oriented Programming paradigm. It further explains the principles and features of object-oriented programming using Java programming language. In addition, it aims to discuss on the basics of the GUI components developments and Java Database Connectivity (JDBC) API.

Learning Outcomes:

On completion of the module, students will be able to:

1. Explain Object-Oriented Programming features concept.
2. Create and execute object-oriented programs using Java
3. Use arrays and other data collections
4. Implement error-handling techniques using exception handling
5. Develop event-driven applications using GUI components
6. Implement input/output (I/O) functionality to read from and write to data and text files
7. Implement multithreaded programs
8. Create JDBC applications to access and query a database

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	3	45
Tutorial	1	15
Practical	3	45
Independent study/self-directed learning	1	15
Total		120

Assessment approach:

Sl. No.	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
9.	Continuous Assessment (Theory)			

3.1.	Term Test: Closed book, one hour duration in 5 th & 10 th week. Covered up to unit-II for test-I and up to unit-VI for test-II.	2	20	25
3.2.	Assignment: Two weeks duration in 6 th & 7 th week	1	5	
2.	Continuous Assessment (Practical)			
3.1.	Lab Reports/Regular laboratory assessment: Weekly assessment.	1	5	25
3.2.	Practical examination: Closed book, 3 hours duration in 14 th Week.	1	10	
3.3.	Project: Mini project development for 4 weeks duration from 9 th to 13 th Week.	1	10	
3.	Semester End Examination Closed book and 3 hours examination.	1	50	50

Students must obtain 40% each in the Continuous Assessment and Semester End Examination. The overall pass mark for the module is 50%.

Pre-requisites: CPL101 Introduction to Programming

Subject Matter:

Unit I: Object-Oriented Programming Concepts

- 1.1 Advantages and applications of object-oriented programming
- 1.2 Features of object-oriented programming: Encapsulation, Abstraction, Inheritance, and Polymorphism.

Unit II: Java Programming Fundamentals

- 2.1 Java architecture, java architecture security and Garbage collections.
- 2.2 Java programming language syntax, variables, data types, statements and expressions
- 2.3 Control statements: if-else, for, while, & do-while loops and switch statements.
- 2.4 Methods, defining constructors, access specifiers and modifiers.
- 2.5 Overloading methods and Overloading constructors

Unit III: Implementing OOP

- 3.1 Implementing inheritance, overriding methods, and interfaces
- 3.2 Implementing multiple inheritance using interfaces.

Unit IV: Exception Handling

- 4.1 Exceptions in java, exception classes, built-in exceptions, try and catch statements
- 4.2 Multiple catch statements, throw and throws statement
- 4.3 Creating and handling user-defined exceptions.

Unit V: Working with Packages

- 5.1 In-built packages like lang package, util package, etc.
- 5.2 Creating and accessing user-defined packages

Unit VI: Working with GUI:

- 6.1 Introduction to an Applet
- 6.2 Awt and Swing components
- 6.3 Layout Managers.

Unit VII: Event Handling

- 7.1 Delegation event model, event listeners, event handlers
- 7.2 Event classes: ActionEvent, MouseEvent
- 7.3 Event listeners interfaces: ActionListener, MouseListener, MouseMotionListener, adjustmentListener, TextListener, WindowListener, ItemListener.

Unit VIII: Threads

- 8.1 Multithreading, Thread class and Runnable interface life cycle of a thread,
- 8.2 Thread priority, thread synchronization and garbage collection.

Unit IX: File Handling

- 9.1 File class and RandomAccessFile class
- 9.2 Input and output streams, character streams
- 9.3 Object serialization, Serializable interface, Remote Method Invocation (RMI).

Unit X: Database Connectivity

- 10.1 Introduction to SQL statements
- 10.2 ODBC/JDBC API: Connection, Statements, PreparedStatements, RecordSet and execute statements.

List of Practical(s):

1. Implementing basic programming construct.
2. Implementing OOP concepts.
3. Implementing awt, swing components and layout managers
4. Implementing event handling
5. Developing multithreaded applications
6. Implementing File Handling.
7. Implementing ODBC & JDBC programming.
8. Developing a simple application using Java

Reading List:

Essential Reading

1. Morelli, R., & Walde, R. (2006). *Java, Java, Java, Object Oriented Problem Solving* (3rd ed.). New Delhi: Prentice Hall.

- Schildt, H. (2014). *Java: The Complete Reference* (9th ed.). New Delhi: Mc Graw Hill.

Additional Reading

- Balagurusamy, E. (2009). *Programming with Java A Primer* (4th ed.). New Delhi: Mc Graw Hill.
- Thomas Wu, C. (2010). *An Introduction to Object-Oriented Programming with Java* (5th ed.). New Delhi: Mc Graw Hill.

Date: March 31, 2016

Module Code and Title	:	MAT102 Engineering Mathematics-II
Programme	:	BE in Civil Engineering
Credit	:	12
Module Tutor	:	Jyothi Lakshmi S, Tshering Denka, Jigme Namgyal
Module Coordinator	:	Jyothi Lakshmi S

General objective:

To develop further the student's abilities in mathematics, in particular the concept of Vector calculus, Multiple Integrals and Differential Equation that finds applications in various fields of Engineering.

Learning outcomes:

On completion of the module, students will be able to:

- Define Rectangular co-ordinate system, Spherical co-ordinate system and Cylindrical co-ordinate system.
- Find the shortest distance between two lines, intersection of two or more planes, and the intersection of a sphere and a plane.
- Determine the consistency of linear equations;
- Determine the characteristic equation and Eigen vectors and explain the properties of Eigen values.
- Define Scalar point functions, vector point function, and the operator Del.
- Find divergence and curl of a function.
- Integrate a vector point function
- Apply Green's Theorem and Stokes Theorem
- Use Multiple Integrals to determine the volume of solids, area of curved surface, centre of Gravity and Moment of inertia.
- Solve Linear Differential Equations of higher order and simultaneous linear differential equations with constant coefficients
- Apply the concept of LDE in simple Harmonic motion and simple pendulum

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	4	60

Tutorial	1	15
Independent study/self-directed learning	3	45
Total		120

Assessment approach:

<i>Mode of Assessment</i>	<i>Nos.</i>	<i>Marks Allocated</i>	<i>Marks (%)</i>
Continuous Assessment (Theory)			
Term Test1: Closed Book, One hour duration in 5 th week Topic: Multiple integrals	1	10	30
Term Test 2: Closed Book, One hour duration in 10 th week Topic: 3D Geometry and Vector Calculus	1	10	
Tutorial Test: Closed Book, One test each after completion of every topic.	4	6	
Assignment: One in 7 th week from Multiple Integrals and one in 13 th week from Vector calculus	2	4	
Semester End Examination: Closed book, 3 hr duration	1	70	70

Pre-requisite: None

Subject matter:

Unit 1: Coordinate Geometry of Three Dimensions: Rectangular Coordinate System

- 1.1. Introduction
- 1.2. Cylindrical and spherical coordinate system.
- 1.3. The plane, the straight line, intersection of line and a plane, shortest distance between two lines,
- 1.4. Intersection of two or more planes, the sphere, Tangent plane, Intersection sphere and a plane, radical plane, cones, cylinder.

Unit II: Matrices

- 2.1. Elementary transformations of a matrix, Elementary matrices, Normal form of a matrix.
- 2.2. Linear dependence of vectors, consistency of a system of linear equations. Linear transformations, orthogonal transformations characteristic equation.
- 2.3. Eigen vectors, properties of Eigen values.
- 2.4. Caley-Hamilton theorem Reduction to diagonal form.
- 2.5. Reduction of a quadratic form to canonical form.
- 2.6. Complex matrices.
- 2.7. Conjugate of a matrix,
- 2.8. Hermitian matrix, skew Hermitian matrix: unitary matrix.

Unit III: Vector Calculus

- 3.1. Differentiation of Vectors, curves in space, velocity and acceleration,
- 3.2. Relation of Velocity and acceleration.
- 3.3. Scalar and vector point functions-vector operator “del”;
 - 3.3.1. Del-application to scalar point functions. Gradient.
 - 3.3.2. Del-application to vector point functions.
 - 3.3.3. Divergence and curl
 - 3.3.4. Physical interpretation of divergence F and curl F.
 - 3.3.5. Del applied twice to point functions.
 - 3.3.6. Del applied to product of point functions.
- 3.4. Integration of vectors line integral-circulation-wirk.
- 3.5. Theorems
 - 3.5.1 Surface integral-flux Greens theorem in plane.
 - 3.5.2 Stoke’s theorem.
 - 3.5.3 Volume integral.
 - 3.5.4 Divergence theorem. In rotational and solenoidal fields. “Greens theorem” Gauss theorem.
- 3.6. Orthogonal curvilinear coordinates.
 - 3.6.1. Del applied to functions in orthogonal curvilinear coordinates cylindrical coordinates.
 - 3.6.2. Spherical and polar coordinates.

Unit IV: Multiple Integrals

- 4.1. Double integral
- 4.2. Change of order of integration Double integrals in polar coordinates.
- 4.3. Areas endorsed by plane curves.
- 4.4. Triple integrals.
- 4.5. Volumes of solids.
- 4.6. Change of variables.
- 4.7. Area of a curved surface. Calculation of mass.
- 4.8. Centre of gravity. Centre of pressure, moment of Inertia.

Unit V: Linear differential equation of higher order and its applications

- 5.1. Definitions
- 5.2. Complete solution
- 5.3. Operator, Rules for finding complementary functions, Inverse operator.
- 5.4. Rules for finding particular Integral
 - 5.4.1. Working procedure
 - 5.4.2. Method of variation of parameters Cauchy’s and legendries linear equations.
 - 5.4.3. Simultaneous linear equations with constant coefficients.
- 5.5. Applications
 - 1.5.1 Introduction
 - 1.5.2 Simple Harmonic motion Oscillation of a spring.
 - 1.5.3 Simple pendulum.

Reading list:

Essential Reading:

1. Kreyszig, E. (2011). *Advanced Engineering Mathematics* (10 ed.). Singapore: John Wiley & Sons (Asia) Pvt Ltd.
2. Grewal, B. S. (2013). *Higher Engineering Mathematics* (43 ed.). New Delhi: Khanna Publishers.

3. Dass, H. K. (2008). *Advanced Engineering Mathematics* (19 ed.). New Delhi: S.Chand & Company Ltd.

Additional Reading:

1. Jain, R. K., & Iyengar, S. R. K. (2007). *Advanced Engineering Mathematics* (3 ed.). New Delhi: Narosa Publishing house.
2. Prasad, I. B. (1982). *Practical Mathematics Vol I and Vol II* (6 ed.). New Delhi: Khanna Publishers.
3. Vasishtha, A. R. (2002). *Matrices* (32 ed). Meerut: Krishna Prakashan Media (P) Ltd.

Date: March 31, 2016

Module Code and Title : MAT210 Discrete Mathematics
Programme : BE in Information Technology
Credit : 12
Module Tutor : S.T.Venkatesan

General objective:

This module introduces the student to the general area of Discrete Mathematics commonly required in many areas of computer science, in particular Graph Theory. It reinforces mathematical maturity and ability to deal with abstraction. It lays foundation to most of the basic terminologies used in information technology courses and application of ideas to solve practical problems.

Learning outcomes:

On completion of the module, students will be able to:

1. Apply precision in logical argument while solving problems
2. Perform operations on sets, functions, relations, propositional and predicate logic, and matrices using the appropriate terminology.
3. Apply mathematical reasoning in constructing valid arguments.
4. Use the language, notation, and methods of set theory and symbolic logic.
5. Use combinations, permutations, and other principles of counting in the field.
6. Use formal logic proofs and logical reasoning to solve problems.
7. Solve problems in computer science using graphs and trees.

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	4	60
Tutorial	1	15
Written assignment	1	15

Independent study/self-directed learning	2	45
Total		120

Assessment approach:

<i>Mode of Assessment</i>	<i>Nos.</i>	<i>Marks Allocated</i>	<i>Marks (%)</i>
Continuous Assessment (Theory)			
Term Test1: Closed Book, One hour duration in 5 th week Topic: Logics	1	10	30
Term Test 2: Closed Book, One hour duration in 10 th week Topic: Counting and Proofs	1	10	
Assignment: One in 7 th week from Sets and Induction; and one in 13 th week from Graphs	2	10	
Semester End Examination: Closed book, 3 hrs duration	1	70	70

Pre-requisite: None

Subject Matter:

Unit I: Propositional logic:

- 1.1 Syntax
- 1.2 Semantics
- 1.3 Valid, Satisfiable and Unsatisfiable formulas
- 1.4 Encoding and examining the validity of some logical arguments.

Unit II: Proof techniques:

- 2.1 Forward proof
- 2.2 Proof by contradiction
- 2.3 Contra-positive proofs
- 2.4 Proof of necessity and sufficiency.

Unit III: Sets, relations and functions:

- 3.1 Operations on sets
- 3.2 Relations
- 3.3 Functions
- 3.4 Binary relations
- 3.5 Partial ordering relations
- 3.6 Equivalence relations
- 3.7 Principles of mathematical induction.
- 3.8 Size of a set
- 3.9 Finite and infinite sets
- 3.10 Countable and uncountable sets
- 3.11 Cantor's diagonal argument and the power set theorem

3.12 Schroeder-Bernstein theorem.

Unit IV: Introduction to counting:

- 4.1 Basic counting techniques – inclusion and exclusion
- 4.2 Pigeon-hole principle
- 4.3 Permutation
- 4.4 Combination
- 4.5 Summations.
- 4.6 Recurrence relation
- 4.7 Generating function.

Unit V: Algebraic structures and morphisms:

- 5.1 Algebraic structures with one binary operation
 - 5.1.1 Semigroups
 - 5.1.2 Monoids and
 - 5.1.3 Groups
- 5.2 Congruence relation
- 5.3 Quotient structures.
- 5.4 Free and cyclic monoids and groups
- 5.5 Permutation groups and substructures
- 5.6 Normal subgroups.
- 5.7 Algebraic structures with two binary operations
 - 5.7.1 Rings
 - 5.7.2 Integral domains and
 - 5.7.3 Fields.
- 5.8 Boolean algebra and Boolean ring.

Unit VI: Introduction to graphs:

- 6.1 Graphs and their basic properties
 - 6.1.1 Degree
 - 6.1.2 Path
 - 6.1.3 Cycle
- 6.2 Subgraphs
- 6.3 Isomorphism
- 6.4 Eulerian and Hamiltonian walks
- 6.5 Graph coloring
- 6.6 Planar graphs
- 6.7 Trees.

Reading list:

Essential Reading:

1. Kenneth H. R (2011). *Discrete Mathematics and its Applications*. Tata McGraw-Hill.
2. Liu, C. L. (2008). *Elements of Discrete Mathematics*. Tata McGraw-Hill.
3. Ralph P. G (2006). *Discrete and Combinatorial Mathematics*. Asia: Pearson Education.

Additional Reading

1. Kenneth, B., Clifford, S., & Robert L. D.(2005). *Discrete Mathematics for Computer Science*. Key College Publishing.
2. Thomas K.(2004). *Discrete Mathematics with Applications*. Elsevier.
3. Norman L. B. (2002). *Discrete Mathematics*. Oxford University Press.

Date: February 3, 2016.

Module Code and Title	:	EWP101 Electrical Workshop Practice
Programme	:	BE in Electrical Engineering
Credit	:	12
Module Tutor	:	Gom Dorji , Pema Yudon
Module Coordinator	:	Pema Yudon

General Objectives:

To develop the basic concept of safety measures while dealing and handling electricity, use and specify common electrician tools and wiring accessories, earthing and carry out maintenance in wiring system.

Learning outcomes:

On completion of the module, students will be able to:

1. Practice occupational health and safety
2. Specify the basic electrician tools and wiring accessories
3. Apply best practices and standards related to the practical work carried out
4. Identify the electrical faults in wiring system.
5. Trace the fault location in electrical system.
6. Carry out electrical wiring maintenance
7. Categorise the electrical control gears
8. Differentiate different types of earthing and chose proper earthing for electrical works
9. Design the suitable illumination for typical house and street lighting

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	1	15
Practical	3	45
Independent study/self-directed learning	4	60
Total		120

Assessment approach:

Sl. No.	Mode of Assessment	Nos.	Marks allocated	Marks (%)
1	Continuous assessment			
1.1	Term Test Closed book, one hour duration in 5 th and 10 th week. Two units each for both the term test	2	20	70
1.2	Case Study (Unit V) Scheduled form the 5 th week of the semester.	1	30	
1.3	Assignments, scheduled on 4 th week, 8 th week and 11 th week.	3	15	
1.4	Maintenance Work (after completion of unit IV)	1	5	
2	Practical Assessment			
2.1	Practical Exam(As per syllabus)	1	20	30
2.2	Viva-Voce	1	10	

Pre-requisite: None

Subject matter:

Unit I: Electrical Installation practice

- 1.1. Introduction to basic electricity
- 1.2. Safety rules and precautions,
- 1.3. Methods for electric shock treatment,
- 1.4. Tools: Specifications of electrician's tools, factors governing the specification of tools,
- 1.5. Measuring instruments: Specification of commonly used measuring instruments in power systems and applications
- 1.6. Joints and soldering: Importance of joints, Safety procedure to be observed while constructing various types of joints including cable joints
- 1.7. Wiring accessories: Specifications of various wiring accessories and their applications
- 1.8. Wiring practices: Conduit wiring, Casing capping wiring, Conceal conduit wiring

Unit II: EARTHING

- 2.1. Various types of earthing,
- 2.2. Pipe earthing as per standard code of practice
- 2.3. Plate earthing as per standard code of practice and
- 2.4. Earth resistance test by earth tester

Unit III: SOLDERING and WELDING PRACTICE

- 3.1. Soldering practices on electronic component
- 3.2. Hand on practice on Arc welding

Unit IV: MAINTENANCE OF WIRING INSTALLATION

- 4.1. Carrying out electrical maintenance as required, in close co-ordination with the electrical maintenance in-charge.
- 4.2. Discussion on nature of fault,
- 4.3. Tracing of electrical faults,
- 4.4. Repair and maintenance work.
- 4.5. Faults in distribution network,
- 4.6. Maintenance work (find out the possible area in the campus).

Unit V: Case Study

- 5.1 AutoCAD Drawing for any Electrical Lay out Plan
- 5.2 Estimation of electrical Installation design as per lay out plan

List of Practical:

1. Specification of electrician's tools and factors governing the specification of tools
2. Soldering Practices on Electronic component, electrical wires and practice types of wiring joints
3. Wiring from Main DB, MCBDB, ENERGY METER to Bus Bar Chamber
4. Stair Case and bell/buzzer Wiring
5. Power Circuit Wiring.
6. Fluorescent/tube /lamp/ frame connection system (testing of choke and starter using lamp)
7. Ceiling fan connections and testing
8. Earthing installation and testing

Reading list:

Essential Reading

1. Wadha, C. L. (2006). *Generation, Distribution and Utilization of Electrical Energy*, (1ed.). New Delhi; Wiley Eastern Limited.
2. Bhatia, S. L. (2006). *Handbook of Electrical Engineering*. (3ed.). New Delhi: Khanna Publishers.
3. Ambrousius, L. (2015). *AutoCAD 2015 and AutoCAD LT 2015 Bible*. (1ed.). New Delhi: Wiley.

Additional Reading

1. Raina, K. B. & Bhattacharya, S. K. (2014). *Electrical Design, Estimating and Costing*, (1ed.). New Delhi: New Age International Publishers.
2. Anwani, M. L. (2013). *Basic Electrical Engineering*, (1ed.). New Delhi: Dhanpat Rai & Co.(P) Ltd, Educational and technical Publishers.

Date: April 2, 2016

Module Code and Title	:	ECD202 Digital Electronics and Logic Design
Programme	:	BE in Electronics & Communication Engineering
Credit	:	12
Module Tutor	:	Mrs. Sonam Peden

General Objective:

This module will familiarize students with the concept of Digital Electronics and develop basic analytical understanding of Digital Electronics in designing and implementation of Digital logic circuits and their applications in the field of Electrical and Electronics Engineering.

Learning Outcomes:

On completion of the module, students will be able to:

1. Identify different Logic Gates and their symbols.
2. Compute and convert from a base 'n' number system to another base number system.
3. Utilize the postulates and theorems of Boolean Algebra.
4. Simplify Boolean expressions using Boolean Algebra and V-K maps.
5. Implement Combinational Logic Circuits using SOP and POS design.
6. Identify different Flip Flops and their symbols.
7. Implement Sequential Logic Circuits using various flip Flops.
8. Discuss the basic concept of Analog to Digital conversion and vice versa.
9. Discuss the basic concept of Mono-stable and Astable multi-vibrators.
10. Formulate logical problems involving combinational and sequential digital design and organize solution methodologies.

Learning and Teaching Approach:

Approach	Hours per Week	Total Credit Hours
Lecture	3	45
Practical	2	30
Independent study/self-directed learning	3	45
Total		120

Assessment Approach:

Sl. No.	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
1	Continuous Assessment (Theory)			
1.1	Term Test: closed book, one hour duration in 5 th and 10 th week	2	20	25
1.2	Assignment: 2-assignments at the end of 2 nd and 4 th unit.	2	5	
2	Practical			
2.1	Lab report weekly Assessments		15	25
2.2	Practical Exam	1	5	
2.3	Viva-Voce	1	5	
3	Semester Examination: 3 hrs duration, closed book	1	50	50
			Total	100

Pre-Requisites: ECD201 Electronics Circuits and Devices- I

Subject Matter:

Unit I: Number System, Codes and Boolean Algebra

- 1.1 Number Systems: Decimal, Binary, Octal, Hexadecimal, 1s and 2s complements
- 1.2 Codes: Binary, BCD, 84-2-1, 2421, Excess 3, Biquinary, Gray, Alphanumeric codes
- 1.3 Boolean theorems
- 1.4 Logic gates
- 1.5 Universal gates
- 1.6 Sum of products and product of sums
- 1.7 Minterms and Maxterms
- 1.8 Karnaugh map and Tabulation methods
- 1.9 Problem formulation and design of combinational circuits
- 1.10 Code-Converters
- 1.11 IC versions

Unit II: Combination Circuits

- 2.1 Half and Full Adders
- 2.2 Half and Full Subtractors
- 2.3 Binary Parallel Adder
- 2.4 Carry Look Ahead Adder
- 2.5 BCD Adder
- 2.6 Magnitude Comparator
- 2.7 Decoder and Encoder
- 2.8 Priority Encoder
- 2.9 Mux/Demux, Implementation of combinational logic using standard ICs, ROM, EPROM and EEPROM, PLA and PAL
- 2.10 IC versions

Unit III : Sequential Circuits

- 3.1 Flip flops – SR, JK, T, D, Master/Slave FF, Triggering of FFS
- 3.2 Synchronous counters: Up/down Counters and Ring Counters
- 3.3 Asynchronous counters: Up/down Counters
- 3.4 Shift registers
- 3.5 Universal Shift Register
- 3.6 Modulus N synchronous counter
- 3.7 IC versions

Unit IV: Logic Families and Semiconductor Memories

- 4.1 Logic families- TTL, MOS, CMOS
- 4.2 Comparison of Logic families
- 4.3 Basic memory cell
- 4.4 RAM
- 4.5 Memory decoding
- 4.6 Static and Dynamic memories
- 4.7 IC versions

Unit V: Multivibrator

- 5.1 Timer 555
- 5.2 Monostable Multivibrator
 - 5.2.1 Retriggerable
 - 5.2.2 Non-retriggerable types
 - 5.2.3 IC versions
- 5.3 Astable Multivibrator
 - 5.3.1 Various types
 - 5.3.2 Synchronization
 - 5.3.3 IC versions
- 5.4 Bistable Multivibrator

Unit VI: Converter

- 6.1. D/A Converter
 - 6.1.1. Weighted resistor D/A converters
 - 6.1.2. Ladder types D/A converters
 - 6.1.3. Performance specifications
 - 6.1.4. IC versions
- 6.2. A/D Converters
 - 6.2.1. Single slope A/D converters
 - 6.2.2. dual-slope A/D converters
 - 6.2.3. successive approximation and other types of A/D converters
 - 6.2.4. Performance specifications
 - 6.2.5. IC versions

List of Practical:

1. Verify their truth tables for Basic Logic gates using Digi Board and Digital ICs bread board trainer.
2. Implement Digital Combinational Design both in SOP and POS for four Boolean variables. Simplify using K-Map and verify the truth-table using Digital ICs bread board trainer.
3. Construct R-S Flip-flop using NAND Gate and verify its truth tables using Digital ICs.
4. Design and construct A- Synchronous Binary Counters, and synchronous Binary Counters using J-K Flip flop and verify its truth table and timing diagram on Logic Analyser.
5. Design and construct various Shift registers using flip-flops and verify their truth tables.
6. Construct half and Full adders using basic logic gates and digital LSI chips.
7. Study Digital to Analog converters using R-2R ladder.
8. Study Analog to Digital converter Single slope and Dual Slope.

Reading List:

Essential Reading:

1. Mano, M. M. (2001). *Digital Logic and Computer Design* (25th Reprint), New Delhi: Prentice–Hall International Inc.
2. Tocci, R. J., Widmer, N., & Moss, G. (2010). *Digital Systems: Principles and Applications* (11th ed.), Upper Saddle River, NJ: Prentice Hall.
3. Scott, N. R. (2004). *Analog and Digital Computer Technology*, New York: McGraw Hill.
4. Malvino, A. P., & Leach, D. P. (2003). *Digital Principle and Application*, New Delhi: Tata McGraw Hill.

Additional Reading:

1. Nashelsky, L. (1994). *Introduction to Digital Computer Technology* (4th ed.), Denver, CO: Regents/Prentice Hall.
2. Williams, G. E. (1982). *Digital Technology* (2nd ed.), New York: Science Research Associates.

Date: February 24, 2016

1.3 Semester-III

Module Code and Title : CTE201 Computer Organization & Architecture
Programme : BE in Information Technology
Credit : 12
Module Tutor : Tandin Wangchuk

General objective:

The module aims to equip students with an understanding of the essential of Computer Organization and Architecture. It also intends to impart knowledge on the factors influencing the design of hardware and software elements to computer systems.

Learning outcomes:

On completion of the module, students will be able to:

1. Identify a simple machine architecture and the reduced- instruction set computer.
2. Classify different generations of computer based on performance.
3. Explain memory control, direct memory access, interrupts, and memory organization.
4. Evaluate basic data flow through the CPU (interfacing, bus control logic, and internal communications).
5. Discuss the importance of Input/output controls.
6. Explain number systems, instruction sets, addressing modes, and data/instruction formats.
7. Solve simple computer arithmetic problems.

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	3	45
Tutorial	1	15

Independent study/self-directed learning	4	60
Total		120

Assessment approach:

Sl. No.	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
1	Continuous Assessment (Theory)			
1.1	Term Test - Closed book, one hour duration in 5 th and 10 th week, units covered up to 5 th week for test I, units covered from 6 th - 10 th week for test II.	2	30	50
1.2	Assignments - in 4 th week (Units covered up to 4 th week) and 11 th week (Units covered from 6 th week – 10 th week)	2	10	
1.3	Mini Project – Case study on emerging topic or concept, submission in 14 th week	1	10	
2	Semester End Examination: Closed book for 3 hours duration	1	50	50

Pre-requisite: None

Subject matter:

Unit 1: Introduction

- 1.1 Basic organization of the computer and block level description of the functional units as related to the execution of a program;
- 1.2 Fetch, decode and execute cycle; role of operating systems and compilers (introduction only);

Unit II: Computer Arithmetic

- 2.1 2's complement number system,
- 2.2 Ripple Carry address, Carry look-ahead address, overflow detection, subtraction, shift and add, multiplication,
- 2.3 Booth's multiplication, resting and non-resting division, SRT division.

Unit III: Central Processing Unit

3.1 Information representation, control and data path, data path components, design of ALU and data path, controller design.

Unit IV: Memory and IO access:

4.1 Main memory, Memory organization, memory maps, static and dynamic memory;
4.2 Cache memory and Memory Hierarchy cache memory access techniques;
4.3 Virtual memory, Read Write operations, Programmed IO, Concept of handshaking, Polled and Interrupt driven IO, DMA data transfer; IO subsystems.

Unit V: Input-Output devices

5.1 Disk, CD-ROM, Printer etc.;
5.2 Interfacing with IO devices, keyboard and display interfaces;
5.3 Data paths; hazards; controller; pipelining; performance.

Reading List:

Essential Reading

1. Stallings, W. (2012). *Computer Organization and Architecture: Designing for Performance* (9th ed.). New Jersey: Prentice Hall.
2. Tanenbaum, A. S., & Austin, T. (2012). *Structured Computer Organization* (6th ed.). Pearson.

Additional Reading

1. Abd-El-Barr M., & El-Rewini, H.(2005). *Fundamentals of Computer Organization and Architecture*. John Wiley & Sons, Inc.
2. Patterson, D.A., & Hennessy, J.L. (2008). *Computer Organization and Design: The hardware/Software Interface* (4th ed.). Morgan Kaufmann

Date: March 31, 2016.

Module Code and Title	:	CTE202 Data Structures & Algorithms
Programme	:	BE in Information Technology
Credit	:	12
Module Tutor	:	Tsheten Dorji

General objectives:

This module will enable the students to develop their solution design logic and analytical skills in problem solving. The module introduces the fundamental concepts of algorithms design & analysis for problem solving, familiarize with various data structures & its applications and different computer algorithms that would enable

students to get prepared in designing the efficient algorithm, implementing and testing the algorithm for software development.

Learning outcomes:

On completion of the module, students will be able to:

1. Differentiate between program, algorithm and data structure
2. Use different forms of writing an algorithm
3. Apply various methods of designing an algorithm to solve a given problem
4. Use appropriate data structures for improving the performance of an algorithm
5. Analyze the complexities of the algorithm to optimize its run time and memory space using asymptotic analysis approaches.
6. Implement the elementary data structures with set of operations.
7. Explain various algorithms for searching and sorting problem and their performance analysis.
8. Choose and apply suitable algorithm for solving a particular problem
9. Design the algorithm by using appropriate design approaches and using other algorithms.
10. Implement and test the algorithms
11. Explain the advance data structures & their applications.

Learning and teaching approach:

Approach	Hours per week	Total credit hours
Lecture	3	45
Practical	3	45
Tutorial	1	15
Self-directed learning	1	15
Total		120

Assessment Approach:

Sl #	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
1	Continuous Assessment (Theory)			
1.1	Term Tests: Closed book, one hour duration. -Test-I in 5 th Week (units covered up to 5 th week) -Test-II in 10 th week(units covered from 6 th - 10 th week)	2	20	25
1.2	Assignments: Assignment-1 in 4th week (Units covered up to 4th week); Assignment-2 in 9th week (Units covered from 6th – 10th week)	2	5	
2	Continuous Assessment (Practical)			
2.1	Lab Reports: Lab exercise every week and report to be submitted for every lab	7	10	25

2.2	Lab Test/exam: Online/Close book one hour duration in 14 th Week, Units III to V	1	10	
2.3	Lab observations/performance: Lab exercise being able to carry out during practical class hours with/without tutor's help.	7	5	
3	Semester End Examination: Closed book, 3 hours duration.	1	50	50

Pre-requisites: MAT210 Discrete Mathematics, CPI101 Introduction to Programming

Subject matter:

Unit I: Introduction

- 1.1 Algorithms Criteria, forms of algorithms writing,
- 1.2 Basic Algorithm Design & Analysis approaches: iterative algorithm, recursive algorithm,
- 1.3 Introduction to RAM model of computation, complexity analysis of algorithms, worst case, best case and average case. Criteria for Compare algorithms, Ideal solutions for comparing algorithms, Asymptotic Analysis & notations.
- 1.4 Basic introduction to algorithmic paradigms like divide and conquer, recursion, greedy.

Unit II: Elementary Data Structures

- 2.1 Linear Data Structures & representations, Non-linear Data Structures & representations, Adv. & disadv. of using Array representation/ Linked List representation,
- 2.2 Arrays & its operations, Linked list & its operations, types of linked list
- 2.3 Stacks & its operations, array and linked list representation of Stack, Application of Stacks,
- 2.4 Queues & its operations, array and linked list representation of Queue, Types of Queues, Applications of Queues,
- 2.5 Heap & Applications, Priority queues,

Unit III: Searching Algorithms

- 3.1 Search schemes, internal search & external search schemes
- 3.2 Sequential Search Algorithm & its Performance Analysis,
- 3.3 Divide & Conquer Approaches: Binary Search Algorithm & Analysis, Interpolation Search, Hashing.

Unit IV: Sorting Algorithms

- 4.1 Bubble sort & its performance analysis,
- 4.2 Divide & Conquer Approaches: quick sort & its performance analysis, merge sort & its performance analysis, heap sort & its performance analysis. Decision tree model and (worst case) lower bound on sorting.
- 4.3 Sorting in linear time -- radix sort, bucket sort, counting sort.

Unit V: Advance Data Structures

- 5.1 Trees, Binary trees , types of binary trees
- 5.2 Binary Search Trees & Applications,
- 5.3 Balanced binary search trees, AVL trees and Red-black trees, B-trees, skip lists, hashing. Interval trees, tries.

List of Practical(s):

- 1. Implementation of list data structure using array representation
- 2. Implementation of list data structure using linked list representation
- 3. Implementation of Stack using array representation
- 4. Implementation of Stack using linked list representation
- 5. Implementation of Queue using array/linked list representation
- 6. Implementation of sequential search algorithm
- 7. Implementation of binary search algorithm
- 8. Implementation of quick sort algorithm
- 9. Implementation of merge sort algorithm
- 10. Implementation of binary tree data structure
- 11. Implementation of binary search tree data structure.
- 12. Implementation of AVL tree and red-black tree.

Reading List

Essential Reading

- 1. Horowitz, E., Sahni, S., & Rajasekaran, S.(1998). *Computer Algorithms* (2nd ed.). NewYork: Computer science press.
- 2. Cormen, T. H., Leiserson, C. L., Rivest, R. L. & Stein, C. (2009). *Introduction to Algorithms* (3rd ed.). London, England: MIT Press.

Additional Reading List

- 1. Kleinberg, J., & Tardos, E.(2006). *Algorithm Design* (1st ed.). India: Dorling Kindersley.
- 2. Lewis, H. R., & Denenberg, L. (1991). *Data Structures and Their Algorithms* (5th ed). New York: HarperCollins.
- 3. Gibbons, A. (1994). *Algorithmic Graph Theory* (1st ed.). New York: Cambridge University Press.

Date: February 29, 2016.

Module Code and Title : MAT206 Scientific Computing and Transforms
Programme : BE in Information Technology
Credit : 12
Module Tutor : S.T.Venkatesan

General objective:

The module introduces students to mathematical methods and selects the most

appropriate solution to tackle a wide range of engineering problems using modern numerical methods. It develops the skill of the students in the area of transform techniques.

Learning outcomes:

On completion of the module, students will be able to:

1. Use the appropriate interpolation formula to find the missing data.
2. Determine critical conditions for solutions of equations, using the Eigen value methods.
3. Solve system of linear equations numerically and to evaluate critically different approaches and techniques for their implementation.
4. Solve numerical differentiation, numerical integration, O. D. E's using numerical techniques, having critically appraised different techniques and select the most appropriate.
5. Apply the basic working knowledge of Mathematical methods in Fourier Transform in engineering situations
6. Solve differential equations using Laplace Transform.
7. Use the scientific computing packages to demonstrate Numerical methods.

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	3	45
Tutorial	2	30
Practical	1	15
Independent study/self-directed learning	2	30
Total		120

Assessment approach:

<i>Mode of Assessment</i>	<i>Nos.</i>	<i>Marks Allocated</i>	<i>Marks (%)</i>
Continuous Assessment (Theory)			
Term Test1: Closed Book, One hour duration in 5 th week Topic: Laplace Transforms	1	10	25
Term Test 2: Closed Book, One hour duration in 10 th week Topic: Fourier Transforms	1	10	
Assignment: One in 7 th week from Fourier Transforms and one in 13 th week from Numerical Methods	2	5	
Continuous Assessment (Practical)			

Regular Assessments		10	25
Practical Exam / Assignments on Numerical Methods	1	10	
Viva-Voce / Test on Numerical Methods	1	5	
Semester End Examination: Closed book, 3 hr duration	1	50	50

Pre-requisite: None

Subject matter:

Unit I: Interpolation

- 1.1 Forward
- 1.2 Backward
- 1.3 Central differences
- 1.4 Newton's forward and
- 1.5 Newton's backward interpolation formula
- 1.6 Gauss's forward and
- 1.7 Gauss's backward interpolation formula
- 1.8 Stirling's interpolation formula
- 1.9 Lagrange interpolation.

Unit II: Numerical Differentiation and Integration

- 2.1 Numerical differentiation at the tabulated points with
 - 2.1.1 Forward
 - 2.1.2 Backward and
 - 2.1.3 Central differences.
- 2.2 Numerical integration:
 - 2.2.1 Trapezoidal rule
 - 2.2.2 Simpson's 1/3 Rule
 - 2.2.3 Simpson's 3/8 Rule
 - 2.2.4 Romberg's integration.

Unit III: System of linear Algebraic equations

- 3.1 System of linear equations: Gauss Seidal iteration method.
- 3.2 Eigen values by
 - 3.2.1 Iteration and
 - 3.2.2 Jacobi's Method.
- 3.2 Solution of Non linear equations
- 3.3 Numerical solution of algebraic and transcendental equations by
 - 3.3.1 Regula-Falsi method and
 - 3.3.2 Newton-Raphson's method.

Unit IV: Numerical solution of first order ordinary differential equations:

- 4.1. Euler's method
- 4.2. Modified Euler's method
- 4.3. Taylor Series method
- 4.4. Runga – Kutta method of 2nd and
- 4.5. Runga – Kutta method of 4th orders.

Unit V: Laplace Transformations

- 5.1. Introduction: Definition
- 5.2. Transforms of Elementary Functions.
- 5.3. Properties of Laplace Transforms.
- 5.4. Existence conditions. Inverse transforms.
- 5.5. Note on partial fraction. Transforms of Derivatives.
- 5.6. Transforms of Integrals. Multiplication by t^n .
- 5.7. Division by 't' and Convolution Theorem.
- 5.8. Applications of Laplace Transforms to Differential Equations.
- 5.9. Simultaneous linear equations with constant coefficients.
- 5.10. Unit Step Functions, Unit Impulse Functions.
- 5.11. Periodic Functions. Special Functions.

Unit VI : Fourier Transforms

- 6.1. Introduction, Definition of Integral Transforms. (Laplace, Fourier, Mellin transforms).
- 6.2. Fourier Integral Theorem.
- 6.3. Fourier Sine and Cosine Integrals.
- 6.4. Complex forms of Fourier Integrals.
- 6.5. Fourier Integral representation of a function.
- 6.6. Fourier Transforms. Fourier Sine and Cosine Transforms.
- 6.7. Finite Fourier Sine and Cosine Transforms.
- 6.8. Properties of Fourier Transforms Convolution Theorem.
- 6.9. Parseval's Identity.
- 6.10. Relation between Fourier and Laplace Transforms. Fourier Transforms of derivatives of a function.
- 6.11. Inverse Laplace Transforms by method of Residues.

Practicals : Simulating Units I to IV using scientific packages.

Reading list:

Essential Reading

1. Dr.B.S.Grewal, B. S (2003). *Numerical Methods in Engineering & Science* (6th ed.). New Delhi, India: Khanna Publishers.
2. Jain, M.K., Iyengar, S.R.K. & R.K.Jain. (2002). *Numerical Methods Problems and Solutions*. New Delhi: New Age International.
3. Won Y. Yang, et al. (2005). *Applied Numerical Methods Using MATLAB*. New Delhi: Wiley India Pvt. Ltd.

Additional Reading

1. Cleve B. Moler,(2004). *Numerical Computing with MATLAB*. Siam Press, ISBN 0-89871-560-1
2. Kreyszig, E. (2000). *Advanced Engineering Mathematics* (8th ed.). Singapore: John Wiley and Sons.
3. Grewal, B.S. (2000). *Higher Engineering Mathematic* (35th ed.). New Delhi: Khanna Publishers.

Date: February 3, 2016.

Module Code and Title	:	MAT205 Statistics and Theory of Probability
Programme	:	BE in Electronics & Communication Engineering
Credit	:	12
Module Tutor	:	Jigme Namgyal

General Objectives:

The aim is to provide an introduction to the fundamental concepts of probability and statistics, as tools for decision making and expose students to basic theory and practice of statistics, with reference to Engineering disciplines. Develop problem solving abilities through examples and communicate the results graphically in a readily understandable format.

Learning Outcomes:

On completion of the module, students will be able to:

1. Calculate and interpret the common summary numbers for frequency distributions, and be able to construct and interpret the most common diagrams for data presentation.
2. Apply the laws of probability in simple calculations.
3. Apply the Combination and Permutation in real situations.
4. Solve problems using Binomial, Poisson and Normal distributions.
5. Apply the properties of probability function.
6. Solve more than one random variable and functions
7. Use regression and correlation to analyze data
8. Use statistical tools to solve engineering problems
9. Apply Microsoft Excel spreadsheets/SPSS/MATLAB to solve the statistical calculations in the light of engineering targets and objectives.

Learning and Teaching Approach:

Approach	Hours per Week	Total Credit Hours
Lecture	3	45
Tutorial	1	15
Independent study/self-directed learning	4	60
Total		120

Assessment Approach:

<i>Mode of Assessment</i>	<i>Nos.</i>	<i>Marks Allocated</i>	<i>Marks (%)</i>
Continuous Assessment (Theory)			

Term Test1: Closed Book, One hour duration in 5 th week Topic: Data presentation and description, Mathematical Theory of Probability	1	15	50
Term Test 2: Closed Book, One hour duration in 10 th week Topic: Regression and correlation, Classification of random Process	1	15	
Quiz: Closed Book, in 12 th week	1	5	
Excel or MATLAB(Practical) Topic: Statistics	1	15	
Semester End Examination: Closed book, 3 hr duration	1	50	50

Pre-requisite: None

Subject Matter:

Unit-1: Data Presentation and Description

- 1.1. Graphical and numerical summaries
- 1.2. Characteristics of Datasets
- 1.3. Measures of Central Tendency and Measures of Dispersion

Unit II: Mathematical Theory of Probability

- 2.1 Basic concepts
- 2.2 Classical and axiomatic approaches
- 2.3 Sample space and events
- 2.4 Permutation and Combination
- 2.5 Properties of probability functions
- 2.6 Conditional probability and independent events
- 2.7 Concept of random variable
- 2.8 Discrete and continuous probability density, mass and distribution functions
- 2.9 Expectations and moments
- 2.10 Moment generating and characteristic function
- 2.11 Uniform, Binomial, Poisson, Exponential and Normal distributions
- 2.12 Multi-dimensional random variables and random vectors, Joint, marginal and conditional probability distributions, Covariance
- 2.13 Functions of random variable and random vector
- 2.14 Linear transformation of random variable and random vector
- 2.15 Independent random variables, Mean square estimation.

Unit III: Regression and Correlation

- 3.1 Correlation and Regression
- 3.2 Fitting straight lines and interpreting the fit

- 3.3 Rank correlation
- 3.4 Transformation of random variables - Central limit theorem.

Unit IV: Classification of Random Processes

- 4.1 Definition and examples
- 4.2 First order, second order, strictly stationary, wide-sense stationary and ergodic processes
- 4.3 Markov process(Markov chains – Transition probabilities)
- 4.4 Binomial, Poisson and Normal processes
- 4.5 Sine wave process
- 4.6 Random telegraph process.

Unit V: Correlation and Spectral Densities

- 5.1 Auto correlation, Cross correlation, Properties
- 5.2 Power spectral density, Cross spectral density, Properties
- 5.3 Wiener-Khintchine relation
- 5.4 Relationship between cross power spectrum and cross correlation function

Unit VI: Linear Systems with Random Inputs

- 6.1 Linear time invariant system
- 6.2 System transfer function
- 6.3 Linear systems with random
- 6.4 Inputs – Auto correlation and cross correlation functions of input and output
- 6.5 White noise.

Unit VII: Excell/SPSS/MatLab/Mathematics practice

- 7.1 Data presentation (charts)
- 7.2 Measures of central tendency and measures of dispersion
- 7.3 Fitting straight lines
- 7.4 Correlation and regression.

Reading List:

Essential Reading:

1. Moorthy, M.B.K, Subramani, K. & Santha, A, (2010) *Probability Random Processes and Queuing Theory* (2nd edition), Scitech Publications Pvt.Ltd, India.
2. Peebles Jr. P.Z, (2002), *Probability Random Variables and Random Signal Principles* (4th edition), Tata McGraw-Hill, New Delhi.
3. Miller & John, E. F. (2016), *Probability & Statistics for Engineers* (9th edition), Prentice Hall of India.

Additional Reading:

1. Montgomery, D., Runger, G.C. & Hubele, N.F. *Engineering Statistics* (2nd Edition). John Wiley. ISBN: 0471388793.
2. Ross, S (2002). *A First Course in Probability* (5th Edition). Delhi: Pearson Education.
3. Iyengar, T.K.V & Gandhi, B.K. *Probability & Statistics*. S.Chand & Company.

སྤྱི་ཚན་འབྲེལ་བཤད།

༡ སྤྱི་ཚན་གྱི་མིང་ : རྫོང་ཁ་བར་དོན་སྤྱོད་ལེན།

༢ སྤྱི་ཚན་ཨང་ : རྫོང་ཁ་༡༠༡ (DZG 101)

༣ སློབ་སྤྱོད་གྱི་ཕྱིང་ : གཞུགས་ལག་གཞི་རིམ་འོག་མའི་སློབ་སྤྱོད་དང་
4949 གཞུགས་ལག་གཞི་རིམ་སློབ་སྤྱོད།

༤ སྤྱོད་འབྲུལ་ : ༡༢

༥ སློབ་སྦྱོན་པ་ : རྫོང་ཁའི་ལོགས་བཤད་པ།

༦ སྤྱི་བཏང་གི་ལས་དོན་ :

རྫོང་ཁ་བར་དོན་སྤྱོད་ལེན་གྱི་སྤྱོད་ཚན་འདི་མཐར་འབྲུལ་ཞེན་མ་ལས་49སློབ་སྤྱོད་པ་ཚུ་གིས་རང་གི་མི་ཚོ་ནང་49ལྷ་གཡོག་དང་འབྲེལ་
བའི་49གནད་དོན་ག་ཅའི་ཐད་ལས་འབད་ཅུང་རྫོང་ཁའི་ནང་དག་ཐོག་དང་ཡིག་ཐོག་གཉིས་ཆ་རའི་ནང་བར་དོན་སྤྱོད་ལེན་ཚུལ་དང་
མཐུན་ཏོག་ཏོ་འབད་འབད་ཚུགས་ནི།

༧ སློབ་སྤྱོད་གྲུབ་འབྲས།

སྤྱི་ཚན་འདི་ལྟར་ཚར་བའི་ལུ་ལྷ་སློབ་སྤྱོད་པ་ཚུ་གིས་ :

- ༧.༡ རྫོང་ཁའི་སྐད་ཡིག་གི་འབྲུང་རབས་དང་རྫོང་ཁ་ལྷ་བ་དགོ་པའི་ཁུངས་དང་དགོས་པ་ཚུ་སླབ་ཚུགས།
- ༧.༢ དུས་རྒྱུན་ལག་ལེན་འཐབ་དགོ་པའི་མིང་གྲ་ཚོགས་ཁད་ཚོག་ཚོག་གོགས་ཚུ་མ་འཛོལ་བར་ལག་ལེན་འཐབ་ཚུགས།
- ༧.༣ དུས་རྒྱུན་ལག་ལེན་འཐབ་དགོ་པའི་མིང་གྲ་ཚོགས་ཁད་ཚོག་ཚོག་གོགས་ཚུ་གི་ཡིག་ལྲེབ་ དགས་འབད་འབྲི་ཚུགས།
- ༧.༤ ལུ་ལྷ་སྤུས་གནས་སྤངས་དང་བལྟན་ཏེ་ཞེས་དང་པལ་སྐད་ཚུལ་མཐུན་འབད་ལག་ལེན་འཐབ་ཚུགས།
- ༧.༥ རྫོང་ཁའི་ཐོག་ལུ་བྲིས་ཏེ་ཡོད་མི་ཚུ་ཚུལ་དང་ལྷན་ཏོག་ཏོ་འབད་ལྷག་ཚུགས།
- ༧.༦ རྫོང་མོ་དང་སློ་བུ་དཔེ་གཏམ་གྱི་རིགས་ཚུ་ལག་ལེན་འཐབ་ཚུགས།
- ༧.༧ འབྲེལ་སྤྱོད་དང་བྱེད་སྤྱོད་ལྷག་བཅས་རྒྱུན་སྤྱོད་ཀྱི་ཚོགས་སྐད་ཚུ་མ་འཛོལ་བར་ལག་ལེན་འཐབ་ཚུགས།

ཕ.༤ འབྲི་ཚོམ་གྱི་ཁད་ཚོས་ཚུ་ཚང་མ་འབད་ལག་ལེན་འཐབ་སྟེ་འབྲི་ཚུགས།

ཕ.༥ གཞུང་སྐོར་ཡིག་འགྲུལ་གྱི་རིགས་འབྲི་ཚུགས།

ཕ.༦ འབྲི་ཤོག་གི་རིགས་ག་ཅི་ར་ཨིན་ཅུང་ཚུང་གའི་ནང་དཀའ་ངལ་མེད་པར་བཀའ་ཚུགས།

ཕ.༧ ལུང་འདྲེན་དང་རྒྱབ་རྟེན་གྱི་མོ་འོས་འབབ་ལཱ་རྟོག་རྟོ་འབད་བཀོད་ཚུགས།

༤ རིག་ཆུལ་ཡར་རྒྱས་ : ཚུང་ཁའི་སྐད་ཡིག་གི་རིག་ཆུལ་བཞི།

༥ གནས་ཚུང་ :

༡༠ སློབ་སྟོན་འབད་ཐངས་ :

སློང་ཚན་འདི་གི་དོན་ལུ་ཡོངས་བསྐྱེམས་ཚུ་ཚུང་༡༥༠ཐོབ་དགོས་ཨིན་ཅུང་དུས་རྒྱུན་སློབ་ཁང་ནང་སློབ་སྟོན་གྱི་དོན་ལུ་ཉུང་མཐའ་ཚུ་ཚུང་
༤༠དགོས་ཨིན། 50དེ་ཡང་བདུན་ཕྱག་རེ་ལུ་ཚུ་ཚུང་༤རེ་འབད་བདུན་ཕྱག་༡༥གི་རིང་ལུ་སློབ་སྟོན་འབད་དགོས་ཨིན། 50དེ་གི་ལྷན་མ་ཚུ་
ཚུང་༤༠སློབ་ཁང་ནང་འབད་མེན་པར་རང་རྒྱུང་གི་ཐོག་ལས་སྟོབ་ནི་དང་ལས་འགུལ་འབྲི་ནི་ཚུ་གི་དོན་ལུ་ལག་ལེན་འཐབ་དགོས་
ཨིན། 50དུས་རྒྱུན་སློབ་ཁང་ནང་ལུ་སློབ་སྟོན་འབད་བའི་སྐབས་ལུ་འོག་གི་ཚུ་ཚུང་དབྱ་བའོ་རྒྱབ་མི་དང་འཁྲུལ་ཏེ་

ལག་ལེན་འཐབ་དགོ

སློབ་སྟོན་ ཚུ་ཚུང་༥༠

སློང་ལུ་ ཚུ་ཚུང་༥༠

སྟུན་ལུ་ ཚུ་ཚུང་༡༠

༡༡ དབྱེ་ཞིབ་ : སློང་ཚན་འདི་གི་དོན་ལུ་སློང་རྒྱགས་དབྱེ་ཞིབ་དང་དུས་རྒྱུན་དབྱེ་ཞིབ་གཉིས་ཆ་ར་ལག་ལེན་འཐབ་སྟེ་དབྱེ་ཞིབ་འབད་དགོས་
ཨིན།

ཀ དུས་རྒྱུན་དབྱེ་ཞིབ་སྐྱགས་ ༥༠%

ལས་འགུལ་ ༥༠%

སློབ་ཁང་སྟུན་ལུ་ ༡༥%

སློབ་ཁང་གི་སློང་ལུ་ ༡༥%

ཁ སློང་རྒྱགས་དབྱེ་ཞིབ་ ༥༠%

ཚོས་རྒྱགས་ ༥༠%

ཡོངས་བསྐྱེམས་སྐྱགས་ ༡༠༠

༡༢ སློན་ཚང་ཤེས་ཡོན་ :

༡༣ རང་དོན་

དོན་ཚན་ཀ་ལ། སྐད་ཡིག་གྱི་དོ་སྟོན། (ཚུ་ཚུང་༥)

༡ ཚུང་ཁའི་སྐད་ཡིག་གི་འབྲུང་རབས།

༢ རྫོང་ཁ་ལྷ་ལ་དགོ་པའི་དགོས་པ།

དོན་ཚན་ཁ་པ། མིང་ཚིག་བརྗོད་པའི་རྣམ་གཞག (རྩ་ཚུལ་༢༥)

༡ མིང་།

༢ བྱ་ཚིག་།

༣ བྱད་ཚིག་།

༤ ཚིག་གོགས།

༥ རྫོང་ཁ་ལ་ལག་གཤེས་འགོ་ལྷགས།

༦ ལྷན་ཚུལ། དཔེ་གཏམ། སློ་བེ། རྫོང་མོ།

༧ རྫོང་ཁ་ཁ་ཉག་རྒྱང་གི་མིང་ཚིག་ལག་ལེན་འཐབ་ཐངས།

༨ མིང་ཚིག་དང་བྱ་ཚིག་བྱད་ཚིག་ཚུ་འོས་འབབ་ལྡན་མ་འབད་ལག་ལེན་འཐབ་ཐངས།

དོན་ཚན་ག་པ། རྫོང་ཁའི་ལག་གཤེས་དང་འབྲེལ་ཏེ་ལྷག་ཐངས། (རྩ་ཚུལ་༤)

༡ ཚིག་མཚམས་བཅད་དེ་ལྷག་ཐངས།

༢ རྗེས་འཇུག་གི་སྐྱོ་སྤྲིལ་བུ་བཏོན་དགོས་དང་མ་དགོ་པའི་རིགས་ཚུ་བྱུང་པར་བྱེ་སྟེ་ལྷག་ཐངས།

༣ རྗེས་འཇུག་མེད་ཅུང་ཡོད་པ་བཟུམ་ལྷག་ཐངས།

དོན་ཚན་ང་པ། ཡི་གཱའི་སྦྱོར་བ། (རྩ་ཚུལ་༦)

༡ འབྲེལ་སྒྲ།

༢ བྱེད་སྒྲ།

༣ ལྷག་བཅས།

༤ རྫོན་སྤྱད།

དོན་ཚན་ཅ་པ། ཡིག་འགྲུལ། (རྩ་ཚུལ་༧)

༡ ཡིག་རྒྱང་འབྲི་ཐངས།

༢ མགོན་ལྷུ་འབྲི་ཐངས།

༣ གཏང་ཡིག་འབྲི་ཐངས།

༤ ལྷུ་ཡིག་དང་ལྷུ་ཚིག་/བཤེར་ཡིག་འབྲི་ཐངས།

༥ གན་ཡིག་འབྲི་ཐངས།

༤ ལྷན་ཁྲིའི་ཐངས།

༥ ལྷན་ཚོད་ཁྲིའི་ཐངས།

༦ ལྷན་བསྐྱུགས་ཀྱི་རིགས་ཁྲིའི་ཐངས།

༧ ལྷན་ཤོག་གི་རིགས་བཀང་ཐངས།

༨ ལྷན་ཚོམ་ཁྲིའི་ཐངས།

༩ ཚལ་ཤད་ལག་ལེན་འཐབ་ཐངས།

༡༠ ལྷན་ལྷན་འདྲེན་དང་རྒྱབ་ཉེན་གྱི་དཔེ་ཐོ་བཀོད་ཐངས།

༡༡ ལྷན་དགོ་བའི་དཔེ་ཐོ།

༡ ལྷན་ཚོད་འདྲི་བྱུང་བ་ལེགས་ཤོམ་འབད་ཐོབ་ནིའི་དོན་ལུ་འོག་ལུ་བཀོད་དེ་ཡོད་མའི་དཔེ་དེབ་ཚུ་དེས་པར་དུ་ལྷན་དགོ

ཀུན་བཟང་དོ་རྗེ། (༢༠༡༡) ལྷོ་ཟེ་ལྷའི་པི་མང་། ཐིམ་ཕུ། རྫོང་ཁ་གོང་འཕེལ་ལྷན་ཚོགས།

ཀུན་བཟང་དོ་རྗེ། (༢༠༡༡) རྫོང་མའི་གྱི་དེབ་ལྷོ་རིག་མེ་ཉོག་ ཐིམ་ཕུ། རྫོང་ཁ་གོང་འཕེལ་ལྷན་ཚོགས།

ཀུན་བཟང་འཕྱིན་ལས། (༢༠༠༧) ཡིག་བསྐྱར་རྣམ་གཞག་གི་དེབ། ཐིམ་ཕུ། གེ་ཨེམ་གྱི།

སྐལ་བཟང་ཚོས་འཕེལ་དང་ཆ་རོགས་ཚུ། (༢༠༡༣) ཉེ་འབྲེལ་མེང་ཚོགས་རབ་འབྱེད། ཐིམ་ཕུ། ཨོལ་གྲུ་གྲེན་པ་ལྷོ།

རྣམ་རྒྱལ་དབང་ལྷན། (༢༠༠༧) རྫོང་ཁའི་ཚད་ལྷན་ལྷན་ལྷན་དང་ཡིག་རིགས་ཁྲིའི་ཐངས། ཐིམ་ཕུ།

རྫོང་ཁ་གོང་འཕེལ་ལྷན་ཚོགས། (༢༠༡༡) སལ་སྐད་ལེ་སའི་རྣམ་གཞག་སྐར་མའི་འོད་ཟེར། ཐིམ་ཕུ། རྫོང་ཁ་གོང་འཕེལ་ལྷན་ཚོགས།

རྫོང་ཁ་གོང་འཕེལ་ལྷན་ཚོགས། (༢༠༡༤) འབྲུག་གི་ཡིག་བསྐྱར་རྣམ་གཞག་ ཐིམ་ཕུ། རྫོང་ཁ་གོང་འཕེལ་ལྷན་ཚོགས།

རྫོང་ཁ་གོང་འཕེལ་ལྷན་ཚོགས། (༢༠༠༩) རྫོང་ཁའི་བར་གཞུང་གསར་པ། ཐིམ་ཕུ། རྫོང་ཁ་གོང་འཕེལ་ལྷན་ཚོགས།

བསམ་བློ་ཚེ་རིང་། (༢༠༠༧) ཡ་རབས་ལམ་དུ་འདྲེན་བའི་སལ་སྐད་དང་ལེ་སའི་དེབ་ཚུང་། (ཁ་གསལ་མེད)

ཁ་ འོག་ལུ་བཀོད་མི་དཔེ་དེབ་ཚུ་ཁ་སྐོང་གི་གནས་ཚུལ་ཐོབ་ནིའི་དོན་ལུ་ལྷན་དགོ་པ་ཨིན།

ཀུན་ལེགས་རྒྱལ་མཚན། (༢༠༠༤) རྫོང་ཁའི་བྱེད་སྒྲུ། ལྷོ་ལོ།

སྐལ་བཟང་དབང་ལྷན། (༢༠༠༢) རྫོང་ཁ་བར་དོན་རྒྱུན་འབྲེལ། བསམ་ཅེ།

བྱམས་པ་ཚོས་རྒྱལ། (༡༩༩༩) ལུ་ལུ་ལུ་ལུ་རྣམ་བཤད། ཐིམ་ཕུ། རྫོང་ཁ་གོང་འཕེལ་ལྷན་ཚོགས།

རྫོང་ཁ་གོང་འཕེལ་ལྷན་ཚོགས། (༡༩༩༠) ཚོགས་དོན་ཀུན་གསལ་མེ་ལོང་། ཐིམ་ཕུ། རྫོང་ཁ་གོང་འཕེལ་ལྷན་ཚོགས།

རྫོང་ཁ་གོང་འཕེལ་ལྷན་ཚོགས། (༡༩༩༩) འབྲི་ཚོམ་ཕྱོགས་དེབ། ཐིམ་ཕུ། རྫོང་ཁ་གོང་འཕེལ་ལྷན་ཚོགས། རྫོང་ཁ་གོང་འཕེལ་ལྷན་ཚོགས།

(༡༩༩༠) རྫོང་ཁ་རབ་གསལ་ལམ་བཟང་། ཐིམ་ཕུ། རྫོང་ཁ་གོང་འཕེལ་ལྷན་ཚོགས།

རིན་ཚེན་མཁའ་འགྲོ། (༡༩༩༤) རྫོང་ཁ་དབྱིན་རྒྱུ་ཚོགས་མཚོད།

བསོད་ནམས་བསྐྱར་འཛིན། (༢༠༠༤) ལོ་འཁོར་བཅུ་གཉིས་ཀྱི་བཤད་པ། ཐིམ་ཕུ། གེ་ཨེམ་གྱི་ལས་ལྷོ།

1.4 Semester-IV

This section presents the module descriptors of all modules in semester-IV.

Module Code and Title	:	DIS201 Database Management Systems
Programme	:	BE in Information Technology
Credit	:	12
Module Tutor	:	Tsheten Dorji

General Objectives:

This module will introduce the concepts of database management & database System architecture, database design concept & methodology and database operations & administration. This module intends to prepare students for development and management of database driven application software.

Learning Outcomes:

On completion of the module, students will be able to:

1. Differentiate the terms Database, DBMS and Database System.
2. Explain the advantages of using database approach.
3. Apply database design process.
4. Choose an appropriate DBMS for database application Development.
5. Use a database design process to achieve good quality design.
6. Apply the ER modeling concepts to design the conceptual database.
7. Design a relational database by using ER-to-Relational Mapping algorithm or/and normalization concept.
8. Implement the database schema design with appropriate data integrity.
9. Write SQL queries to retrieve and manipulate data in database.
10. Setup RDBMS servers in the computer.
11. Write and execute the PL/SQL programs.

Learning and Teaching Approach:

Approach	Hours per week	Total credit hours
Lecture	3	45

Practical	3	45
Tutorial	1	15
Self-directed Learning	1	15
Total		120

Students must obtain 40% each in the Continuous assessment of theory, and the semester end examination. The overall pass mark for the module is 50%.

Assessment Approach:

SI #	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
1	Continuous Assessment (Theory)			
1.1	Term Tests: Closed book, one hour duration. -Test-I in 5 th Week (units covered up to 5 th week) -Test-II in 10 th week(units covered from 6 th - 10 th week)	2	20	25
1.2	Assignments: Assignment-1 in 4th week (Units covered up to 4th week); Assignment-2 in 9th week (Units covered from 6th – 10th week)	2	5	
2	Continuous Assessment (Practical)			
2.1	Lab Reports: Lab exercise every week and report to be submitted for every lab	7	10	25
2.2	Lab Test/exam: Online/Close book one hour duration in 14 th Week, Units III to V	1	10	
2.3	Lab observations/performance: Lab exercise being able to carry out during practical class hours with/without tutor's help.	7	5	
3	Semester End Examination: Closed book, 3 hours duration.	1	50	50

Pre-requisite: None.

Subject matter:

Unit I: Introduction

- 1.1 Basics definitions & functionalities of database management systems,
- 1.2 Database users, characteristics & advantages of databases approaches,
- 1.3 Capabilities and applications of database.

Unit II: Database system architecture

- 2.1 Data Models, Database schemas, three-schema architecture
- 2.2 Data Abstraction/ Independence, Client-server Architecture for DBMS
- 2.3 Database languages and interfaces

Unit III: Data Modeling & Database Design

- 3.1 Database design process, database application design process,
- 3.2 Entity-Relationship Model concepts and constraints, Enhanced ER-Model concepts and Constraints
- 3.3 Relational Data Model concepts, Relational Model constraints,
- 3.4 Relational database design using ER-to Relational Mapping Algorithm.

Unit IV: Relational query languages

- 4.1 Relational algebra & Operations, Relational calculus & Operations,
- 4.2 **SQL**: Schema/data definition & manipulation, Basic constraints definition & manipulation, Retrieval & update queries, Aggregate functions, Views, database administration.
- 4.3 Database programming with API & JDBC, Database Stored Procedure & SQL/PSM, PL/SQL.

Unit V: Database Design Theory & Methodology

- 5.1 Relational database design approaches in practices, Relational database design guidelines,
- 5.2 Functional Dependencies, Armstrong's Inference rules,
- 5.3 Normalization & De-normalization, various Normal Forms for Relation schema, Relational Database design algorithms: Relational Decomposition, Multivalued dependencies, Join dependencies.
- 5.4 Practical database design methodology & Use of UML Tools.

Unit VI: Query processing and optimization

- 6.1 Evaluation of relational algebra expressions, query equivalence, joins strategies, query optimization algorithms.
- 6.2 Database storage strategies: Indexing, B-trees, hashing

Unit VII: Transaction processing

- 7.1 Recovery and concurrency control, locking and timestamp based schedulers,
- 7.2 Concurrency Control schemes.

Unit VIII: Introduction to Advanced topics

- 8.1 Object-oriented and object relational databases, logical databases,
- 8.2 Web databases, distributed databases, data warehousing and data mining.

List of Practical (s)

- 1. Installation & configuration of RDBMS server,

2. Database schema design, database creation, tables definition and modification using DDL statement,
3. Manipulation of database using DML statements,
4. Specify retrieval Queries commands & nested queries,
5. Generates required information using SQL aggregate functions,
6. Virtual table: View creations & manipulation and queries on views
7. Database Administration: Creation of users, grant permission, change in password, backup, recovery

Reading list:

Essential Reading

1. Elmasri, R., & Navathe, S. (2014). *Database Systems* (6th ed.). Pearson.
2. Elmasri, R., & Navathe, S.(2011). *Fundamentals of Database Systems* (4th ed.). Addison-Wesley.

Additional Reading

1. Silberschatz, A., Korth, H., & Sudarshan, S.(2011). *Database System Concepts*. McGraw-Hill.
2. Ramakrishna, R., & Gehrke, J. (2000). *Database Management Systems* (2nd ed.). McGraw-Hill.
3. Desai, B. C. (1990). *An Introduction to Database Systems* (1st ed.). West Publishing Company.
4. Abiteboul, S., Hull, R., & Vianu V. (1995). *Foundations of Databases*. Addison-Wesley.

Date: February 29, 2016.

Module Code and Title	:	CTE203 Operating Systems
Programme	:	BE in Information Technology
Credit	:	12
Module Tutor	:	Gagandeep Singh

General objectives:

This module is intended to introduce overview of operating systems such as operating system structures, processes, process synchronization, deadlocks, CPU scheduling, memory management, file systems, secondary storage management.

Learning outcomes:

On the completion of the module, students will be able to:

1. Describe the basic principles used in the design of modern operating systems.
2. Contrast kernel and user mode in an operating system.
3. Explain process management and storage management
4. Differentiate between various preemptive and non-preemptive process scheduling
5. Demonstrate the working of various scheduling algorithms.
6. Understand and practice with the concepts of process management, concurrent processes and threads, memory management, virtual memory concepts, deadlocks.
7. Explain in detail I/O and file systems.

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	3	45
Tutorial	1	15
Independent study/self-directed learning	4	60
Total		120

Assessment:

Sl. No.	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
1.	Continuous Assessment (Theory)			
1.1.	Term Test -Closed book, one hour duration in 5 th and 10 th week, units covered up to 5 th week for test I, units covered from 6 th - 10 th week for test II.	2	30	50
1.2.	Assignments – in 4th week (Units covered up to 4th week) and 11th week (Units covered from 6th week – 10th week)	2	20	
2.	Semester End Examination: Closed book for 3 hours duration	1	50	50

Pre-requisite: None.

Subject matter:

Unit I: Introduction

- 1.1 Application scenarios, Kind of resource support needed by applications

- 1.2 What is an “Operating System” and what support is provided to run an application, hardware and software layers, A bare-bone operating system
- 1.3 Organization of a computer system, operational view of a computing system with resources like processor, memory, input and output
- 1.4 Issues in resource management , introduction to the issues in communication with devices
- 1.5 kernel and shell of an operating system, processes and file

Unit II: Process Management

- 2.1 Processor resource management: Explanation of processor as a resource, definition of a process, processor utilization, multi-processing and time sharing, response time, 5 process state, process state transitions, process scheduling, short-term and long term schedules, non-pre-emptive and pre-emptive scheduling policies, time slice, policies like FCFS, SJF etc. Gantt charts and parameters to compare policy performance, context switching of process state information.
- 2.2 Kernel architecture: User and kernel mode of operation, System calls, process states, kernel operations, design of a scheduler. Inter process communications, Synchronization, semaphores, Deadlock Prevention, Recovery, Detection and Avoidance

Unit III: Memory Management

- 3.1 Motivation for memory management, When and where primary and secondary memory management is needed, compiled code and memory relocation, linking and loading, processes and primary memory management
- 3.2 Memory allocation policies, critique of various policies like first fit, best fit, internal and external fragmentation, secondary memory management
- 3.3 Fixed and variable partitions, virtual memory concept
- 3.4 Paging and page replacement policies, Page faults, thrashing, hardware support for paging
- 3.5 Segmentation, segmentation with paging, swapping, demand paging, page replacement algorithms.

Unit IV: File Systems and Management

- 4.1 Principle of I/O hardware, I/O software
- 4.2 Disks & Disk scheduling
- 4.3 file systems: What is a file, user view of files, file types and file operations, file types in Unix and Microsoft, file operation commands, file access rights, file storage management, Inode or FAT structure, file control blocks, root file system, directory and file paths, blocks, impact of block size selection, contiguous allocation, chained and indexed allocations, impact of allocation policy on fragmentation, mapping file blocks on the disk platter, cylinder, disk access control and scheduling

UNIT V: CASE STUDY

- 5.1 UNIX- Kernel Architecture, Features, shell programming.
- 5.2 Linux – Kernel Architecture, Features, process and memory management, system calls, Implementation, security

Reading List:

Essential Reading

1. Silberschatz A., GALVIN P.B., Gagne G. (2011). *Operating System Concepts* (8th ed.). John Wiley & Sons (ASIA) Pvt. Ltd.
2. Stallings W. (2009). *Operating Systems internal and Design Principles* (6th ed.). Prentice Hall.
3. Dhamdhare D M. (2009). *Operating systems concept-based approach* (2nd ed.). The McGram-Hill companies.
4. Shukla V. (2011). *Operating Systems* (3rd ed.). SK Kataria & Sons.
5. Tanendaum S A., Woodwill Albert S.,2002. *Operating systems design and implementation* (2nd ed.). Prentice Hall of India.

Additional Reading

1. Stallings W. (2005). *Operating Systems internal and design principles* (5th ed.). Prentice Hall.
2. Deital M H., Deital J P., Choffnes R D., (2004). *Operating System* (3rd ed.). Pearson Education.
3. Tanenbaum Andrew S., (2011). *Modern Operating Systems* (3rd ed.). PHI learning Pvt. Ltd.
4. Murrel H, (2006). *Operating Systems*. University of KwaZulu-Natal.
5. Crowley C., (2001). *Operating Systems: A Design Oriented Approach*. McGraw-Hill.

Date: February 25, 2016.

Module Code and Title :CTE204 Internet Technologies & Web Engineering

Programme : BE in Information Technology

Credit :12

Module Tutor : Yeshe Jamtsho

General objective:

This module will introduce students with Internet Technology and its applications. It will also enable the students to prepare and develop technical skills in web designing.

Learning outcomes:

On completion of the module, students will be able to:

1. Explain the TCP/IP model.
2. Differentiate IPv6 and IPv4 and their co-existence schemes.
3. Illustrate the operation of URL, WWW, HTML, and Telnet.
4. Design any form.
5. Differentiate between Intranet and Internet.
6. Employ various selectors in CSS with HTML document.
7. Identify the importance of web engineering.
8. Design a Website.
9. Carry out a mini project to apply client-side form validation using JavaScript.

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	3	45
Tutorial	1	15
Practical	3	45
Independent study/self-directed learning	1	15
Total:		120

Assessment approach:

Mode of Assessment	Nos.	Marks Allocated	Marks (%)
Continuous Assessment (Theory)			
Term Test: Closed book, one hour duration in 5 th week (Unit I to Unit II) and 10 th week (Unit I to Unit V).	2	20	25
Class Test / Assignment / presentation / case study (Unit III)	1	5	
Continuous Assessment (Practical)			
Laboratory Report	5	5	25
Laboratory Test: Closed book, half an hour duration in 12 th week (Unit I to Unit V).	1	5	
Viva-voice: Closed book in 12 th week (Unit I to Unit V) together with laboratory test.	1	5	
Mini-project	1	10	
Semester End Examination: 3 hrs duration, closed book	1	50	50
Total			100

Pre-requisites: None**Subject Matter:****Unit I: Introduction**

- 1.1 History of Internet.
- 1.2 Networking, internetworking, virtual network connections.

Unit II: TCP/IP model

- 2.1 Link Layer: Network drivers for hardwares, ARP, tunnels, PPP, ATM, Frame relay, MAC: Ethernet, Wireless, DSL, ISDN, and FDDI.
- 2.2 Internet layer: IPv4, IPsec, Introduction to IPv6.
- 2.3 Transport layer: TCP, UDP, ICMP, and IGMP.

2.4 Application Layer: Telnet, SSH, FTP, HTTP, DNS, RIP, SNMP, SMTP, POP, IMAP, SIP, RTSP, RTP.

Unit III: The World Wide Web (WWW), Tools for WWW

- 3.1 Web Servers, Web Browsers, URL.
- 3.2 HTML, XHTML, CSS.
- 3.3 Designing for the WWW-Working on the Web, Text for the Web, Images for the Web, Sound for the Web, video for the Web, Animation for the Web, FTP, and Telnet.

Unit IV: Features on JAVA

- 4.1 Threads and multithreaded programming.
- 4.2 Synchronization of threads, dead locks.
- 4.3 Exception handling.
- 4.4 Introduction to packages, Math package, lang package, Utility package.
- 4.5 Applets programming.
- 4.6 Streams: I/O in JAVA, I/O Package, Handling Files, Random access files, chaining streams.

Unit V: JavaScript

- 5.1 Data types, variables, operators.
- 5.2 Control statements.
- 5.3 Array object, date object, string object.
- 5.4 Functions.
- 5.5 Form validation.

Unit VI: Java Servlet

- 6.1 Servlet environment and rule.
- 6.2 HTML support.
- 6.3 Servlet API, Servlet cycle.
- 6.4 Cookies and Sessions.

Unit VII: Web Engineering

- 7.1 Introduction.
- 7.2 Effective web design component, successful and failure web sites.
- 7.3 WebApps Engineering process: planning, technologies, developing time, resource, design (Navigation), elements, and maintenance.

List of Practical:

- 1. Develop static web page using HTML.
- 2. Develop dynamic web page using JAVA.
- 3. Mini project.

Reading List:

Essential Reading

1. Balaguruswamy, E. (2009). *Programming with Java* (4th ed.).India: Tata Mcgraw Hill Education Private Limited.
2. Bhunia, C. T. (2005). *Information Technology network and Internet*. Delhi:New Age International (P) Ltd.
3. Forouzan, B. A. (2003). *TCP/IP protocol suite* (4th ed). United States: McGraw-Hill, Inc.
4. Halsall, F. (2005). *Computer networking & the internet* (5th ed.).U.S.A: Addison Wesley.
5. Kogent Learning Solutions Inc. (2015). *HTML 5 in simple step*. New Delhi: Dreamtech press.

Additional Reading

1. Greenlaw, R., & Hepp, E. (2007). *Fundamentals of internet and www* (2nd ed.) .India: Tata McGraw-Hill.
2. Kurose, J.F., & Ross, K.W. (2013). *Computer networking: A top-down approach featuring the internet* (6th ed.). India: Addison Wesley.
3. Sklar, J. (2001). *Principles of web design* (2nd ed.).Uttar Pradesh: Vikas Publishing House Pvt.Ltd.
4. Underdahle, B., & Underdahle, K. (2001). *Internet and web page / website design* (2nd ed.). India: IDG Books India (P) Ltd.
5. Young, M. L. (2002). *Internet: The complete reference* (2nd ed.). New York: McGraw-Hill, Inc.

Date: April 13, 2016.

Module Code and Title : NWC201 Computer Communication Networks
Programme : BE in Information Technology
Credit : 12
Module Tutor : Mr. Karma Wangchuk

General objective:

This module will provide the students with computer communication and networking concepts. It also prepares and develops students' technical skill in designing, installing, and applying computer networks.

Learning outcomes:

On completion of the module, students will be able to:

1. Explain OSI model and TCP/IP model.
2. Explain different network layers.
3. Setup Local Area Networks.
4. Compare network topologies.
5. Appraise the application of networking device.
6. Use different types of networking media.
7. Design peer-to-peer network and switch network connecting lab computers.

Learning and teaching approach:

Approach	Hours per week	Total credit hours
Lecture	3	45
Practical	3	45
Tutorial	1	15
Independent study	1	15
Total		120

Assessment approach:

Sl. No.	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
1	Continuous Assessment (Theory)			
2.1.	Term Test - Closed book, one hour duration in 5 th and 10 th week, units covered up to 5 th week for test I, units covered from 6 th - 10 th week for test II.	2	20	25
2.2.	Assignments – in 4th week (Units covered up to 4th week) and 11th week (Units covered from 6th week – 10th week)	2	5	
2	Continuous Assessment (Practical)			
2.1	Lab Work – Lab exercise execution every week	8	8	25
2.2	Lab Reports – Lab exercise every week and reports to be submitted for every lab	8	7	
2.3	Lab Exam – Online/Close book one hour duration in 14 th Week, Units covered will be from 1 st to 6 th .	1	10	
3	Semester End Examination: Closed book for 3 hours duration	1	50	50

Pre-requisite: None

Subject Matter:

Unit I: Introduction

- 1.1 Computer Networks, Network goals, Application of Networks, Network topology,
- 1.2 Communication media: copper, wireless, optical fiber, satellite.
- 1.3 The OSI Reference Model: Physical Layer, Data Link Layer, Network Layer, Transport layer, Session layer, Presentation layer, Application layer, TCP/IP model, TCP/IP vs OSI model.

Unit II: The Physical Layer

- 2.1 Transmission Media: Magnetic Layer, Twisted pair, Base Band Coaxial Cable, Brought Band Coaxial Cable, Fiber optics
- 2.2 Communications Satellite.

Unit III: The Data Link Layer

- 3.1 Framing: Character oriented/Bit oriented, HDLC/SDLC, Flag, Bit stuffing & de stuffing, Address, Control, Error Control
- 3.2 Error Detection and Correction: Error Correction Codes, Error Detecting Codes, FEC/BEC, ARQ protocols: Stop-and-Wait protocols
- 3.3 Performance analysis: Throughput comparison, Sliding Window Protocols: One Bit sliding window protocols, Window, Performance analysis.

Unit IV: Network Layer

- 4.1 Network Service design Issues: Services provided to the transport layer, Internal Organization of the Network Layer
- 4.2 Internetworking: Internetworking Devices, Internet Protocol, IPv4 & IPv6 Addressing and Networking.
- 4.3 Routing: Fixed, Dynamic, Centralized, Distributed, Flooding, Floyd's routing algorithm, OSPF, Bellman & Ford routing algorithm.

Unit V: The Transport Layer

- 5.1 The Transport Layer Design Issue: Services provided to the Session Layer, Quality of Service, The OSI Transport Service Primitives,
- 5.2 Transport Protocols, Elements of Transport Protocols.

Unit VI: Session Layer

- 6.1 The Session Layer Design Issue: Services Provided to The Presentation layer, Data Exchange,
- 6.2 Function of Session Layer: Dialogue Management, Synchronization, Activity Management, Exception Reporting.

Unit VII: Presentation & application layer

7.1 Security and Services: Security, DNS, Remote Logging, Electronic Mail, File Transfer, HTTP & WWW.

List of Practical:

1. NIC Installation & Configuration.
2. Prepare network cables (Straight through, Crossover, and Rollover), test different cables, study a topological orientation and build the Small Network.
3. Fibre Optic Splicing and Installation
4. Implement bit stuffing and character stuffing using C programming language.
5. Study Network command and Network Configuration Commands.
6. Implement socket programming using Java.
7. Establishing the Console Session with Router and performing basic configuration.
8. Configure a Network topology using Network Simulation Tools
9. Configure Network using Link State Vector routing protocol (OSPF)
10. Design and Setup LAN.

Reading List

Essential Reading

1. Forouzan, B. A. (2007). *Computer Communication and Networking* (4th ed.). New York: McGraw Hill.
2. Stallings, W. (2011). *Data & Computer Communication* (9th ed.). New Jersey: Prentice-Hall.
3. Tanenbaum, S. A. (2011). *Computer Networks* (5th ed.). Boylston: Prentice Hall.

Additional Reading

1. Bertsekas, D. & Gallager, R.(1992). *Data Networks* (2nd ed.). Prentice-Hall.
2. Bhunia, C. T. (2006). *Information Technology, Network and Internet*. New Age International Publishers
3. Keiser, G. E.(2002). *Local Area Networks* (2nd ed.). McGraw Hill
4. Kurose, J. F. & Ross, K.W. (2013). *Computer Networking (A top-down approach featuring the internet)* (6th ed.). Addison Wesley.
5. Raghavan, S. V. (1990). *Solution to Local Area Networks*. Tata McGraw Hill Pub. Co.

Date: March 31, 2016

Module Code and Title	:	EVS301 Environmental Science
Programme	:	BE in Civil Engineering
Credit	:	12
Module Tutors	:	Mr. Basant Pradhan & Mr. Bharat K Humagai

Module Coordinator : Mr. Bharat K Humagai

General Objective:

The module aims to introduce the concepts of environment and associated issues such as poverty, disaster risk reduction and gender. It dwells on the key emerging environmental pressures in the country and the corresponding adaptation measures in response to the pressure. Mainstreaming of cross cutting issues (environment, climate change, poverty, disaster and gender) into policies and plans and mainstreaming tools such as SEA and EIA are also introduced.

Learning outcomes:

On completion of the module, students will be able to:

1. Explain man-environment relationship and emerging sustainability problems/issues.
2. Prepare a range of innovative and proactive adaptation and disaster resilient measures to respond to climate change.
3. Suggest remedial measures to overcome environmental pressures.
4. Prepare Environmental Impact Assessment (EIA) reports.
5. Describe the concept of Strategic Environmental Impact Assessment
6. Evaluate Risk Assessment on disaster risk reduction.
7. Describe mainstreaming of cross cutting issues of ECPM (Environment Climate Change and Poverty Management)

Learning and teaching approach:

Some of the topics will be lectured while some will be taught through discussion and participation. For better understanding and to translate the theories learnt in the classes into practice, discussion on recent case studies and sharing of practical experiences will be an integral part of the course.

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	3	45

Case study/Presentation/Group activities	1	15
Independent study/self-directed learning	4	60
Total		120

Assessment approach:

<i>Sl. No.</i>	<i>Mode of Assessment</i>	<i>Nos.</i>	<i>Marks Allocated</i>	<i>Marks (%)</i>
1	Continuous Assessment			
1.1	Term Tests: Closed book, one hour duration in 5 th and 10 th week Two units will be covered for Term I and four units for Term II.	2	20	50
1.2	Assignment: In 2 nd week Focus will be given to Water, energy, land degradation, pollution, air, water, soil, forest and Mineral resources: State, Pressures and Response strategies	2	20	
1.3	Presentation & case study: Starting 2 nd week Focus will be given to energy, land degradation, pollution, air, water, soil, forest and mineral resources relating to State, Pressures and Response strategies	1	10	
2	Semester End Examination: 3 hrs duration, closed book	1	50	50

Pre-requisite: None

Subject matter

Unit I: Introduction to Environment and other Crosscutting issues.

- 1.1 Introduction to environment
- 1.2 Human-environment-development relationship: construing environment as opportunity and means of livelihood particularly for the poor.
- 1.3 Environment in GNH and five-year plans, gender and development.
- 1.4 Environmental governance, sustainable development.

Unit II: Emerging Environmental Issues and interventions to address them

- 2.1 Climate Change
- 2.2 Brief introduction to Climate change and national and international commitments (for example carbon neutrality) to climate change.
- 2.3 Causes of climate change, both natural and anthropogenic.
- 2.4 Impact of climate change in general and in Bhutanese context
- 2.5 International obligation for Adaptation and adaptation measures initiated in Bhutan (*Experience sharing on the National Adaptation Plan of Action and other successful adaptation interventions*) and elsewhere.
- 2.6 Greenhouse emission and policy measures to reduce greenhouse gas emission.
- 2.7 Introduction to waste, different types of waste and impacts: municipal waste, industrial waste, e-wastes and hazardous waste.
- 2.8 Integrated Solid Waste Management and using solid waste as resource
- 2.9 Solid Waste Management Act.
- 2.10 Land degradation: Causes (Urbanization, agricultural practices, change in land use pattern, developmental activities), impacts, adaptation and mitigation.
- 2.11 Air, Forest and Mineral resources: State, Pressures and Response strategies.
- 2.12 Pollution Issues: Noise, Thermal Pollution: causes, impacts and adaptive and interventions

Unit III: Disaster Risk Reduction and Management Approaches

- 3.1 Introduction to natural, climate induced and manmade disasters such as floods, forest fires, windstorm, earthquake, Glacial Lake Outbreak Flood (GLOF).
- 3.2 Causes and impacts of disasters.
- 3.3 Disaster Risk Analysis/ Risk Assessment and Disaster Risk Reduction
- 3.4 Innovative and proactive measures, including non-structural mitigation measures (falling hazards) initiated in Bhutan and beyond in managing and reducing the risk of disaster.

Unit IV: Environmental Impact Assessment (EIA)

- 4.1 Principles and theoretical background of Environmental Impact Assessment (EIA), including social impact assessment (SIA).
- 4.2 Introduction to SEA, Difference between SEA and EIA, Rationale and importance/benefit of SEA, Challenges of conducting SEA, limitation and emerging criticism on SEA.

Unit V: Mainstreaming of cross cutting issue (ECP, DRR and Gender) into development policies, plan and programs

5.1 Introduction to Environment, DRR and Gender mainstreaming, National and international mandates on Environmental.

5.2 DRR and Gender Mainstreaming, Challenges of mainstreaming, Approaches and Tools for Mainstreaming.

Reading List:

Essential Reading

1. Canter, L.W. (1996). *Environmental Impact Assessment*. Singapore: McGraw-Hill, Inc.
2. Davis, H.L., & Masten, S.J. (2004). *Principles of Environmental Engineering & Sciences*. New York, NY: McGraw Hill
3. Masters, G.M. (1991). *Introduction to Environmental Engineering and Science*, New Delhi: Prentice-Hall India Pvt. Ltd.
4. Nebel, B. J., (1987). *Environmental Science*, Prentice-Hall Inc.,.
5. Therivel, R. (2004). *Strategic Environmental Assessment in Action*. London: Earthscan
6. Cunningham, W.P., & Cunningham, M. A. (2007). *Principles of Environmental Science: Inquiry & Application* (4th ed.) New Delhi: McGraw Hill Inc.
7. P Wathern, Unwin Hyman (1988). *Environmental Impact Assessment: Theory and Practice*, London,

Additional Reading

- 1) Clayton, B.D., & Bass, S. (2009). *The challenges of environmental mainstreaming: Experience of integrating environment into development institutions and decisions*. London: Environmental Governance No.3. International Institute for Environment and Development.
- 2) Clayton, B.D., & Sadler, B. (2005). *Strategic Environmental Assessment: A sourcebook and reference guide to international experience*. London: Earthscan
- 3) Wright, R.T., & Nebel, B.J. (2002). *Environmental Science: Towards a Sustainable Future*.

Date: March 26, 2016.

1.5 Semester-V

This section presents the module descriptors of all modules in semester-V.

Module Code and Title : CTE305 Software Engineering
Programme : BE in Information Technology
Credit : 12
Module Tutor : Tsheten Dorji

General Objective:

This module introduces the students to fundamental of Software engineering used in software development project. It will enable the students to get prepared with structural approaches of software requirement analysis modeling & design methods, software design concepts, Software testing methods & validation for quality assurance.

Learning Outcomes:

On completion of the module, students will be able to:

1. Differentiate between process, products and systems.
2. Use the software process in software development project
3. Choose a suitable software process model for a particular software project
4. Apply software requirement engineering process to gather the software requirements and produce a good SRS document.
5. Translate SRS into the different types of analysis documents
6. Apply design concepts and techniques to design good software.
7. Use different techniques and strategies of software testing.
8. Explain the quality management and review techniques.

Learning and Teaching Approach:

Approach	Hours per week	Total credit hours
Lecture	3	45
Tutorial	1	15
Case Study	2	30
Self-directed learning	2	30
Total		120

Assessment Approach:

sl#	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
1	Continuous Assessment			
1.1	Term Tests: Closed book, one hour duration. -Test-I in 5 th Week (units covered up to 5 th week) -Test-II in 10 th week(units covered from 6 th - 10 th week)	2	30	50
1.2	Assignments: Assignment-1 in 4th week (Units covered up to 4th week); Assignment-2 in 9th week (Units covered from 6th – 10th week)	2	5	
1.3	Case Study: Group-wise topic should be given by the tutor in 5 th week. The study should focus mainly on requirement analysis and software design aspects. The outcome of study should be atleast produce SRS document.	1	15	
	Progress Presentations in 8 th and 11 th Week	2	5	
	Study report: submission in 13 th week	1	5	
	Final Presentation in 14 th Week	1	5	
2	Semester End Examination: Closed book, 3 hours duration	1	50	50

Pre-requisite: None.

SUBJECT MATTER:

Unit I: INTRODUCTION

- 1.1 Definition of terms, The evolution of software, Software Crisis, Attributes of good Software, Software characteristics, Software myths, A Layer technology,
- 1.2 Software Applications, Software Engineering methods, Software Engineering tools
- 1.3 The software process/Software Life Cycle

Unit II: SOFTWARE PROCESS MODEL

- 2.1 The Linear Sequential Model/Waterfall Model
- 2.2 Evolutionary Software Process Models: The Prototyping Model, The Incremental Model, The Spiral Model,
- 2.3 The RAD Model, The Concurrent Development Model, Fourth generation Techniques.

Unit III: SYSTEM ENGINEERING

- 3.1 System Engineering Hierarchy, Software Product Engineering

- 3.2 Requirement Engineering: Requirement Elicitation, Requirements Analysis and Negotiation, Requirements Specification, Requirements Validation and Management, Functional Specifications.

Unit IV: ANALYSIS CONCEPTS AND MODELING

- 4.1 Requirement Analysis, Analysis Principles,
- 4.2 Data Modeling: Data Objects, Attributes, and Relationships, Cardinality and Modality, Entity/Relationship Diagrams, Data flow Diagrams, Behavioral Modeling, The Data Dictionary, Other classical analysis methods.

Unit V: SOFTWARE DESIGN CONCEPTS

- 5.1 Design Principles and methods, software design concepts & techniques
- 5.2 Effective Modular Design: Functional Independence, Cohesion, and Coupling, Design Documentations,
- 5.3 Architectural Design, Software Architecture,
- 5.4 Mapping Design into Software Architecture: Transform flow, Transaction flow,
- 5.5 Interface Design: Interface design models, User Interface Design, User Interface Design process, Design Issues, Implementations Tools.

Unit VI: SOFTWARE TESTING TECHNIQUES

- 6.1 Software Testing Fundamentals, Test Case Design
- 6.2 Testing methods: White box testing, basic path testing, Control structure testing, Black box testing, Software
- 6.3 Testing Strategies: Unit Testing, Integration Testing, Validation Testing, System Testing, Verification and Validation.

Unit VII: SOFTWARE QUALITY

- 7.1 Software Quality Assurance, Quality Concept-cost of quality,
- 7.2 Software Quality Group, Roles and responsibilities of SQA group-Formal Technical reviews,
- 7.3 Quality standards, Software Reliability.

Reading List:

Essential Reading

1. Roger, S. P. (2005) . *Software Engineering – A Practitioner’s Approach* (6th ed.). McGRAW-HILL
2. Ian, S.(2011). *Software engineering* (9th ed.). Pearson Education Asia, New Delhi.

Additional Reading

1. Richard, F. (2000). *Software Engineering Concepts*. Singapore: McGraw Hill International Edition.

2. Ali, B., & Frederick, J. H. (2003). *Software Engineering Fundamentals*. Noida: Oxford University Press.

Date: 29th February 2016.

Module Code and Title : CTE306 Mobile Application Development
Programme : BE in Information Technology
Credit : 12
Module Tutor : Manoj Chhetri

General objectives:

This module is intended to provide student the essentials of mobile application development. It introduces the students to the different platforms and tools available for mobile application development.

Learning outcomes:

On completion of the module, students will be able to:

1. Explain mobile operating system.
2. Explain different mobile application development platforms.
3. Develop basic android phone apps.
4. Develop basic iOS phone apps.
5. Develop basic windows phone apps.
6. Demonstrate cross platform mobile application development.
7. Develop basic cross platform app using MobileFirst.

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	3	45
Tutorial	1	15
Practical	3	45
Independent study/self-directed learning	1	15
Total		120

Assessment Approach:

Sl. No.	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
10.	Continuous Assessment (Theory)			

3.1.	Term Test: Closed book, one hour duration in 5 th (1-3 unit) & 10 th week(4-6 unit)	2	20	25
3.2.	Assignment: Two weeks duration in 6 th & 7 th week(content includes any topic related to 1-6unit).	1	5	
4.	Continuous Assessment (Practical)			
3.1.	Lab Reports/Regular laboratory assessment: Weekly assessment.	1	5	25
3.2.	Practical examination: Closed book, 3 hours duration in 14 th Week (1-6 unit).	1	10	
3.3.	Project: Mini project development for 4 weeks duration from 9 th to 13 th Week (students have to build application based on concepts learned in 1-6 unit).	1	10	
5.	Semester End Examination Closed book and 3 hours examination (All units).	1	50	50
			Total =	100

Pre-requisites: CPL102 Object Oriented Programming

Subject Matter:

Unit I: Introduction

- 1.1 Mobile operating system, Operating system structure, Constraints and Restrictions, Hardware configuration with mobile operating system,.
- 1.2 Features of mobile OS: Multitasking Scheduling, Memory Allocation, File System Interface, Keypad Interface, I/O Interface, Protection and Security, Multimedia features.
- 1.3 ARM and intel architectures.

Unit II: Mobile Applications

- 2.1 Characteristics of mobile applications.
- 2.2 Introduction to Mobile development IDE's.
- 2.3 Types of mobile apps: Native app, web app and hybrid app.
Differences between native, web and hybrid app.

Unit III: Windows Phone

- 3.1 Introduction to Windows Phone, Windows phone fundamentals.
- 3.2 Underlying OS, built-in controls, Architecture, memory management, communication protocols, application development methods and deployment.

Unit IV : Android

- 4.1. Introduction to Android, Android fundamentals, underlying OS(Linux).
- 4.2. History, Architecture, memory management, communication protocols.
- 4.3. Anatomy of an android app, built-in controls, fragments, intents and services.
- 4.4. IDE, application development methods and deployment.

Unit V: iOS

- 5.1. Introduction to iOS, Underlying OS(Darwin).
- 5.2. History, Architecture, memory management, communication protocols.
- 5.3. Anatomy of an iOS App, hardware, xCode and iOS SDK, the iOS Human interface guideline.
- 5.4. Application development methods, built-in control, deployment.
- 5.5. Objective-C or swift basics: classes, control structures, Exception handling.

Unit VI: Mobile First

- 6.1. Introduction to MobileFirst basics, Optimization, pages and fragments .
- 6.2. Writing a basic program- in MobileFirst Studio, Client technologies, Client side debugging.
- 6.3. Creating adapters, Invoking adapters from MobileFirst Client application.
- 6.4. Common Controls, Using Java in adapters.
- 6.5. Programming exercise with Skins, Understanding Apache Cordova, Offline access, and Encrypted cache deprecated, Using JSONStore.

List of Practical(s):

1. Practical: Design and development of Application for windows using visual studio. Introduction to App-structure, built-in Controls, file access, basic graphics, DB access, network access, contacts/photos/etc.
2. Practical: Design and development of Application for Andriod using Android studio. Introduction to App-structure, built-in Controls, file access, basic graphics, DB access, network access, contacts/photos/etc.
3. Practical: Design and development of Application for iOS using XCode. Introduction to App-structure, built-in Controls, file access, basic graphics, DB access, network access, contacts/photos/etc.
4. Practical: Creating basic cross platform app using Mobile First.

Reading list:

Essential Reading

1. McWherter, J., & Gowell, S. (2012). *Professional Mobile Application Development*. New Delhi: Wiley.

2. Ray, J.(2015). *iOS 8 Application Development in 24 Hours*. United States:Sams publication.
3. Buron,M.(2015). *Android Application Development for Dummies*(3rd ed).New Delhi:Wiley.
4. Lee.H., & Chuvyrov.E.(2012). *Beginning Windows Phone App Development*(1st Ed).New Delhi:Apress

Additional Reading

1. Mark,D.,Nutting,J.,Topley,K.,Olsson,F.,& LaMarche,J.(2014). *Beginning iPhone Development with Swift: Exploring the iOS SDK* (4th ed) .New Delhi: Apress

Date: April 27,2016

Module Code and Title	:	DIS302 Object Oriented Analysis and Design
Programme	:	BE in Information Technology
Credit	:	12
Module Tutor	:	Tshering

General Objective:

The module provide knowledge about modeling techniques that are applicable to software development process through business analysis and software development. The Modeling technique covers the most significant activity in the software development process that enables developer efficiently analyze the existing business process and create the new software system. Unified Modeling Language (UML) is introduced to enable students to create the structure and design of an object-oriented system.

Learning outcomes:

On completion of the module, students will be able to:

1. Use software development life cycle
2. Apply requirement modeling
3. Implement Requirements and Design phases
4. Apply static and dynamic modeling
5. Integrate Software Architecture
6. Analyze a problem using business and system modeling
7. Model requirements using use cases, actors, classes, attributes, operations, and objects
8. Create interaction, activity, state diagrams, package, component and deployment diagrams
9. Apply framework and patterns to design the software system
10. Apply UML to quality processes

Learning and teaching approach:

Approach	Hours per week	Total credit hours
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Lecture	3	45
Practical	3	45
Tutorial	1	15
Independent study	1	15
Total		120

Assessment approach:

Sl. No.	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
1	Continuous Assessment (Theory)			
1.1	Term Test -Closed book, one hour duration in 5 th and 10 th week, units covered up to 5 th week for test I, units covered from 6 th - 10 th week for test II.	2	20	25
1.2	Assignments – in 4th week (Units covered up to 4th week) and 11th week (Units covered from 6th week – 10th week)	2	5	
2	Continuous Assessment (Practical)			
2.1	Lab Work – Lab exercise execution every week	8	8	25
2.3.	Lab Reports – Lab exercise every week and reports to be submitted for every lab	8	7	
2.4.	Lab Exam – Online/Close book one hour duration in 14 th Week over all units covered.	1	10	
3.	Semester End Examination: Closed book for 3 hours duration	1	50	50

Prerequisite: None.

Subject matter:

Unit I: Introduction to OOAD and UML

- 1.1 SDLC phases,
- 1.2 Software development approaches
- 1.3 Process Models: waterfall, Prototype, Spiral, Win-win spiral, Incremental, Rational Unified Process
- 1.4 Object-oriented concept, Role of OOAD in SDLC

- 1.5 Evolution and scope of UML, Building blocks of UML, Types of UML diagram, Associate UML diagrams with UML modeling techniques
- 1.6 Software system architecture
- 1.7 Role of UML in SDLC

Unit II: Introducing Requirements Modeling

- 2.1 Analyze a problem
- 2.2 Business and system modeling
- 2.3 Stakeholders,
- 2.4 System requirements
- 2.5 Requirement gathering techniques
- 2.6 Story boarding techniques
- 2.7 Use case diagrams for system modeling.

Unit III: Migrating from Requirements to Design

- 3.1 System boundary
- 3.2 Scope of a project
- 3.3 Refine use cases
- 3.4 Use case in the design phase
- 3.5 Generate test cases.

Unit IV: Static and Dynamic Modeling

- 4.1 Concepts of static
- 4.2 Concepts of dynamic modeling
- 4.3 Class and object diagram
- 4.4 Types of classes
- 4.5 Class relationship
- 4.6 Abstract classes
- 4.7 Interfaces
- 4.8 Sequence diagrams
- 4.9 Communication diagrams
- 4.10 State machine diagrams
- 4.11 Events and transitions
- 4.12 Activity diagram.

Unit V: Understanding Software Architecture

- 5.1 Package diagram
- 5.2 Package diagrams for the IMS
- 5.3 Component diagrams
- 5.4 Deployment diagrams
- 5.5 Software architecture
- 5.6 Viewtypes

Unit VI: Using Frameworks and Patterns

- 6.1 Patterns
- 6.2 Frameworks
- 6.3 GRASP patterns: Expert, Creator, and Controller

- 6.4 GoF patterns: Creational, Structural, and Behavioral, model design patterns
- 6.5 Map design to a code
- 6.6 Refactoring design
- 6.7 Session façade.

Unit VII: UML and Quality Software Processes

- 7.1 Quality process
- 7.2 Dimensions of a quality process
- 7.3 Quality process metamodels
- 7.4 Tailoring UML: Stereotypes, Constraints, and Tagged values
- 7.5 Additional constructs: process and thread.

Unit VIII: Measuring Software projects

- 8.1 Process-components
- 8.2 Evolution of Function Points (FP)
- 8.3 calculate FPs
- 8.4 Complexities of UML artifacts

List of Practical:

Student will take up project which will cover following areas:

1. Creating a simple use-case diagram using Visio
2. Identifying requirements and design a system
3. Designing a prototype for a system
4. Modeling the static view of a system
5. Modeling the dynamic view of a system
6. Creating an activity diagram for a system
7. Design architectural model for a system
8. Generating a code for a system
9. Identifying dimensions of process model
10. Determining the FP count

Reading List:

Essential reading

1. Booch, G., RumBaug, J., & Jacobson, I. (2010). *The unified Modeling language Reference Manual*. New Delhi: Pearson Education.
2. NIIT,(2013). *Object-Oriented Analysis and Design using UML-student guide I*. New Delhi: Sona printers Pvt. Ltd.
3. NIIT,(2013). *Object-Oriented Analysis and Design using UML-student guide II*. New Delhi: Sona printers Pvt. Ltd.
4. Priestly. M, (2006). *Practical Object Oriented Design Using UML(2nd ed)*. McGraw-Hill Education.
5. Dennis. A, Wizom. H. B, Tegarden.C(2004). *Systems Analysis and Design with UML Version 2.0: An Object-Oriented Approach*. Wiley.

Additional reading

1. Roger, S. P, (2005). *Software Engineering – A Practitioner’s Approach (6th ed.)*. New Delhi: McGRAW-HILL.
2. Ian, S. (2011). *Software Engineering (9th ed.)*. New Delhi: Pearson Education Asia.

Date: April 28, 2016

Module Code and Title : CTE307 Human Computer Interaction
Programme : BE in Information Technology
Credit : 12
Module Tutor : Nima Dukpa

General Objective:

This module is aimed to introduce students to basic but essential concepts on Human-Computer Interaction (HCI). The module is inherently interdisciplinary and addresses cognitive psychology, human factors, computer systems and user interfaces design. In essence, the course shall provide essential background to allow students to practice system design, selection, evaluation and use with the knowledge of human characteristics, interaction styles, use context, task characteristics, and design processes.

Learning outcomes:

On completion of the module, students will be able to:

1. Critically discuss the basic physiological, perceptual, and cognitive components of human learning and memory.
2. Analyze interaction problems from a technical, cognitive, and functional perspective.
3. Explain how interface design is ultimately dependent on human perception and cognition.
4. Choose an appropriate interaction style for a given need (GUI, command-line, natural language, etc.)
5. Simulate how a user would understand and attempt to use an interface using an analytical method such as the cognitive walkthrough.
6. Choose appropriate widgets for a GUI.
7. Implement the user-centered design process and usability in designing, evaluating and implementing computer systems and user-interfaces.

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	3	45
Tutorial	1	15
Independent study	4	60
Total		120

Assessment approach:

<i>Mode of Assessment</i>	<i>Nos.</i>	<i>Marks Allocated</i>	<i>Marks (%)</i>
Continuous Assessment (Theory)			
Term Test: closed book, one hour duration in 5 th and 10 th week.	2	20	30
Class Test / Assignment / presentation / case study	2	10	
Semester End Examination: 3 hrs. duration, closed book	1	70	70

Pre-requisite: None

Subject matter:

Unit I: Human perception and Information presentation

- 1.1 HCI: introduction, goals, benefits, human characteristics, contributory disciplines.
- 1.2 Cognitive principles (perception, memory, problem solving etc.)
- 1.3 Understanding the user, designing for humans (affordances, conceptual models, feedback, constraints, mapping, stages of action etc.), input devices, ergonomics and virtual reality.

Unit II: Low-level human cognition

- 2.1 Time-scales and the illusion of multi-tasking.
- 2.2 GOMS Keystroke-Level Modeling.
- 2.3 Hypothesis testing and statistical significance.

Unit III: Higher cognition and interaction styles

- 3.1 Metaphor
- 3.2 Direct Manipulation
- 3.3 Widget Survey
- 3.4 Command Languages
- 3.5 Other interaction styles and choosing among interaction styles

Unit IV: Usability analysis

- 4.1 Error handling and prevention.
- 4.2 Heuristic evaluation
- 4.3 Usability guidelines

Unit V: HCI Design and Evaluation

- 1.1 Activities in HCI design.
- 1.2 User analysis, user experience and interaction styles, task analysis.
- 1.3 User-centered design methods, usability and usability testing/standards.
- 1.4 Interaction styles/models and design principles.
- 1.5 Types of interaction and design factors of: Command-line, menus, natural language interaction, point-and-click, 3-D, and WIMP interfaces
- 1.6 Matching interface elements to user requirements.

- 1.7 Biometrics, repetitive stress syndrome, ADA508.
- 1.8 Localization and globalization, developing tools.

Unit VI: Web usability

- 6.1 Content analysis and information architecture.
- 6.2 Supporting navigation
- 6.3 Browser and device dependence/independence.
- 6.4 Implementation: html, CSS, JavaScript

Essential Reading

- 1. Shneiderman, B., & Plaisant, C. (2010). *Designing the User Interface* (5th ed.). Addison Wesley.
- 2. Jenifer, T. (2006). *Designing Interfaces: Patterns for Effective Interaction Design* (2nd ed.). O'Reilly.
- 3. McCracken, D.D., & Wolfe, R.J. (2004). *User-centered Website Development: A human computer interaction approach*. Pearson prentice hall.

Additional Reading

- 1. Alan Dix, & et al. (2004). *Human Computer Interaction*. Prentice Hall.
- 2. Tan, Desney, Vanderdonckt, & Jean. *Human-Computer Interaction Series*. Springer

Date: May 26, 2016.

Module Code and Title	:	CTE3408 Advanced Web Technology
Programme	:	BE in Information Technology
Credit	:	12
Module Tutor	:	Yeshi Wangchuk

General objectives:

This module will enable students to learn the advance web technology concept such as service oriented architectural design and application development frameworks. It will also prepare and develop students' technical skill and abilities to in designing and developing web services using technology such as Java technology and ASP.NET technology.

Learning outcomes:

On completion of the module, students will be able to:

- 1. Explain the web services architecture and web base architecture in n-tier technology.
- 2. Implement working principles of XML and XML Web Services, and its application.
- 3. Write XML document and develop XML-based application.
- 4. Explain the JSP, J2EE and web services
- 5. Write ASP, JSP and ASP.NET programs implementing web services.

6. Develop the application implementing the web service incorporating the scripting languages such as PHP, JSP, ASP, and ASP.NET with VB/C#
7. Deploy the applications on different web servers using file copying and IDE deployment methods.

Learning and teaching approach:

Approach	Hours per week	Total credit hours
Lecture	3	45
Practical	3	45
Tutorial	1	15
Independent study	1	15
Total		120

Assessment Approach:

Sl. No.	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
4.	Continuous Assessment (Theory)			
4.1.	Term Test -Closed book, one hour duration in 5 th and 10 th week, units covered up to 5 th week for test I, units covered from 6 th - 10 th week for test II.	2	20	25
4.2.	Assignments – in 4th week (Units covered up to 4th week) and 11th week (Units covered from 6th week – 10th week)	2	5	
5.	Continuous Assessment (Practical)			
2.1	Lab Work – Lab exercise execution every week	8	8	25
2.2	Lab Reports – Lab exercise every week and reports to be submitted for every lab	8	7	
2.3	Lab Exam – Online/Close book one hour duration in 14 th Week, Units covered will be from 1 st to 5 th .	1	10	
3	Semester End Examination: Closed book for 3 hours duration	1	50	50

Pre-requisite: None

Subject Matter:**Unit I:XML**

- 1.1 Introduction to XML, XML fundamentals, Well-formed XML documents, Valid XML documents.
- 1.2 Components of XML document, XML tools, XML namespaces, XML Schema
- 1.3 XSL Stylesheet, XML DOM, XML database

Unit II:WEB SERVICES

- 2.1 Web Services architecture, overview of web services, service oriented roles
- 2.2 Architecture, architectural process, 3-tier web based architecture
- 2.3 Types of web Services (RSS, SOAP, RESTful)

Unit III:JAVA WEBSERVICES ARCHITECTURE

- 3.1 Introduction to JSP and java servlets
- 3.2 System architecture, servlets, JDBC API
- 3.3 Overview of JSP, J2EE and web services.

Unit IV:ACTIVE SERVER PAGES

- 4.1 HTML and VBScript fundamentals, ASP concepts
- 4.2 Using Request, Response, application, session, server objects, using cookies.

Unit V:.NET FRAMEWORK

- 5.1 Introduction to .NET framework, building blocks of .NET platform, role of .NET class libraries
- 5.2 Understanding CTS, CLR, CLS
- 5.3 ODBC/SQLConnections
- 5.4 Building simple Web Services application, building VB/C# application
- 5.5 Deploying .NET application.

List of Practical:

1. Prepare XML document and apply XSLT stylesheet
2. Create simple web services as an application provider and consume it through application client.
3. Develop database-driven application using JSP, Servlet and JDBC API
4. Write VB script program
5. Demonstrate the JDBC connectivity.
6. Write, compile and execute the ASP.NET program
7. Demonstrate the SQLConnections in .NET framework.
8. Develop a database-driven web site using ASP.NET.

Reading List:**Essential Reading**

1. Kochmer, C., & Frandsen, E. (2002). *JSP and XML: Integrating XML and Web Services in Your JSP Application*: Addison-Wesley.
2. Ladd, E. O'Donnell, J. (2003). *Using XHTML 4, XML and Java 2*. New Delhi: PHI.
3. Moghan, R. & Preethan, V.V. (2003). *Java Web Services Programming*. New Delhi: Wiley Dreamtech.

- Schmelzer, R., Bloomberg, J., Siddalingaiah, M., Hunting, S., Qualls, M., Darby, C., Houlding, D., & Kennedy. (2002). *XML and Web Services Unleashed* (1 ed.). Sams.

Additional Reading

- Hunter, J. & Crawford, W. (2000). *Java Servlet Programming*. USA: O'Reilly Publications.
- Troelsen, A. (2003). *C# and the .NET platform*. USA: 2003.

Date: April 9, 2016

1.6 Semester-VI

Module Code and Title	:	NWC302 Mobile Computing
Programme	:	BE in Information Technology
Credit	:	12
Module Tutor	:	Gagandeep Singh

General objectives:

The module aims to provide an understanding of the different psychological and social perspectives and methods used in studying mobile computing. It also aims to develop critical awareness of the theoretical approaches to the study of individual differences, besides encouraging students to research on how these concepts and principles are being applied in actual computing

Learning outcomes:

At the end of this module, students are expected to be able to:

- Explain Mobile communication system and Technologies.
- Set up Wireless LAN using wireless networking concepts
- Identify the GSM, GPRS and Bluetooth software model for mobile computing
- Analyze mobile and wireless networks.
- Explain the handling mechanism of data in mobile computing.
- Identify the important issues and concerns on mobile security
- Differentiate between different Ad hoc routing protocols.

Learning and teaching approach used:

Approach	Hours per week	Total credit hours
Lecture	3	45
Tutorial	1	15
Independent study	4	60

Total	120
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Assessment

Sl. No.	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
6. Continuous Assessment (Theory)				
6.1.	Term Test -Closed book, one hour duration in 5 th and 10 th week, units covered up to 5 th week for test I, units covered from 6 th - 10 th week for test II.	2	20	30
6.2.	Assignments – in 4th week (Units covered up to 4th week) and 11th week (Units covered from 6th week – 10th week)	2	10	
7.	Semester End Examination: Closed book for 3 hours duration	1	70	70

Pre-requisite: None.

Subject matter:

Unit I: Introduction

- 1.1 Issues in mobile computing, overview of wireless telephony: cellular concept
- 1.2 GSM: air-interface, channel structure, location management: HLR-VLR
- 1.3 Hierarchical, handoffs, channel allocation in cellular systems, CDMA, GPRS.

Unit II: Wireless Networking

- 2.1 Wireless Networking, Wireless LAN Overview: MAC issues, IEEE 802.11, Blue Tooth
- 2.2 Wireless multiple access protocols, TCP over wireless, Wireless applications
- 2.3 Data broadcasting, Mobile IP
- 2.4 WAP: Architecture, protocol stack, application environment, applications.

Unit III: Data Management

- 3.1 Data management issues, data replication for mobile computers
- 3.2 Adaptive clustering for mobile wireless networks, File system, disconnected operations.

Unit IV: Mobile Agents

- 7.1 Mobile Agents computing, security and fault tolerance,
- 7.2 Transaction processing in mobile computing environment.

Unit V: Ad Hoc Network

- 5.1 Introduction to Ad Hoc networks, localization, MAC issues
- 5.2 Routing protocols, global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Ad Hoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA)
- 5.3 QoS in Ad Hoc Networks, applications.

Reading List:

Essential Reading

1. Hansmann, M., & Nicklous, S, (2006). *Principles of Mobile Computing* (2nd ed.). Dreamtech Press.
2. Jochen Schiller, (2004). *Mobile Communications* (2nd ed.). Addison-Wesley.
3. Behravanfar R., (2005). *Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML*. Cambridge University Press:United Kingdom.

Additional Reading

1. Stojmenovic, Cacute. (2002). *Handbook of Wireless Networks and Mobile Computing*. Wiley.
2. Adelstein, F. G., & Sandeep K.S.,(2005), *Fundamentals of Mobile and Pervasive Computing* (3rd ed.). McGraw-Hill Professional: New Delhi.
3. Martyn, M.(2003). *Mobile and Wireless Design Essentials*. Wiley DreamTech.

Date: February 25, 2016.

Module Code and Title	:	DIS303 Cryptography and Network Security
Programme	:	BE in Information Technology
Credit	:	12
Module Tutor	:	Tandin Wangchuk

General Objective:

The module will introduce the theory and practice of modern cryptography, mathematics of information security and implementation using a modern computer system. It also introduces cryptanalysis (breaking the code) in which systems can be used to increase security or misused to compromise security.

Learning Outcomes:

On completion of the module, students will be able to:

1. Perform modular computations by hand, include modular exponentiation.
2. Cryptanalyze different ciphers and modern cryptosystems.
3. Evaluate the security of systems by different models of cryptanalysis.

4. Apply modular arithmetic to the implementation of modern public-key cryptosystems.
5. Analyze strengths and weaknesses in different systems.
6. Explain the basic structure of the DES and AES private-key systems.
7. Use hash functions in a modern security environment
8. Analyze a hash function for suitability.
9. Explain the strengths and limitations of cryptography
10. Implement cryptographic algorithms in a modern high level computer system.

Learning and Teaching Approach:

Approach	Hours per Week	Total Credit Hours
Lecture	3	45
Practical	3	45
Tutorial	1	15
Independent study/self-directed learning	1	15
Total		120

Assessment Approach:

Sl. No.	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
1	Continuous Assessment (Theory)			
1.1	Term Test - Closed book, one hour duration in 5th and 10th week, units covered up to 5th week for test I, units covered from 6th - 10th week for test II.	2	20	25
1.2	Assignments - in 4th week (Units covered up to 4th week) and 11th week (Units covered from 6th week - 10th week)	2	5	
2	Continuous Assessment (Practical)			
2.1	Lab Reports – Lab exercise every week and reports to be submitted for every lab	8	15	25
2.2	Pop Quiz – Surprise test of ½ hr duration in 6 th and 12 th week	2	5	
2.3	Q & A Sessions – viva and completion of lab work at the end of each lab	8	5	
3	Semester End Examination: Closed book for 3 hours duration	1	50	50

Pre-requisite: None.

Subject Matter:

Unit I: Introduction

- 1.1 Security attacks, services and mechanism, Introduction to cryptography.
- 1.2 Conventional encryption model, Classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, stenography, stream and block ciphers.

Unit II: Block ciphers

- 2.1 Block ciphers principals, Shannon's theory of confusion and diffusion, data encryption standard(DES), strength of DES, differential and linear crypt analysis of DES, block cipher modes of operations,
- 2.2 Double DES, Triple DES, IDEA encryption and decryption, strength of IDEA,
- 2.3 Confidentiality using conventional encryption, traffic confidentiality, key distribution, random number generation.

Unit III: Cryptography algorithm

- 3.1 Introduction to graph, ring and field
- 3.2 Prime and relative prime numbers, modular arithmetic, Fermat's and Euler's theorem, primality testing, Euclid's Algorithm, ~~Chinese Remainder theorem~~, discrete Algorithms.
- 3.3 Principals of public key crypto systems, RSA algorithm, security of RSA, key management, Diffe-Hellman key exchange algorithm, introductory idea of Elliptic curve cryptography, Elgamal encryption.

Unit IV: Message Authentication and Hash Function

- 4.1 Authentication requirements, authentication functions, message authentication code,
- 4.2 Hash functions, birthday attacks, security of hash functions and MACS, MD5 message digest algorithm, secure hash algorithm (SHA).
- 4.3 Digital Signatures: Digital Signatures, authentication protocols, digital signature standards (DSS), proof of digital signature algorithm.

Unit V: Authentication Applications

- 5.1 User Authentication
- 5.2 Kerberos and X.509 directory authentication service,
- 5.3 Electronic mail security-pretty good privacy (PGP), S/MIME.

Unit VI: Security

- 6.1 IP security: Architecture, Authentication header, Encapsulating security payloads, combines security associations, key management.
- 6.2 Web Security: Secure socket layer and transport layer security, secure electronic transaction (SET).
- 6.3 System Security: Intruders, Viruses and related threads, firewall design principals, trusted systems, Wireless Equivalent Privacy.

List of Practical(s):

- 1. Installation and Use of encryption/decryption tools
- 2. Cryptanalysis of symmetric ciphers
- 3. Solve mathematical problems
- 4. Implementations of Euclid's and extended Euclid's Algorithm
- 5. Private and public key implementation
- 6. Secure email
- 7. Secure web application

Reading List:

Essential Reading

- 1. Stallings, W. (2013). *Cryptography and Network Security: Principals and Practice* (6th ed.). Pearson.
- 2. Stallings, W. (2013). *Network Security Essentials: Applications and Standards* (5th ed.). Pearson.

Additional Reading

- 1. Shema, M. (2014). *Anti-Hacker Tool Kit* (4th ed.): McGraw-Hill Education.
- 2. Anderson, R. J. (2008). *Security Engineering: A Guide to Building Dependable Distributed Systems* (2nd ed.). Wiley and Sons, Inc.
- 3. Buchmann, J. (2004). *Introduction to Cryptography* (2nd ed.). New York: Springer-Verlag.
- 4. Schmech, K. (2003). *Cryptography and Public Key Infrastructure on the Internet*. Wiley & Sons, Inc.
- 5. Chirillo, J. (2001). *Hack Attacks Denied: a Complete Guide to Network Lockdown*. Wiley & Sons, Inc.
- 6. Bandel, D. A. (2000). *Linux Security Toolkit*. Wiley & Sons, Inc.

Date: March 31, 2016.

Module code and Title	:	ITM302 System Administration
Programme	:	BE in Information Technology
Credit	:	12
Module Tutor	:	Mr. Yeshi Wangchuk

General objectives:

This module will provide students with the skills to configure of different servers, monitoring and managing different servers systems. It will also prepare and develop students' skills to troubleshoot and monitor different systems running different services.

Learning Outcomes:

On completion of the module, students will be able to:

- 1) Install and configure server OS.
- 2) identify different file systems
- 3) set permissions to the files and owner
- 4) identify different web tools for monitoring and managing resources
- 5) Perform backup and restore files
- 6) Install and configure application servers: gateway, DNS, web, mail, proxy.
- 7) Configure networking, services and security on servers.
- 8) Troubleshoot systems administration problems.

Learning and Teaching approach:

Approach	Hours per week	Total credit hours
Lecture	3	45
Practical	3	45
Tutorial	1	15
Independent study	1	15
Total		120

Assessment approach:

Sl. No.	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
4	Continuous Assessment (Theory)			
7.1.	Term Test -Closed book, one hour duration in 5 th and 10 th week, units covered up to 5 th week for test I, units covered from 6 th - 10 th week for test II.	2	20	25
7.2.	Assignments – in 4 th week (Units covered up to 4 th week) and 11 th week (Units covered from 6 th week – 10 th week)	2	5	

5	Continuous Assessment (Practical)				
2.4	Lab Work – Lab exercise execution every week	8	8	25	
2.5	Lab Reports – Lab exercise every week and reports to be submitted for every lab	8	7		
2.6	Lab Exam – Online/Close book one hour duration in 14 th Week, Units covered will be from 1 st to 7 th .	1	10		
6	Semester End Examination: Closed book for 3 hours duration	1	50	50	

Pre-requisites: None

Subject Matter

Unit I: Operating System (servers)

- 1.1 Overview, System Installation
- 1.2 File systems: File system hierarchy, Files, Directories.
- 1.3 Permissions: File permission, User, group and owner, Access list, Multi-tasking.
- 1.4 Utilities, GUIs, Configuration, Security, backup and restores.

Unit II: Name Server

- 2.1 overview, installation, name configuration, zone configuration
- 2.2 Name Server Security, DNSSEC, Dynamic DNS

Unit III: Web Server

- 3.1 Overview, installation, system requirement.
- 3.2 Configurations: HTTP, HTTPS, VirtualHost.

Unit IV: Database server

- 4.1 overview, installation, configuration, accessing database
- 4.2 Database user and privilege: root user, creating users, granting privileges to user
- 4.3 SQL: listing databases, using database, showing tables and table description

Unit V: Gateway server

- 5.1 Introduction: overview, installation, accessing gateway server
- 5.2 DHCP: configuration, IP subnet and supernetting
- 5.3 DHCP security, DHCP Snooping
- 5.4 Proxy : configuration, firewall, NAT, caching, routing, filters, DNS forwarding.

Unit VI: Mail Server

- 6.1 overview, installation, configuration, accessing mail server.

6.2 SMTP, POP, IMAP, Filters

Unit VII: Other Services

7.1 FTP server installation and configuration, FTP services

7.2 File server installation and configuration, routers configuration.

7.3 NMS, SNMP, Cronjob.

7.4 OpenSSH, SSH and SSH Agent

Practical List

1. Setting up client server network.
2. Server OS installation and configuration.
3. DNS installation and configuration.
4. Configure DNSSEC name server
5. Web and database server installation and configuration.
6. Creating users and its privileges
7. Mail server installation and configuration.
8. Gateway installation and configuration.
9. FTP and File server installation and configuration.
10. Implementation of SSH and SSH Agent
11. NMS Server Installation configuration

Reading List

Essential Reading

1. Adelstein, T., & Lubanovic, B. (2007). *Linux System Administration*. O'Reilly Media.
2. Frisch, A. (2002). *Essential System Administration: Tools and Techniques for Linux and Unix Administration* (3ed. ed.). O'Reilly Media.
3. Nemeth, E. (2011). *UNIX and Linux System Administration Handbook* (4e. ed.). New Delhi, India: Dorling Kindersley (India) Pvt. Ltd.

Additional Reading

4. Bragg, R., & Hunt, C. (2005). *Windows Server 2003 network administration*. O'Reilly Media.

Date: February 3, 2016

Module Code and Title : CTE309 Multimedia Technologies
Programme : BE in Information Technology
Credit : 12
Module Tutor : Kezang Dema
General objective:

This module will introduce students to Multimedia Technologies and its applications. It will also enable the students to prepare and develop technical skills in multimedia applications.

Learning outcomes:

On completion of the module, students will be able to:

1. Differentiate types of multimedia
2. Explain coding schemes for audio, video, images and data used in multimedia applications.
3. Use compression standards of multimedia application development.
4. Integrate different services for multimedia and network requirements.
5. Edit audio and video
6. Produce hypermedia documents using multimedia tools.
7. Process images, audio and video.

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	3	45
Tutorial	1	15
Practical	3	45
Independent study/self-directed learning	1	15
Total		120

Assessment approach:

SL.No	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
1	Continuous Assessment (Theory)			
1.1	Term Test: Closed book, one hour duration in 5 th week (Unit I to Unit II) and 10 th week (Unit I to Unit IV).	2	20	25
1.2	Assignments: Assignment I on 6 th week (Units I to II) and Assignment II on 9 th week (Units IV to Unit V).	2	5	
2	Continuous Assessment (Practical)			
2.1	Laboratory assessment	4	5	25
2.2	Laboratory report	4	5	
2.3	Laboratory test	1	5	
2.4	Mini-project (Image, Audio and Video processing)	1	10	

3	Semester End Examination: 3 hrs duration, closed book	1	50	50
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Pre-requisites: None.

Subject Matter:

Unit I: Introduction to Multimedia System

- 1.1 Architecture and components.
- 1.2 Multimedia distributed processing model.
- 1.3 Synchronization, Orchestration and Quality of Service (QOS) architecture.

Unit II: Audio and Speech

- 2.1 Data acquisition, Sampling and Quantization.
- 2.2 Human Speech production mechanism.
- 2.3 Digital model of speech production, Analysis and synthesis, Psycho-acoustics, low bit rate speech compression, MPEG audio compression.

Unit III: Images and Video

- 3.1 Image acquisition and representation.
- 3.2 Composite video signal NTSC, PAL and SECAM video standards.
- 3.3 Bilevel Image Compression standards: ITU (formerly CCITT) Group III and IV standards.
- 3.4 JPEC image compression standards.
- 3.5 MPEG video compression standards.

Unit IV: Multimedia Communication

- 4.1 Fundamentals of data communication and networking.
- 4.2 Bandwidth requirements of different media.
- 4.3 Real time constraints: Audio latency, Video data rate, multimedia over LAN and WAN.
- 4.4 Multimedia conferencing.

Unit V: Hypermedia presentation

- 5.1 Authoring and Publishing.
- 5.2 Linear and non-linear presentation.
- 5.3 Structuring Information.
- 5.4 Different approaches of authoring hypermedia documents.
- 5.5 Hypermedia data models and standards.

Unit VI: Multimedia Information Systems

- 6.1 Operating system support for continuous media applications: A limitation is usual OS.
- 6.2 New OS support, Media stream protocol, file system support for continuous media.
- 6.3 Data models for multimedia and hypermedia information.
- 6.4 Content based retrieval of unstructured data.

List of Practical:

1. Image acquisition, editing and compression into different formats.
2. Audio acquisition, editing and compression into different formats.
3. Video acquisition, editing and compression into different formats.
4. Authoring and publishing hypermedia documents.

Reading List:**Essential Reading**

1. Bhunia, C. T. (2009). *Multimedia and multimedia communication*. New Delhi: New Age International.
2. Buford, J.F.K. (1994). *Multimedia systems*. New York: Addison-Wesley Publishing Co.
3. McGloughlin, S. (2000). *Multimedia: Concepts and practice*. Upper Saddle River, NJ, USA: Prentice-Hall, Inc.

Additional Reading

1. Andleigh, P. K., & Thakrar, K. (1995). *Multimedia systems design* (1st ed.). Upper India: Prentice-Hall, Inc.
2. Faulkner, A., & Chavez, C. (2015). *Adobe photoshop CC Classroom in a book* (1st ed.). United States: Adobe Press.
3. Halsall, F. (2001). *Multimedia communications: Applications, networks, protocols and standards*. United States: Pearson Education.
4. Lozano, J., Willif, J., & Molina, L. (1997). *Multimedia sound & video*. India: Prentice-Hall of India.
5. Wirasinha, A. (2004). *Flash in a flash: Web development* (1st ed.). India: Prentice-Hall.

Date: April 13, 2016.

Module Code and Title : CTE310 Web Application Development

Programme : BE in Information Technology

Credit : 12

Module Tutor : Tandin Wangchuk

General objective:

This module provides knowledge on the tools needed for the development of a dynamic web application. It will also guide the student through the web programming with an experiential approach, filled with numerous examples and hands-on exercises, including substantial practice in coding a functional application.

Learning outcomes:

On completion of the module, students will be able to:

1. Explain the importance of web application
2. Apply web design principles

3. Explain basics of web programming language
4. Implement forms and perform form validations
5. Develop data-driven web applications
6. Debug, Validate and Secure Web Applications
7. Use one of the Application Development Framework
8. Implement Email, HTTP headers, buffers & caches

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	3	45
Practical	3	45
Tutorial	1	15
Independent study/self-directed learning	1	15
Total		120

Assessment approach:

Sl. No.	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
1	Continuous Assessment (Theory)			
1.1	Term Test – Closed book, one hour duration in 5th and 10th week, units covered up to 5th week for test I, units covered from 6th - 10th week for test II.	2	20	25
1.2	Assignments – in 4th week (Units covered up to 4th week) and 11th week (Units covered from 6th week – 10th week)	2	5	
2	Continuous Assessment (Practical)			
2.1	Lab Reports – Lab exercise every week and reports to be submitted for every lab	8	10	25
2.2	Project – A web application development project to be submitted in week 15 th	1	10	
2.3	Pop Quiz – Surprise test of ½ hr duration in 6th and 12th week	1	5	
3	Semester End Examination: Closed book for 3 hours duration	1	50	50

Pre-requisite: None.

Subject Matter:

Unit I – Introduction

- 4.1 Web Basics, Web, Networks, Networking Protocols, The Internet, Network Address, Domain, DNS, Client and Server, Web, Hypertexts, URL, Publishing website, web hosting and domain registration
- 4.2 Web Development Processes
- 4.3 Information Architecture, Design Issues, Web Accessibility and Usability

Unit II – Web Language Basics

- 2.1 Language and Logic of Programming,
- 2.2 Translation Process, Syntax, Difference between Syntax and Semantics,
- 2.3 Importance of web programming language, Quotes, Comments, Special Characters, Language Environment, Data Types, Typed Languages, Operator Precedence, Variables, Constants, Arrays
- 2.4 Language concepts

Unit III – Web Language Flow: Conditional and Iteration Statements

- 3.1 Conditional statements
- 3.2 Loop statements, break and continue statement

Unit IV - Functions

- 3.1 Function Definition, Calling Functions, Function Parameters, Internal Functions

Unit V - Working with Files

- 5.1 File System Basics, Types of File Functions,
- 5.2 Reading from Files, Writing to Files, File System Performance,
- 5.3 Array Functions, language Libraries

Unit VI - Regular Expressions

- 5.1 POSIX vs Perl Regex, Regular Expression Syntax, Regular Expression functions
- 5.2 Searching array and patterns

Unit VII - Programming Basics

- 6.1 Structuring a Program,
- 6.2 Guidelines to Create a Skeleton
- 6.3 String Handling and Manipulations
- 6.4 Files and directory handling

Unit VIII - Web and Database Basics

- 7.1 Basic HTML form, How Servers and Clients Communicate
- 7.2 Transmitting Data to a Web Server, Buffers, Browser Caching
- 7.3 State management such as Cookies, Sessions
- 7.4 Configuration Email Delivery Options
- 7.5 Database Basics, Relational Databases, ORM
- 7.6 Database connections, Data access Abstraction Layer

- 7.7 Prepared User authentication using HTTP, hard-coding, file-based and database
- 7.8 Statements, Stored Procedures, Transactions
- 7.9 Introduction to web services

Unit IX - Object Oriented Web Development

- 8.1 Defining Classes, Creating Objects, Static Context, Class Constants,
- 8.2 Access Specifiers (visibility): Public, Private, and Protected,
- 8.3 Inheritance, Polymorphism, Function Overriding, Namespaces

Unit X - Build Web Applications

- 9.1 Web Development Frameworks, Web Services, Performance Enhancements, Code Acceleration (Op Code Caching), Profiling
- 9.2 Security: file deletion and cross-site scripting, input sanitization
- 9.3 Troubleshooting Procedures: Development and Error Messages, documentations, Debugging and Error Handling

List of Practical(s):

1. Designing, developing and Debugging Web Application
2. Reading and Writing Data on Files
3. Connecting database with Web application
4. Developing interactive web development
5. Validating Forms
6. Implement Function Overriding
7. Creating Web Service
8. Securing Web Applications

Reading List:

Essential Reading

1. Leon, S. & Rosen, R. (2009). *Web Application Architecture: Principles, Protocols and Practices* (2nd ed.). Wiley.
2. Moseley, R. & Savailiya, M.T. (2011). *Developing Web Applications*. New Delhi: Wiley India.

Additional Reading

1. Beighley, L., & Morrison, M. (2009). *Head First PHP & MySQL*. O'Reilly Media, Inc.
2. Gilmore, W. J. (2010). *Beginning PHP and MySQL: From Novice to Professional* (4th ed.). Apress.
3. Nixon, R. (2009). *Learning PHP, MySQL and JavaScript*. O'Reilly Media.
4. Suehring, S., & Valade, J. (2013). *PHP, MySQL, JavaScript & HTML5, All-in-one For Dummies* (1 ed. Wiley & Sons, Inc.

Date: March 23, 2016.

Module Code and Title : ITM301 Software Project Management
Programme : BE in Information Technology
Credit : 12
Module Tutor : Nima Dukpa

General objectives:

The module is designed to encompass fundamental foundation needed to effectively initiate and manage workplace software projects. With prime emphasis on critical insight into various phases of system development lifecycle, the module will cover essential knowledge areas of project management with relevant tools, techniques and methodology.

Learning outcomes:

On the completion of the module, students will be able to:

1. Apply the principles of system development lifecycle in the implementation of an IT application.
2. Implement the software project planning techniques.
3. Apply the costs estimation techniques and the principles of project risk management.
4. Implement appropriate network scheduling techniques.
5. Implement the principles and procedure of monitoring and controlling.
6. Determine quality attributes of an IT development project products.
7. Exhibit leadership skills of building and maintaining an effective development team.
8. Evaluate software project and prepare reports on IT development project.

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	3	45
Tutorial	1	15
Independent study/self-directed learning	4	60
Total		120

Assessment:

Sl. No	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
1	Continuous Assessment (Theory)			
1.1	Term Test: Closed book, one hour duration in 5 th and 10 th week of the semester. Term Test I: From Unit-I, Unit-II, and Unit-III. Term Test II: From Unit-IV & Unit-V	2	30	50

1.2	Assignments: During fourth and 8 th week, Unit I-II(Assignment 01) & Unit III-IV (Assignment 02)	2	10	
1.3	Class test	1	5	
1.4	Presentation: During 10 th week.	1	5	
2	Semester End Examination: 3hours duration, closed book	1	50	50
Total				100

Pre-requisite: None.

Subject matter:

Unit I: A brief introduction to stages of a project

- 1.1 Feasibility studies and the establishment of a business case for a project.
- 1.2 Requirements elicitation, analysis and verification: purpose and methods.
- 1.3 Project objectives, goals and measures of success.
- 1.4 Stages of a development project: requirements elicitation; requirements analysis; design of software, hardware and networks; system building (including software coding) and integration; verification and validation; installation.
- 1.5 Development life cycle to projects.
- 1.6 Criteria for building or buying in software applications.
- 1.7 Project management with particular reference to incremental and iterative approaches.
- 1.8 Project closure and post implementation activities.
- 1.9 Project support activities, including configuration management and change control.

Unit II Project planning and estimating

- 2.1 Product and work breakdown structures (PBS and WBS).
- 2.2 Network plans and analysis; critical path analysis.
- 2.3 Resource allocation, including the identification of resource types and the resolution of resource clashes.
- 2.4 Principles, methods, advantages and disadvantages and relative accuracy of different estimating techniques.
- 2.5 Project Cost-Benefit analysis: NPV, ROI, Payback analysis and IRR

Unit III Progress monitoring, project control, and reporting

- 3.1 Monitoring: key project metrics related to time/progress (e.g. planned and actual activity duration) costs (e.g. planned and actual effort and other costs) scope/size of functionality (e.g. lines of code, function points) and quality (e.g. number of error reports).
- 3.2 Project control (comparing actual and planned progress).
- 3.3 Types of report: exception, progress (or checkpoint), management (e.g. highlight reports)
- 3.4 Monitoring and control of project finances and quality.
- 3.5 Earned value analysis: planned and earned value, actual costs; cost and schedule performance indicators, including their graphical representation.

3.6 Assessment of impact and implications due to project deviations and changes to project plan.

Unit IV Risk management

4.1 Risk identification: types of risk, risk checklists.

4.2 Risk prioritization: assessment of likelihood and impact of risk; qualitative and quantitative methods of assessing risk exposure.

4.3 Risk management tactics, including risk avoidance, risk transfer, risk reduction, risk mitigation and contingency planning

Unit V Software quality management

5.1 Definition of product quality and software quality

5.2 ISO 9001 and quality management systems: principles and features

5.3 System quality specification and measurement, including an overview of ISO 9126.

5.4 Process and product quality approaches: capability maturity models.

5.5 Quality assurance and quality control, project audit and quality audit.

5.6 Methods of enhancing quality: the different types of testing, inspections, reviews, standards.

5.7 Management and control of testing.

Unit VI Human factors

6.1 The role, responsibilities and skills of the project manager

6.2 Team management, motivation, retention

6.3 Management of relationships with the stakeholders within and outside the project team, including users

6.4 Project organization: roles of project boards, user and developer representatives, project managers, team leaders, suppliers, programme and project support.

Reading list

Essential Reading

1. Fairly, R. E. (2009). *Managing and Leading Software projects*. New York, USA: Wiley-IEEE Computer Society Press.
2. Stellman, E., & Greene, J. (2005). *Applied Software Project Management*. California, US: O'Reilly Media.
3. Hughes, B., & Cotterell, M. (2008). *Software Project Management* (4th ed.). New Delhi: McGraw-Hill.

Additional Reading

1. Project Management Institute. (2013). *A Guide to the Project Management Body of Knowledge* (5thed.). Project Management Institute.
2. Stover, T. S. (2011). *Microsoft Project 2010 inside out* (1st ed.). California, US: O'Reilly Media.

Date: May 10, 2016.

Module Code and Title : PRW301 Introduction to Research
Programme : BE in Civil Engineering
Credit : 12
Module Tutor : Mr Tsheten Dorji

General Objective:

This module aims to provide students with an understanding of research principles, a range of research methodologies and appropriate analysis tools. It will also develop in the students the skills and knowledge necessary to undertake an independent project. Students will take up a small scale research project that will enable them to go through the whole research process to better understand the theory learned and to equip them with the practical skills and knowledge required to undertake their project work in a later semester of the programme

Learning outcomes:

On completion of the module, students will be able to:

1. Develop an achievable set of research / major project aims and objectives
2. Analyse the characteristics of different methodological approaches and methods of research.
3. Evaluate the applicability of different research methods within their own study area.
4. Develop a research methodology and justify the selection of the chosen research method(s).
5. Justify the selection of appropriate data analysis methods.
6. Produce a clear, coherent and well-presented proposal.
7. Write scientific report.

Learning and teaching approach:

The subject matter of the module will be taught to the students through 2 hours of lecture each week for the first 10 weeks of the semester, totaling 20 hours of lecture for the module. A tutor will be assigned as a guide for a group of students (3-4). Most of the learning will take place by students carrying out the basic research steps. Students will identify a research topic at the beginning of the semester in consultation with the guide. The topic should be finalized by the 3rd week of the semester. Once the topic is identified, students will research on the topic in consultation with the guide. At the end of the 5th week, students will present their proposal to a committee comprising of at least 3 tutors identified by the programme leader. At the end of 12th week students will be required to produce a 3000 word scientific report on the research conducted.

Approach	Hours per Week	Total Credit Hours
Lecture		20
Self-directed learning		100
Total		120

At the end of the 12th week, students will have to submit printed copy of the research report and also present to the same committee.

Timeline of research:

SI No	Activities	Due date (week)
1	Grouping of students	1 st week
2	Finalisation of topic	3 rd week
3	Proposal presentation	5 th week
4	1 st review by guide	8 th week
5	2 nd review by guide	10 th week
6	Final report submission	12 th week
7	Report presentation	14 th week

Assessment approach:

The module will be assessed in four parts as shown below. Out of a total of 100 marks, 20 marks for proposal presentation, 30 marks for continuous assessment by guide, 20 marks for report presentation and 30 marks for submitting scientific report. The detail marking scheme is shown below.

Sl. No.	Mode of Assessment	Marks Allocated
1	Proposal Presentation	20
2	Submission of proposal	20
3	Report presentation	30
4	Submission of scientific report	30

Presentation	Marks allocated
Presentation Techniques	3
Content	6
Response to the Questions	8
Language (Verbal clarity) and confidence	3

Proposal evaluation	20
Aim and objectives	4
Methodology	8
Expected outcome	2
Feasibility	2
Originality and practicality	2
Work plan	2

The continuous assessment by guide will be based on sections like (i) Introduction, (ii) Problem statement with aim and objectives, (iii) methods, (iv) literature review, (v) results, (vi) discussion with conclusions. Students are expected to submit each section every week and the guide will award marks for every section independently.

Report Evaluation	30
Abstract	1.5
Introduction	1.5
Literature review	4.5
Technical content	7.5
Results	7.5
Originality	3
Practicality	3
Conclusion	1.5

Pre-requisites: None

Subject matter:

Unit I: Introduction

- 1.1 Research theory analysis
- 1.2 Principles and practice of research
- 1.3 Research process
- 1.4 Research proposal
- 1.5 Research paper
- 1.6 Designing a research or project strategy

Unit II: Proposal Writing

- 2.1 Processes
- 2.2 Component of proposal
- 2.3 Administrative procedures
- 2.4 Technical check lists
- 2.4 Assurances and certification

Unit III: Research Methodologies

- 3.1 Overview of various methodologies,
- 3.2 Comparisons between different modes of investigation
- 3.3 Appropriateness of various methodological approaches to research
- 3.4 Developing the research question
- 3.5 Developing aims and objectives

Unit IV: literature Review

- 4.1 The purpose and production of a literature review
- 4.2 Review of literature
- 4.3 Searching strategy
- 4.4 Review processes
- 4.4 Compiling a research bibliography.
- 4.5 Review of ethical, legal and political issues.

Unit V: Data & Analysis

- 5.1 Sampling types and authentication
- 5.2 Data collection techniques
- 5.3 Methods of data analysis
- 5.4 Evaluation of analysis tools
- 5.5 Interpreting the results of data analysis
- 5.6 Presentation and Interpretation of result

Unit VI Referencing System

- 6.1 Type of referencing and citation
- 6.2 Referencing and citation system
- 6.3 Table, Figure and formula citation

Unit VII Report and Publication

- 7.1 Accurate documentation
- 7.2 Abstract, introduction, methods, literature review, result discussion and conclusion.
- 7.3 Publication process

Reading List:

Essential Reading:

1. Balnaves, M. & Caputi, P. (2001). *Introduction to Quantitative Research Methods: An investigative approach*, Sage Publications Ltd., London.
2. Hart, C (1998). *Doing a Literature Review*, Sage Publications Ltd., London.
3. Ruane J M (2005). *Essentials of Research Methods: A Guide to Social Science Research*, Wiley-Blackwell Publishing, London.
4. Punch K.F. (2006). *Developing Effective Research Proposals (Essential Resource Books for Social Research)* (2nd edition), Sage Publications Ltd., London.

Additional Reading:

1. Plowright, D. (2011) *Using Mixed Methods: frameworks for an integrated methodology*, Sage Publications Ltd., London.
2. Yin, R. (2009) *Case Study Research: Design and Methods* (4th edition.), Sage Publications Ltd., London.

Date: March 26, 2016

1.7 Semester-VII

Module Code and Title	:	DIS404 Management Information Systems
Programme	:	BE in Information Technology
Credit	:	12

Module Tutor : Nima Drukpa

General objective:

This module introduces an understanding of different psychological and social perspectives and methods used in Management Information Systems. It also gives students an awareness of the role of information systems in supporting the operations and improving the flow of information in an organisation. Through the learning activities for the module, students will get the opportunity to see the concepts and principles of management information systems being applied in the real world scenario

Learning outcomes:

On completion of the module, students will be able to:

1. Identify different and competing perspectives of organizational behavior.
2. Interpret relevant factors affecting people's behavior in the workplace
3. Relate the theoretical knowledge to practice and decision making process
4. Use information systems frame work
5. Apply management information system for decision making
6. Position resource in planning technique
7. Incorporate reengineering model
8. Model organizational functions into MIS

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	3	45
Tutorial	1	15
Self-study	4	60
Total		120

Assessment Approach:

SL. No	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
1	Continuous Assessment (Theory)			
1.1	Term Test: closed book during 5 th & 10 th week for 1 hour duration each.	2	20	30
1.2	Assignments: Two weeks duration on 6 th & 7 th week from Unit VI	1	5	
1.3	Case Study	1	5	
2	Semester End Examination	1	70	70

Pre-requisite: None

Subject matter:

Unit I: Introduction

- 1.1 Definition of management, its definition, purpose, elements of science
- 1.2 Patterns of management analysis.
- 1.3 Functions of managers

Unit II: People and Organization

- 2.1 People: psychological factors, worker's skill & abilities
- 2.2 Organization: Organizational characteristics, Organizational behavior, corporate culture, power inter-group conflict, intra-group dynamics
- 2.3 The MIS function in organization, MIS personal
- 2.4 Computer operation personal, MIS management.

Unit III: System and Models System

- 3.1 Components of a system, environment, open Vs Closed systems.
- 3.2 Models: modeling systems general vs specific models, levels of models, types of models.
- 3.3 Models of organizational systems.
- 3.4 A general model of organization and its internal environment.
- 3.5 Strategic planning models.

Unit IV: Management & Decision Making

- 4.1 Management: labels of management, managerial role, planning & control, Managerial styles,
- 4.2 Managerial decision making: characteristics of types of decision.

Unit V: Transaction Processing & Management Reporting Systems

- 5.1 An information systems frame work: Transaction processing framework, Management reporting system, Decision support system, Knowledge based systems, Office systems
- 5.2 Transaction processing: nature, function, role of IT in transaction processing, processing cycles, Transaction processing subsystem.

Unit VI: Management Reporting System

- 6.1 Evaluation of management reporting system, types of reports, structuring report content.
- 6.2 products, DSS development tools, User interfaces, Executive information system (EIS),
- 6.3 Executive roles & decision making, Executive decision making environment

Unit VII: MIS in the Functional Areas of Business

- 7.1 Financial information system
- 7.2 Marketing MIS
- 7.3 Manufacturing MIS

Unit VIII: Enterprise Resource Planning

- 8.1 Materials Requirement planning (MRP), Closed loop MRP, Manufacturing Resource Planning (MRP – II),

- 8.2 Enterprise Resource Planning
- 8.3 Functional architecture of ERP, Benefits of ERP, Business Process,
- 8.4 Reengineering and ERP, ERP implementation, SAP.

Case Study: Case study method, Analytical Case, Issue Case, Written Case Analysis, Illustrations.

Reading list:

Essential Reading list:

1. Davis. G.(2008). *Information System : Conceptual Foundations, Structure and Development*. New Delhi: Tata McGraw Hill
2. Charles, P., & Thomas, C. (1993). *Management Info System: Strategy & action*. New York : McGraw-Hill, Inc.

Readings/Books:

1. Kelkar S.A.(2006). *Management Information Systems- A concise study*. New Delhi: Prentice Hall of India.
2. Post & Anderson.(2008). *Management Information System*. New Delhi: Tata McGraw Hill.
3. Okha. M. M.(2009). *Management Information Systems*. Pune: Everest Publishing House.

Date: April 28, 2016.

Module Code and Title	:	CME404 Fiber Optic Communication
Programme	:	BE in Electronics & Communication Engineering
Credit	:	12
Module Tutor(s)	:	Ms. Karma Kelzang Eudon/Mr. Purna B. Samal
Module Coordinator	:	Ms. Karma Kelzang Eudon

General objectives:

This module will enable the students to learn about Fiber Optical communication, mainly Source, Transmitter, Receiver and Links. And expose students to know about different types of techniques for measuring Fiber optics communication parameters and to know about techniques of optical coupling, amplification and oscillation.

Learning outcomes:

On completion of the module, students will be able to:

1. Describe principles and techniques Fiber Optics Communication.
2. Explain different types of light sources and their application in the Fiber optic communication.
3. Explain different types of receiver (Photodetectors) and use suitable one for different system.
4. Explain different components of Fiber Optics Communication System.
5. Design and implementation of optical communication system.
6. Analyse optical communication system and its components.

7. Experiment on different techniques of measurement of parameters of optical communication.
8. Use OTDR and splicing machines to find the fault and connect the cables.

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	2	30
Tutorial	1	15
Practical	2	30
Independent study/self-directed learning	3	45
Total		120

Assessment Approach:

Sl. No.	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
1	Continuous Assessment (Theory)			
1.1	Term Test: Closed book for 1 hour (Term Test I is closed book after completion of Unit I and Unit II. Term Test II is closed book after completion of Unit III and Unit IV)	2	20	25
1.2	Assignment (Numerical and problem solving after completion of two units)	2	1.5	
1.3	Case Study (A report on the study done on an existing FOC system)	1	1.5	
1.4	Presentation/Discussion (Small topics at the end of each unit to be prepared and presented)	1	2	
2	Practical			
2.1	Regular Assessments: Practical record every week after conducting the practical.	10	15	25
2.2	Practical Exam: Conducted after the completion of practical classes for 1 hour.	1	7	
2.4	Viva-Voce: Conducted after the completion of practical classes for 5 to 15 minutes.	1	3	
3	Semester Examination: Closed book for 3 hours.	1	50	50

Pre-requisite: PHY102 Engineering Physics II

Subject Matter:

Unit I: Optical Fiber Communication

- 1.1 Principles and systems
- 1.2 Single-mode Fiber : Mode Cut-Off wavelength, Mode-field Diameter
- 1.3 Equivalent Step-Index (ESI) Profile and Measurement
- 1.4 Dispersion Measurements: Time-Domain method & Frequency Domain Method
- 1.5 Geometrical Measurements: Diameter, deformation, eccentricity, ellipticity
- 1.6 Mechanical Strength of Optical Fiber

Unit II: Transmitters and Receivers

- 2.1 LED, Laser Diodes, Lasers, Bias & stabilization
- 2.2 Driver circuits for analog & digital modulation
- 2.3 Modulation bandwidth, PIN, APD photodiodes, photo diode amplifiers: construction, working and characteristics.
- 2.4 Signal to noise ratio in PIN and APD receivers
- 2.5 Receiver sensitivity, Eye diagram, Coupling mechanism
- 2.6 Transmission Characteristics of Fibers
- 2.7 Short haul, long haul and high speed links, optical power budget calculations

Unit III: Optical Interconnecting Devices

- 3.1 Optical isolators, polarizer, circulators, attenuators, amplifiers, oscillators, filters
- 3.2 Add/drop multiplexers, optical modulators

Unit IV: Measurement

- 4.1 Lock-in-Amplifier, Monochromator, Infrared viewer, Optical spectrum Analyser
- 4.2 Multi-mode-Fiber: Parameters for characterization
- 4.3 Steady-State Power distribution, mode stripper
- 4.4 Measurement of Attenuation: Loss Mechanisms in Fiber, Calorimetric Method
- 4.5 Absorption & Scattering I/O attenuation, Cut-Back method, OTDR techniques
- 4.6 Numerical Aperture-trigonometric & Scanning method
- 4.7 International Standards for Measurements

List of Practical:

1. Measurement of Parameters for characterization, Steady-State Power distribution, mode stripper of Single Mode and Multimode fiber.
2. Measurements of attenuation: Loss Mechanisms in Fiber, Calorimetric Method, Absorption & Scattering to attenuation, Cut-Back method, OTDR techniques; Numerical Aperture – trigonometric & Scanning methods.
3. Refractive Index Profile : Reflection method, Near Fiber Scanning, Refracted Near Field methods, Interferon
4. Dispersion Measurements : Time-Domain Method & Frequency Domain Method
5. Single-mode-Fiber : Mode Cut-Off wavelength, Mode-field Diameter, Equivalent Step-Index (ESI) Profile, Measurement
6. Measurement of Mechanical Strength of Optical Fiber.
7. International Standards for Measurements : World Bodies, ITU, IEC, ATM, Recommendations
8. Splicing of cables

Reading List:

Essential Reading:

1. Ghatak (2005), *Fibre Optics Communication* (Third Edition). Tata McGraw-Hill, New Delhi,.
2. J.M., Senior (2009), *Optical Fibre Communication* (3rd Edition), Prentice Hall of India, New Delhi.
3. G. Keiser (2000), *Optical Fibre Communication* (3rd Edition), McGraw Hill, New York.

Additional Reading:

1. D.K Mynbaev, & L.L., Scheiner (2011), *Fibre Optic Communication Technology*, Pearson Ltd.
2. D. Marcuse (1981), *Principles of Optical Fibre Measurements*, Academic Press Inc., New York.
3. G. Cancellieri, & U. Ravaioli (1984), *Measurements of Optical Fibres & Devices – Theory & Experiments*, Artech House Inc. Dedham, USA.
4. B. Pal (1992), *Fundamentals of Fibre Optics in Telecommunication & Sensor Systems*, Wiley Eastern Limited.
5. G. Cancellieri (1998), *Single-Mode Optical Fibre Measurements, Characterization & Sensing*, Artech House Inc. Boston.
6. D.C. Agarwal (2007), *Fibre Optic Communication*, S. Chand & Comp., New Delhi.

Date: February 24, 2016.

Module Code and Title	:	CTE411 Artificial intelligence
Programme	:	BE in Information Technology
Credit	:	12
Module Tutor	:	Karma Wangchuk/ Yeshe Jamtsho
Module Coordinator	:	Yeshe Jamtsho

General objectives:

This module will enable students to learn about the art and technology of artificial intelligence and machine learning. It will also familiarize students with the different approaches of computational intelligence and expose them to different applications of artificial intelligence.

Learning outcomes:

On completion of the module, students will be able to:

1. Apply the principles of AI in decision-making algorithm.
2. Solve some basic AI problems as state space search and state the search techniques
3. Explain approaches towards knowledge representations
4. Apply probabilistic reasoning approaches in solving AI problems
5. Describe machine learning approaches.

6. State soft computing techniques
7. Apply AI in text and speech-signal processing

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	3	45
Tutorial	1	15
Independent study/self-directed learning	4	60
Total=		120

Assessment Approach:

Sl. No	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
1	Continuous Assessment (Theory)			
1.1	Term Test: Closed book, one hour duration in 5 th and 10 th week of the semester. Term Test I: From Unit-I, Unit-II, and Unit-III. Term Test II: From Unit-IV, Unit-V, Unit-VI, and Unit-VII	2	20	30
1.2	Assignments: To encourage student centred learning and to determine the students ability in solving the problems using the concepts covered in the class. Unit I-IV(Assignment 01) & Unit V-VII (Assignment 02)	2	10	
3	Semester End Examination: 3hours duration, closed book	1	70	70
Total				100

Pre-requisite: None

Subject Matter:

Unit I: Artificial intelligence

- 1.1 Introduction to Artificial Intelligence and components
- 1.2 Problems and Search: The AI Problems, Defining the Problem as a State Space Search, Solving problems by Searching: problem solving agents, searching for solutions
- 1.3 Uniform search strategies: breadth first search, depth first search, & depth limited search

Unit II: Heuristic Search Techniques

- 2.1 Generate-and- Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis
- 2.2 Adversarial search: Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening

Unit III: Knowledge Representation

- 3.1 Knowledge Representation Issues, Representations and Mappings, Approaches to knowledge Representation
- 3.2 Using Predicate Logic:- Representing Instance and Isa Relationships, Resolution, Natural Deduction
- 3.3 Representing Knowledge Using Rules:- Procedural Versus Declarative knowledge, Logic Programming, Forward versus Back ward Reasoning, Matching, Control Knowledge

Unit IV: Symbolic Reasoning under Uncertainty

- 4.1 Introduction to Non-monotonic Reasoning, Logics for Non-monotonic Reasoning, Implementation Issues,
- 4.2 Statistical Reasoning:- Probability and Baye's Theorem, Certainty Factors and Rule-Based Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic.
- 4.3 Weak Slot-and-Filler Structures: - Semantic Nets, Frames.

Unit V: Learning

- 5.1 Forms of learning, inductive learning, learning decision trees; Learning by Taking Advice explanation based learning, learning using relevance information, neural net learning & genetic learning.
- 5.2 Expert Systems: Representing and using domain knowledge, expert system shells, and knowledge acquisition.

Unit VI: Soft computing approaches

- 6.1 Optimization strategies: Genetic algorithm, swarm optimization
- 6.2 Connectionist Models: Hopfield Networks, Learning in Neural Networks, recurrent networks

Unit VII: Application

- 7.1 Natural Language processing: Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing
- 7.2 Computer vision: Random fields & Deep learning strategies, Basic knowledge of programming language like Prolog & Lisp

Reading Lists:

Essential Reading

1. Rich, E., & Knight, K. (2010). *Artificial Intelligence* (3rd ed.). New Delhi: Tata McGraw-Hill Publishing Company Ltd.

Addition reading

1. Patterson, D.W. (2009). *Introduction to Artificial Intelligence and Expert Systems*. New Delhi: Prentice Hall India Ltd.
2. Konar, A. *Artificial Intelligence and Soft Computing*. CRC Press.
3. Akerkar, R (2005). *Introduction to Artificial Intelligence*. PHI Learning Pvt. Ltd.
4. Bharati, A., Chaitanya, C., & Sangal, R. (1995). *Natural Language Processing: A Paninian Perspective*. Prentice Hall of India.

Date: March 31, 2016

Module Code and Title	:	CTE412 Developing Distributed Applications (Java EE)
Programme	:	BE in Information Technology
Credit	:	12
Module Tutor	:	Yeshi Wangchuk

General Objectives:

This module introduces you to Java Server Faces (JSF), which provides event driven, component-based technology for developing J2EE Web applications. This technology greatly simplifies the development of Web applications. It also introduces Spring framework, which makes J2EE development easier by simplifying common tasks and encouraging a strong application design.

Learning Outcomes:

On completion of the module, students will be able to:

- 1) Use FacesServlet, FacesContext and Action Java classes to control the user experience of the Web application.
- 2) Write JSF applications that gather and update information from external application servers.
- 3) Create and use custom Tag Libraries in JavaServer Pages.
- 4) Apply the use of the standard JSF Validators and JSF Data Conversion classes.
- 5) Apply Hibernate for managing object persistence in a relational model.
- 6) Use the relationships between Java, JSF, Spring, and Hibernate.
- 7) Capture both relational and inheritance associations in metadata using XML
- 8) Create and use mappings between Java classes and relational databases.
- 9) Implement the persistent object lifecycle.
- 10) Implement transactions and concurrency.
- 11) Write applications that take advantage of the Spring container and the declarative nature of assembling simple components into applications.
- 12) Implement the use of Hibernate and JSF within the Spring framework.

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
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Lecture	3	45
Tutorial	1	15
Practical	3	45
Independent study/self-directed learning	1	15
Total		120

Assessment approach:

Sl. No.	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
1.	Continuous Assessment (Theory)			
1.1.	Term Test: Closed book, one hour duration in 5 th & 10 th week. Covered up to unit-IV for test-I and up to unit-X for test-II.	2	20	25
1.2.	Assignments: Two weeks duration in 6 th & 7 th week.	1	5	
2.	Continuous Assessment (Practical)			
2.1.	Lab Reports/Regular laboratory assessment: Weekly assessment	1	15	25
2.2.	Practical examination/quiz/viva voce: Closed book, 3 hours duration in 14 th Week.	1	10	
3.	Semester End Examination			
	Closed book and 3 hours examination.	1	50	50
			Total	100

Pre-requisites: CPI102 Object Oriented Programming

Subject Matter:

Unit I: Overview of JSF

- 1.1 Design goals of JSF, advantages of JSF, comparing JSF with Struts,
- 1.2 JSF architecture, life-cycle of a JSF page,
- 1.3 Components of a JSF application

Unit II: Developing User Interface using JSF

- 2.1 HTML tag library, core tag library,
- 2.2 Creating a JSF page using JSP as a view technology,
- 2.3 Creating a JSF page using facelets, identify benefits of facelets over JSP,
- 2.4 Create custom components

Unit III: Managing User Input

- 3.1 Define managed beans, managed bean scopes,
- 3.2 Configuring managed beans, binding managed beans with UI components,

3.3 Implement convertors and validators

Unit IV: Managing Page Flow in a Web Application

- 4.1 Introduce navigation model, static and dynamic navigation, implicit navigation, rule based navigation,
- 4.2 Configuring navigation rule, global navigation rule,
- 4.3 Implementing conditional navigation

Unit V: Event Handling

- 5.1 Explore JSF event model, identify event classes and event listeners,
- 5.2 Implement event handler, attaching the event listener to a UI component

Unit VI: Overview of Hibernate

- 6.1 Introduce object relational mapping, features of hibernate,
- 6.2 Comparing hibernate with EJBs, hibernate architecture, configuring hibernate

Unit VII: Querying Databases

- 7.1 Identify hibernate types and mapping elements,
- 7.2 Mapping component and collections, querying mapped objects

Unit VIII: Persisting Objects

- 8.1 Object states: Transient, Persistent, and Detached,
- 8.2 Persisting an object, retrieving objects, updating objects, deleting objects.

Unit IX: Implementing Transaction and Concurrency

- 9.1 Basics of transactions, configuring transactions,
- 9.2 Implementing concurrency, managing concurrency issues

Unit X: Overview of Spring Framework

- 10.1 Features of spring, spring architecture,
- 10.2 Compare spring with other frameworks,
- 10.3 Identify spring packages: Core, DAO, ORM, AOP, and MVC

Unit XI: Managing and Configuring Beans

- 11.1 Explore Bean life-cycle,
- 11.2 Instantiating beans: BeanFactory, Application context,
- 11.3 Configure beans: explicit wiring and autowiring

Unit XII: Implementing Aspect Oriented Programming (AOP)

- 12.1 Features of AOP, describe terms: Aspects, Advice, jointpoint, pointcut, target, proxy, and weaving,
- 12.2 Create aspects, managing transactions

Unit XIII: Implementing Spring in Web Layer

- 13.1 Managing Web requests and configuring dispatcher servlet,
- 13.2 Mapping requests to controllers, applying business logic, rendering response to the clients and implement view resolver

Unit XIV: Integrating Spring with Business and Presentation Layer

- 14.1 Integrate JSF with Spring,
- 14.2 Integrate Hibernate with Spring

List of Practical(s):

1. Creating managed bean
2. Create JSP application and validating user data
3. Implement page navigation in a JSF application
4. Implement event handling
5. Standardize the Web page layout
6. Develop AJAX-enabled Web Page
7. Creating a Simple Hibernate application
8. Mapping class with relational databases
9. Implement Object persistency
10. Implement transaction and concurrency
11. Creating a simple Web application using Spring framework
12. Integrating JSF with Spring
13. Integrating Hibernate with Spring

Reading List:

Essential Readinglist

1. Mann, K. (2005). *JavaServer Faces in Action* (3rd ed.).United States of America: Manning Publication Co.
2. Grove, R. F. (2009). *Web-based Application Development* (1st ed.). USA, America: David Pallai.
3. Juneau, J. (2013). *Java EE 7 Recipes: A Problem-Solution Approach* (1st ed.). Delhi, India: Springer.

Additional Readin

1. Bauer, C. & King, G. (2007). *Java Persistence with Hibernate* (2nd ed.).United States of America: Manning Publication Co.
2. Walls, C. (2005). *Spring in Action* (4th ed.).United States of America: Manning Publication Co.

Date: April 27, 2016.

Module Code and Title : CTE413 Distributed Application Development
Programme : BE in Information Technology
Credit : 12
Module Tutor : Manoj Chhetri

General objectives:

This module introduces the students to distributed applications and their architecture. It also covers COM+ services, .NET remoting, and XML web services. The module also covers the details of Windows Communication Foundation (WCF) as the latest .NET technology that unifies all other .NET technologies used to develop distributed applications.

Learning outcomes:

On completion of the module, students will be able to:

1. Identify the architecture of distributed applications
2. Implement .NET Remoting in web-based applications
3. Use Web and Windows Common Foundation(WCF) services in .NET application
4. Configure serialisation and encoding in XML web services.
5. Implement transactions in WCF
6. Develop peer-to-peer applications
7. Apply COM+ components in developing distributed application

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	3	45
Tutorial	1	15
Practical	3	45
Independent study/self-directed learning	1	15
Total		120

Assessment approach:

Sl. No.	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
10.	Continuous Assessment (Theory)			
3.1.	Term Test: Closed book, one hour duration in 5 th (1-7 unit) & 10 th week(7-14 unit)	2	20	25
3.2.	Assignment: Two weeks duration in 6 th & 7 th week (content includes units from 1-9).	1	5	
6.	Continuous Assessment (Practical)			
3.1.	Lab Reports/Regular laboratory assessment: Weekly assessment.	1	5	25

3.2.	Practical examination: Closed book, 3 hours duration in 14 th Week (1-14 unit).	1	10	
3.3.	Project: Mini project development for 4 weeks duration from 9 th to 13 th Week (students have to come up with an idea of an application and build it).	1	10	
7.	Semester End Examination Closed book and 3 hours examination (content includes all units).	1	50	50
			Total	100

Pre-requisite: None

Subject Matter:

Unit I: Introducing Distributed Applications and COM+

- 1.1. Distributed application architecture, advantages of distributed application architecture,
- 1.2. Evolution of COM+, COM+ services, .NET remoting, Web services, configure and register a .NET component
- 1.3. Types of COM+ application, create a COM+ application

Unit II: Understand .NET Remoting

- 2.1. Remoting architecture, remote objects,
- 2.2. Define channels, register a channel,
- 2.3. Activate a remote object, register a remote object

Unit III: Understand Web Services:

- 3.1 Features of a Web service, components of a Web service,
- 3.2 Life-cycle of a Web service, create and consume a Web service

Unit IV: Understand WCF

- 4.1. Fundamentals of WCF, architecture of WCF,
- 4.2. Exploring programming model of WCF: Address, Binding, and Contract,
- 4.3. Hosting and consuming a WCF service

Unit V: Exception Handling

- 5.1. Exception Communication by Using SOAP,
- 5.2. Detect a Faulted Channel, Communicating Exception Details,
- 5.3. Using the FaultException Class, Using the Generic FaultException Class

Unit VI: Tracing and Monitoring WCF services

- 6.1 Implement tracing, logging messages
- 6.2 Monitoring a WCF service

Unit VII: Configuring Serialization and Encoding

- 7.1 Define serialization and encoding,
- 7.2 WCF serialization class, implement custom serialization
- 7.3 ECF encoding types

Unit VIII: Working with Transactions

- 8.1. Identify properties and components of a transaction, transaction model
- 8.2. Implement transactions in WCF

Unit IX: Implement Reliable Messaging

- 9.1. Types of reliable messaging
- 9.2. Use reliable sessions, use queue

Unit X: Develop Peer-to-Peer Applications:

- 10.1. Define P2P network, advantages of P2P network, challenges of P2P network,
- 10.2. Communication between P2P applications

Unit XI: Securing WCF Service

- 11.1. Security concepts
- 11.2. Security levels in WCF,
- 11.3. Impersonation,
- 11.4. Securing services over Internet,
- 11.5. Securing services over Intranet

List of Practical:

1. Implementing Object Pooling in a COM+ Serviced Component
2. Implementing .NET Remoting
3. Creating and Consuming a Web Service & WCF Service
4. Self-Hosting and Consuming a WCF Service, Hosting a WCF Service in IIS and Consuming It, Hosting a WCF Service in a Windows Service and Consuming it
5. Implementing Exception Handling
6. Implementing Tracing and Message Logging
7. Monitoring a WCF Service
8. Implementing Serialization and Encoding, Transactions, Reliable Messaging by Using Reliable Sessions & Reliable Messaging by Using Queues
9. Creating a Peer-to-Peer Application
10. Implementing Security, Instancing & Custom Format Validation

Reading List:

Essential Reading List:

1. Juval L. (2005). *Programming .NET Components* (2nd ed.). New Delhi: O'Reilly.
2. Pablo C., Kurt C., & Fabio C. (2010). *Professional WCF 4 Windows Communication Foundation with .NET 4* (1st ed.). New Delhi: Wrox.

Additional Reading List:

1. Matthew M., (2003). *Microsoft .NET Distributed Applications: Integrating XML Web Services and .NET Remoting* (1st Ed.). New Delhi: Microsoft Press.

Date: May 25, 2016.

Module Code and Title : MAT412 Optimization Techniques
Programme : BE in Information Technology
Credit : 12
Module Tutor : S.T. Venkatesan

General objective:

The module will acquaint the students with the applications of Optimization techniques to business and industry. It will also expose students to the significance of various scientific tools & models that are available for managerial decision making.

Learning outcomes:

On completion of the module, students will be able to:

1. Formulate linear programming problems
2. Solve linear programming problems by graphical method
3. Solve linear programming problems by simplex method
4. Use theory of duality to solve L.P.P.
5. Perform sensitivity analysis so as to determine the ranges of deviation of parameters that preserves optimality of the solution obtained.
6. Formulate and solve transportation problems.
7. Evaluate various algorithms to solve assignment problems.
8. Solve simple scheduling problem.
9. Compute saddle point of a game and solve a game problem by appropriate method.
10. Use queuing theory to solve the Computer Science problems.

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	4	60
Tutorial	1	15
Written assignment	1	15
Independent study/self-directed learning	2	45
Total		120

Assessment approach:

Mode of Assessment	Nos.	Marks Allocated	Marks (%)
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Continuous Assessment (Theory)			
Term Test1: Closed Book, One hour duration in 5 th week Topic: Operations Research Models	1	10	30
Term Test 2: Closed Book, One hour duration in 10 th week Topic: Dual problems	1	10	
Class Test : Closed Book, One hour duration in 12 th week Topic: T.P and A.P	1	5	
Assignment: One in 7 th week from Sensitive Analysis and one in 13 th week from Integer Programming	2	5	
Semester End Examination: Closed book, 3 hrs duration	1	70	70

Pre-requisites: None.

Subject matter:

Unit I: Operations Research Models

- 1.1 O. R. Techniques – Art of Modelling
- 1.2 Construction of Linear Programming Model
- 1.3 Graphical L. P. Solution
- 1.4 Graphical sensitivity analysis
- 1.5 The Simplex Algorithm
- 1.6 The M-method
- 1.7 The two phase method
- 1.8 Special cases
 - 1.8.1 Degeneracy
 - 1.8.2 Alternative optima
 - 1.8.3 Unbounded solutions
 - 1.8.4 Infeasible solutions.

Unit II: Definition of the Dual problem

- 2.1 Primal-Dual relationship
- 2.2 Economic interpretation of duality
- 2.3 Dual Simplex Method
- 2.4 Primal dual computation
- 2.5 Post optimal or sensitivity analysis
 - 2.5.1 Changes affecting feasibility
 - 2.5.2 Changes affecting optimality
- 2.6 Revised simplex method.

Unit III: Definition of Transportation Model

- 3.1 Determination of the Starting Solution
 - 3.1.1 Northwest corner rule
 - 3.1.2 Vogel's approximation method
- 3.2 Test for optimality (MODI – Method)
- 3.3 The Assignment Model

- 3.4 Determination of the Starting Solution
- 3.5 Special cases in Assignment
 - 3.5.1 Travelling salesman Problem

Unit IV: Sequencing Model

- 4.1 Processing 'n' jobs through '2' machines
- 4.2 Processing 'n' jobs through '3' machines
- 4.3 Processing '2' jobs through 'm' machines
- 4.4 Processing 'n' jobs through 'm' machines
- 4.5 Game Theory - Terminology
- 4.6 Two person zero sum Game
- 4.7 Mixed Strategy Games
- 4.8 '2 x n' Games or 'm x 2 Games
- 4.9 L.P. Packages.

Unit V: Queuing Theory & Applications

- 5.1 Markovian Queuing models
- 5.2 Little's formula, Multi-server Queues
- 5.3 M/G/1 Queues
- 5.4 Pollaczek-Khintchine formula.

Unit VI: Integer programming

- 6.1 Concepts
- 6.2 Formulation
- 6.3 Solution and applications

Reading list:

Essential Reading:

1. Handy. A. Taha (2002), "*Operations Research – An Introduction*," 7th edition, Pearson Education, Asia.
2. J. K. Sharma (1997) "*Operations Research – Theory and Applications*," Macmillan India Ltd, New Delhi.
3. Dipak Chatterjee (2005), "*Linear Programming and Game Theory*," Prentice-Hall of India, New Delhi.
4. Singiresu. S. Rao(2009), "*Engineering Optimization – Theory and Practice*," 3rd edition, New Age International (p) Ltd, New Delhi.

Additional Reading:

1. Schaum's Outline Series(2003), "*Operations Research*", McGraw Hill Publishers.
2. F.S Hillier & G.J. Lieberman (1995), "*Introduction to OR*", McGraw hill Int. Series.
3. A Ravindran (1993), "*Introduction to Operations Research*", John Wiley & Sons.
4. R.Kapoor (1991), "*Computer Assisted Decision Models*", Tata McGraw Hill.

Date: Feb 3, 2016.

Module Code and Title : ITM403 Financial Management & Accounts
Programme : BE in Information Technology
Credit : 12
Module Tutor : Ms. Tshewang Dema

General Objective:

The module aims to provide a basic understanding of accounting and financial management concepts which can be applied using information technology. Students will acquire the knowledge and skills to prepare financial statements for a company, interpret the financial position of a company, and to apply capital budgeting techniques to select profitable projects. Further, the module will enable students to understand the importance function of accounting and finance in an organization.

Learning outcomes:

On completion of the module, students will be able to:

1. Define the financial management terminologies.
2. Describe the Principles and conventions of Accounting
3. Identify finance and accounts roles and functions.
4. Generate financial statements(Income & Balance Sheet)
5. Apply Capital Budgeting techniques for investment decisions.
6. Apply budget control technique.
7. Interpret books of accounts and balance sheets.

Learning and teaching approach:

Approach	Hours per Week	Total Hours	Credit
Lecture	3	45	
Tutorial	1	15	
Independent study/self-directed learning	4	60	
Total		120	

Assessment Approach:

Mode of Assessment	Nos.	Marks Allocated	Marks (%)
1. Continuous Assessment			
1.1 Term Test: Closed book, one hour duration in 5 th and 10 th week of the semester. Term 1(Unit I-II) & Term II (Unit III-V)	2	20	30
1.2 Case Study/Assignment: Assignment/Case Study duration in 6 th and 11 th week(Ratio Analysis of a Bhutanese Company and Problems on Capital Budgeting)	2	10	

2. Semester End Exam 3 hours duration, closed book	1	70	70

Pre-requisites: None

Subject Matter:

Unit I: Accounting

- 1.1 Basic accounting concepts, important definitions, uses, limitations, advantages
- 1.2 Types of Accounting
- 1.3 Financial statements
- 1.4 Introduction to Journal Accounting; Different types of Vouchers, double entry bookkeeping different types of transactions related to Financial Accounting

Unit II: Financial Control

- 2.1 Posting of Ledgers and preparation of Trial Balance;
- 2.2 Preparation of Balance Sheet and Profit and Loss Accounts; Controlling other departments by Financial Accounting (A practical Approach).
- 2.3 Interpret book of accounts through Ratio Analysis.

Unit III: Introduction to Financial Management

- 3.1 Financial Management(Introduction)
- 3.2 Financial Planning and Capitalization- definitions, objectives, changing roles and functions,
- 3.3 Financial Decision.

Unit IV:Capital Budgeting

- 4.1 Nature of Investment decision, Importance of Capital Budgeting,
- 4.2 The Capital. Budgeting Process -Investment Criterion, Pay-back period, Accounting, ROR (Rate of Return) Method, Discounting Cash flow method, Net – present value method, IRR (Internal Rate of Return) method, The benefit-Cost Ratio method.

Unit V: Management of Working Capital

- 5.1 Various concepts, Elements, Classification
- 5.2 Financing and importance of working capital, Investment analysis, Cash flow determination, cost of capital,
- 5.3 Capital budgeting methods.

Unit VI-Budgeting Control Technique

- 6.1 Concepts of Budget, budgeting and budgetary control, Objectives, Functions, Uses, Advantages,Limitations;
- 6.2 Master Budget and Report.

Unit VII-Cost – Volume – Profit Analysis

- 7.1 Classification of costs, Allocation, apportionment and absorption,
- 7.2 Cost centers, different costing systems, Cost analysis for managerial decisions,
- 7.3 Meaning of Linear CVP analysis, Objectives, Assumptions,
- 7.4 Break – Even analysis, determining the Break-Even point profit, Volume graph profit, Volume ratios margin of Safety.

Reading List:

Essential Reading

1. Khan, M. Y & Jain, P.K.(2011), *Financial Management*, (6th Edition). New Delhi:Tata McGraw hill Education Private Limited.
2. Pandey, I.M. (2013) , *Financial Management* (10th Edition). New Delhi:Vikas Publishers.

Additional Reading

1. Gupta, A.(2012), *Financial accounting for management : An analytical perspective*(4th Edition). New Delhi, Pearson Education.
2. Gupta S. K. (2011) , *Management & Accounting: Principles and Practice*.(12th Edition). New Delhi:Kalyani Publishers.
3. Van Horne J. C. & Dhamija S(2012), *Financial Management and Policy* (12th Edition). Pearson India.

Date: March 3, 2016

Module Code & Title	:	ITW404 Professional Practices in IT
Programme	:	BE in Information Technology
Credit	:	12
Module Tutor	:	Tandin Wangchuk

General objectives:

In addition to technical skills, an IT professional must understand the social and professional context of information technology and computing, and adhere to ethical codes of conduct. This module covers the historical, social, professional, ethical and legal aspects of computing. It identifies how teamwork is integrated throughout IT and how IT supports an organization. It also stresses professional oral and written communication skills.

Learning outcomes:

On completion of the module, students will be able to:

1. Describe the nature of IT Profession
2. Express IT related concepts clearly and succinctly in written, oral, and other forms of communication media

3. Identify emerging technologies in the context of the history of computing technologies
4. Describe positive and negative ways in which information technology alters in social context of computing
5. Discuss how team work is integrated throughout IT and how IT supports an organization
6. Differentiate the Intellectual Properties such as patents, trademarks and copyrights
7. Practice the key skills, knowledge, attributes and attitudes required to be an IT professional, with particular reference to professional practice, code of ethics and professional standards
8. Identify legal, ethical and professional issues in workplaces
9. Apply the principles of team work with the appreciation of the issues, such as ethics, conflict resolution, negotiation
10. Prepare presentations on relevant acts in Bhutan

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	3	45
Tutorial	1	15
Independent study/self-directed learning	4	60
Total		120

Assessment approach:

Sl. No.	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
1	Continuous Assessment (Theory)			
1.1	Term Test - Closed book, one hour duration in 5th and 10th week, units covered up to 5th week for test I, units covered from 6th - 10th week for test II.	2	20	50
1.2	Assignments - in 4th week (Units covered up to 4th week) and 11th week (Units covered from 6th week – 10th week)	5	5	
1.3	Case Study – Social & Professional related topics, submission in the 14 th week	1	25	

2	Semester	End			
	Examination: Closed book for 3 hours duration	book	1	50	50

Pre-requisite: None

Subject matter:

Unit I: Introduction

- 1.1 Implications of History of computer hardware, software and Internet.
- 1.2 IT profession, IT education.

Unit II: Social Context of Computing

- 2.1 Social Informatics
- 2.2 Social impact of IT on society
- 2.3 Online communities & social implications, Philosophical context
- 2.4 Diversity issues, Accessibility, Globalization issues, Economic issues in computing, Digital divide

Unit III: Professional Communication Skills

- 3.1 Paraphrasing and summarizing, referencing and plagiarism
- 3.2 Learning styles: deep and surface learning
- 3.3 Critical Thinking
- 3.4 Interpersonal communication
- 3.5 Effective written communication- report writing, instruction writing, presentations

Unit IV: Teamwork Concepts and Issues

- 4.1 Group work, Collaboration, Group Dynamics, Leadership styles, Personality types, Groupware

Unit V: Intellectual Properties

- 5.1 Intellectual Properties – patent, trademarks, trade secrets and copyright
- 5.2 International Differences
- 5.3 Digital Millennium Copyright Act (DMCA)
- 5.4 TEACH Act, Ownership of information, Plagiarism
- 5.5 The Industrial Act of Bhutan, The Copyright Act of Bhutan

Unit VI: Legal and Regulatory Issues in Computing

- 6.1 Compliance (ADA508, FERPA, HIPPA ...)
- 6.2 Hackers/crackers, Computer crime, Viruses
- 6.3 System use policies & monitoring
- 6.4 Risks and liabilities of computer-based systems, Accountability, responsibility, liability
- 6.5 Social Media Policy of RGoB
- 6.6 Bhutan Information, Communication and Media Act

Unit VII: Organizational Context

- 7.1 Business processes, IT environment, Organizational Culture, Professionalism

Unit VIII: Professional and Ethical Issues

- 8.1 Relationship with professional societies
- 8.2 Code of professional conduct such as IEEE, ACM, BCS, ITAA, AITP
- 8.3 Ethics and history of ethics; Ethical hacking

Unit IX: Privacy and Civil Liberties

9.1 HIPPA and FERPA, E.U. Data protection, Gramm-Leach-Bailey Act

Note: Any legal acts and code of IT practices reflected under DIT, MoIC will be covered.

Reading List:

Essential Reading

1. Quinn, M. J. (2015). *Ethics for Information age (6th ed.)*. Boston: Pearson Addison Wesley.
2. Baase, S. (2013). *Gift of Fire, A: Social, Legal, and Ethical Issues for Computing Technology(4th ed.)*. Pearson.

Additional Reading

1. Ermann, M. D. & Shauf, M.S. (2003). *Computers, Ethics and Society (3rd ed.)*, Oxford University Press, Oxford.
2. Gerson, & Steven M. (2011), *Technical writing: process and product (7 ed)*, New Delhi: Pearson Education.

Date: May 2, 2016.

Module Code and Title	:	PRW403 Project Work
Programme	:	BE in Civil Engineering
Credit	:	24
Module Tutor	:	All tutors
Module Coordinator	:	As appointed by programme leader

General objectives:

The objective of this module is to enable students to apply theoretical knowledge to an engineering problem and improve their analytical skills in engineering. It will also enable students to test general engineering ability.

Learning Outcomes:

On completion of the module, students will be able to:

1. Conduct literature review.
2. Formulate the problem for the specific project of his/her interest.
3. Analyse the technical and economic implications of the proposed project.
4. Appraise themselves with the processes involved in project execution.
5. Interpret the problem areas and contingencies.
6. Identify relevant remedial measures.
7. Predict the outcomes under similar conditions.
8. Infer technical reasons for the project outcome.

9. Prepare a written report and present to a professional audience.

Learning and teaching approach:

Directed reading and assigned problems develop inquisitiveness for bridging the current research loopholes and assist in research problem formulation. Application oriented projects require knowledge of various industrial standards and utility aspects, which can be gathered through directed studies.

Students will be divided into groups comprising of 3-6 members. Each group will be guided by a tutor with minimum of Masters Qualification. Tutors who do not have experience in project supervision or without Master's degree may be appointed as co-guide. A tutor may guide more than one group. The choice of guide(s) will be based on the interest of the students and they will be required to choose their guide(s) from the pool of tutors available within the department or from other department with the consent of the programme leader. Students will be divided into groups based on the merit ranking till 5th semester. The programme leader in consultation with the tutors will ensure that not all the top ranking students are in one group. Group formation and selection of guide(s) shall be done before the end of the 6th semester.

Project work will begin in the 7th semester and complete in 8th semester. The students are expected to decide their project topics by 4th week of the 7th semester and present their proposal to the committee in the 6th week. If the topics are not within the standard expected at undergraduate level or the committee feels that students will not be able to complete within the given time frame, they may be asked to resubmit within next two weeks. At the end of the 12th week, there will be 1st review of the project during which students are expected to present their work progress after the proposal presentation.

In the 4th week of the 8th semester, there will be second review of the project during which students are expected to present their project progress after the 1st review. Final or the third review will be conducted in the 10th week. During the review, students will present progress of their work after the last review only.

Approach	Hours per Week	Total Credit Hours
Interaction with supervisor to discuss project progress	1 each for 2 Sems	30
Independent study/self-directed learning	7 each for 2 Sems	210
Total		240

In order to encourage publication of project works, the College will facilitate and organise annual students' research meet on the last Saturday of April.

Assessment approach:

The project work evaluation is in four parts as shown below. Out of a total of 100 marks, 60 marks are allocated for internal continuous assessment, 20 marks for project report evaluation, 15 marks for final project presentation and 5 marks for submitting scientific paper for *ZORIG MELONG*, technical journal published annually by the college. The detail marking scheme is shown below.

SI No	Activities	Due date (week)
1	Grouping of students	12 th week of 6 th Semester

2	Finalisation of topic	4 th week of 7 th Semester
3	Proposal presentation	6 th week of 7 th Semester
4	1 st review	12 th week of 7 th Semester
5	2 nd review	4 th week of 8 th Semester
6	3 rd review	10 th week of 8 th Semester
7	Final presentation	14 th week or after the 8 th Semester end examination

The detail marking scheme is shown below.

Areas to be evaluated			Marks
1	Continuous Assessment		60
	1.1	Proposal presentation	10
	1.2	1st review	10
	1.3	2nd review	10
	1.4	3rd review	10
	1.5	Regular work (by supervisor)	20
2	Report Evaluation (External)		20
	2.1	Abstract	1
	2.2	Introduction	1
	2.3	Literature review	3
	2.4	Technical content	5
	2.5	Results	5
	2.6	Originality	2
	2.7	Practicality	2
	2.8	Conclusion	1
3	Project Presentation		15
	3.1	Presentation Techniques	2
	3.2	Content	4
	3.3	Response to the Questions	7
	3.4	Language (verbal clarity) and confidence	2
4	Writing scientific paper		5
Total Marks			100

Project proposal presentation will consist of 15 minutes oral presentation by one of the group members and 15 minutes question and answer session. The committee may ask any one member to present.

Proposal Presentation	10
Aim and objectives	2

Methodology	4
Expected outcome	1
Feasibility	1
Originality and practicality	1
Work plan	1

During the project review, one of the members will be asked to present for 15 minutes followed by 15 minutes question answer session.

Project Review Presentation	10
Work progress	6
Response to questions	3
Future work	1

Regular Work (Continuous Assessment by Project Guide)	20
Actual work involvement	2
Team spirit & work culture	2
Conceptual understanding	2
Punctuality	2
Planning & execution/ compliance in carrying out guides instruction	2
Technical background materials collection	2
Analysis & interpretation capability	2
Time Management	2
Technical writing skills	2
Computational/logical ability	2

Prerequisites: PWR301 Introduction to Research

Subject Matter:

This will depend on student's interest and guide's expertise. The final report must be as per the format set by the College.

Reading List: Conference paper, journal articles and other books that are relevant to the chosen title.

Date: March 26, 2016.

1.8 Semester-VIII

Module Code and Title : PRW402 On the Job Training

Programme : BE in Civil Engineering

Credit	:	12
Module Tutor	:	All tutors
Module Coordinator	:	Mr Tsheten Dorji

General objectives:

The purpose of the attachment program is to gain practical experience from a real industrial environment and instill in the students the right kind of work attitude and work professionalism, so that they can become effective and productive to their respective organizations much sooner than is usual for fresh graduates.

Learning Outcomes:

On completion of the module, students will be able to:

1. Strengthen work values through an improved understanding of themselves and the work environment
2. Gain interpersonal skills that promote personal growth and development.
3. Apply own skills and knowledge learned in the institute
4. Acquire skills needed to become practice-oriented engineers
5. Nurture the spirit of professionalism and develop professional ethics for students in a real life environment.
6. Familiarize with the operation of a company or industry or a manufacturing plant, including its organization structure, management style, sources of raw materials, inventory control, marketing channels, and other logistic supports.
7. Prepare a written report and present to a professional audience.

Learning and teaching approach:

All students need to undergo OJT in relevant organizations as part of their degree programme. The period of attachment is 45 days including weekends. The students will be sent on OJT at the end of 7th Semester. Students are expected to identify and request organizations for OJT placement by themselves. The OJT placement need to be related to the field of study. Incase if the students are not able to find OJT placement, then the College through Dean of Research and Industrial Linkages will facilitate placement of students in relevant organization.

The students will be monitored during the OJT through following procedures.

1. During OJT, students will follow the normal office working hours of the organization and maintain log of daily activities. At the end of the OJT period, students have to submit a printed report and also present their report to the committee appointed by the programme leader.
2. On-site monitoring will be conducted by tutors at least once during the course of the OJT after 3rd week of job placement to ensure student's progress. During the field visit, students will be asked to present about the activities that they are carrying out at the sites. Visits will be planned to coincide with the student's work schedule and at a time students' supervisor is available for meeting.

3. Students will maintain log of daily activities which must be signed by the supervisor or employer. The visiting tutor will review each students' log book to ensure that the required information is filled appropriately and they are gainfully used.
4. The visiting tutor will also discuss with the students' supervisor(s) about the strengths and weaknesses, and obtain feedback on performance of the students.
5. At the end of the OJT, students must request a letter from the supervisor/employer commenting on the engagement of the student during the OJT and highlighting any particular achievements.
6. Students must complete a final report conforming to the report marking schemes.

Assessment approach:

The student's performance during OJT will be assessed as detailed below.

- Field evaluation : 20%
- Written report : 40%
- Oral presentation : 25%
- Log book : 15%

Each student will be assessed individually.

Areas to be evaluated			Marks
1	Field Evaluation (by Supervisor)		20
	1.1	Attendance and punctuality	2
	1.2	Work Attitude and Ethics	3
	1.3	Problem Solving capability	3
	1.4	Taking initiatives and working within their calibre	3
	1.5	Ability to adapt to work environment	3
	1.6	Rapport with work colleagues	3
	1.7	Contribution to the organisation	3
2	Report evaluation		40
	2.1	Cover page design and presentation	1
	2.2	Abstract	3
	2.3	Acknowledgement	1

	2.4	Correct implementation of Format , language and style	8
	2.5	Introduction to the organization	3
	2.6	Technical and field work details	15
	2.7	Observations and discussions	7
	2.8	Recommendations	2
3	Presentation		25
	3.1	Presentation Techniques	3
	3.2	Content (Technical + Field work carried out)	7
	3.3	Response to the Questions	10
	3.4	Language (Verbal clarity) and confidence	5
4	Log Book		15
	4.1	Presentation of log book	2
	4.2	Appropriate reporting of daily activities	8
	4.3	Clarity (legibility, completeness, sequential)	5

Students will submit a printed report no later than 2nd week of 8th semester and presentation will be organised in 3rd week. If a student is placed in the organisation alone, he/she will be asked to present his/her report in 15 minutes and another 15 minutes for question answer session. In case if the students are placed in an organisation in groups then each student will be allotted 10 minutes for presentation and 10 minutes for question answer session.

Prerequisites:None

Subject Matter:

Reading List: None

Date: March 27, 2016

Module Code and Title : DIS405 Data Mining and Warehousing

Programme : BE in Information Technology

Credit : 12
Module Tutor : Nima Dukpa

General Objective:

This course is designed to introduce the core concepts of data warehousing and mining, associated techniques, implementations, benefits. The course also introduces the art and techniques of knowledge management, different application of data warehousing & mining and knowledge management.

Learning outcomes:

On completion of the module, students will be able to:

1. Describe the key principle of data mining and knowledge management.
2. Identify data mining and data warehousing functionalities.
3. Describe and demonstrate basic data mining algorithms, methods, and tools.
4. Apply the practices & principles of data mining and knowledge management.
5. Differentiate different techniques of data abstracting and mining.
6. Apply data preprocessing techniques - data cleaning, data integration and transformation, data reduction, discretization, and concept hierarchy generation
7. Identify business applications of data mining and warehousing.

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	3	45
Tutorial	1	15
Independent study/self-directed learning	4	60
Total		120

Assessment approach:

Sl. No.	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
Continuous Assessment (Theory)				
3.1.	Term Test: Closed book, one hour duration in 5 th & 10 th week. Covered up to unit-II for test-I and up to unit-VI for test-II.	2	20	30
3.2.	Class Test/ Assignment/ Presentations/ Case Study: Two weeks duration in 6 th & 7 th week	2	10	
8.	Semester End Examination Closed book and 3 hours examination.	1	70	70
Total				100

Pre-requisites: DIS201 Database Management Systems

Subject matter:

Unit I: Introduction

- 1.1 Data mining concepts and attributes
- 1.2 Data warehousing – definitions and characteristics, Multi-dimensional data model, Warehouse schema.

Unit II: Data Marts:

- 2.1 Data marts, types of data marts, loading a data mart, metadata, data model, maintenance, nature of data
- 2.2 Software components; external data, reference data, performance issues, monitoring requirements and security in a data mart.

Unit III: Online Analytical Processing

- 3.1 OLTP and OLAP systems, Data Modeling, LAP tools, State of the market
- 3.2 Arbor Essbase web, Microstrategy DSS web, Brio Technology
- 3.3 Star schema for multi-dimensional view, snowflake schema; OLAP tools.

Unit IV: Developing a Data Warehousing

- 4.1 Building of a Data Warehousing, Architectural strategies & organizational issues
- 4.2 Design considerations, data content, distribution of data, Tools for Data Warehousing

Unit V: Data Mining

- 5.1 Definitions; KDD(Knowledge Discovery database) versus Data Mining
- 5.2 DBMS versus Data Mining, Data Mining Techniques; Issues and challenges
- 5.3 Applications of Data Warehousing & Data mining in Government.

Unit VI: Association Rules

- 6.1 A priori algorithm, Partition algorithm, Dynamic inset counting algorithm
- 6.2 FP–tree growth algorithm; generalized association rule.

Unit VII: Clustering Techniques

- 7.1 Clustering paradigm, Partition algorithms, CLARA – Clustering Large Applications, CLARANS – Clustering Large Application based on RANdomize Search
- 7.2 Hierarchical clustering, DBSCAN-Density-based spatial clustering of application with noise, BIRCH-Balanced Iterative Reducing and Clustering using Hierarchies, CURE; Categorical clustering, STIRR, ROCK – RObust Clustering using LinKs, CACTUS-Clustering Categorical Data Using Summeries .

Unit VIII: Decision Trees

- 8.1 Tree construction principle, Best split, Splitting indices, Splitting criteria
- 8.2 Decision tree construction with presorting.

Unit IX: Web Mining

- 9.1 Web content Mining, Web structure Mining, Web usage Mining, And Text Mining.

Unit X: Temporal and Spatial Data Mining

- 10.1. Basic concepts of temporal data Mining, The GSP algorithm,
- 10.2. SPADE-Sequential Pattern Discovery using Equivalence classes, SPIRIT-Sequential Pattern mining with Regular Expression Constraints, WUM-Web Utilization Miner

Reading List:

Essential reading

- 1. Prabhu, S. (2004). *Data Warehousing – Concepts, Techniques, products, application* (2nd ed.). India: PHI Learning Pvt. Ltd.
- 2. Pujari, A.K. (2013). *Data Mining Techniques* (3rd ed.). India: Universities Press.

Additional reading

- 1. Berson, A. & Smith, S. J. (1997). *Data Warehousing, Data Mining and OLAP*. New Delhi: McGraw Hill.
- 2. Anahory, S. & Murray, D. (1997). *Data Warehousing in the real world* (1st ed.). India: Addison Wesley Longman Ltd.
- 3. Dunham, M. (2002). *Data Mining Introductory & Advanced Topic* (1st ed.). India: Pearson Education.

Date: April 27, 216

Module Code and Title	:	MGT301 Entrepreneurship Development
Programme	:	BE in Civil Engineering
Credit	:	12
Module Tutor	:	Ms. Tshewang Dema

General Objectives:

The main objectives of module are to build entrepreneurial culture and create awareness on viable business opportunities in Bhutan and scope of entrepreneurs. It aims to infuse among them the skills and intricacies required to establish enterprise and manage it successfully. Further it also facilitates students with practical tools

needed to start, finance, and manage their own business or “embark on a career in private equity”.

Learning Outcomes:

On completion of the module, students will be able to:

1. Explain the opportunities, value and scope of Entrepreneurship.
2. Identify the role and importance of motivational factors for the success of an enterprise.
3. Develop a viable and feasible business plan.
4. Apply the procedures and formalities for New Venture creation and management
5. Interpret institutional support and regulations for establishing or expanding a business
6. Modify intervening strategies to sustain and manage the business growth.
7. Take up entrepreneurship as preferred “career option”.
8. Demonstrate problem solving and decision making in enterprise management
9. Exercise business ethics and corporate social responsibilities

Learning and teaching approach:

Approach	Hours per Week	Total Hours	Credit
Lecture	2	30	
Tutorial	2	30	
Independent study/self-directed learning	4	60	
Total		120	

Assessment Approach:

	<i>Mode of Assessment</i>	<i>Nos</i>	<i>Marks Allocated</i>	<i>Marks (%)</i>
1.	Continuous Assessment			
1.1	Mini project in the 5 th to 10 th week to study a real life business in Bhutan and presentation in groups.	1	10	70
1.2	2 Assignment/Case Study duration in 6 th and 11 th week (Business Case Study and Assignment on Ease of doing Business in Bhutan)	2	10	
1.3	Business Plan (Report) prepared after Unit IV is taught.	1	40	
1.4	Business Plan (Presentation) during the 13 th - 14 th week.	1	10	
2.	Semester End Exam			

	Semester Examination: 2 hrs duration, Closed Book.	1	30	30
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Pre-requisites: None

Subject Matter:

Unit I: Understanding New Venture Development - *Why study entrepreneurship?*

- 1.1 New Venture development:- Definition & Role of an entrepreneur.
- 1.2 Charms of being an entrepreneur, Entrepreneurial traits
- 1.3 Entrepreneurs vs Managers
- 1.4 Entrepreneurship in Bhutan: Growth and Development of entrepreneurship in Bhutan
- 1.5 Influence of environmental factors on New Venture Development
- 1.6 EDP programs-training and development of entrepreneurs
- 1.7 Business Ethics: concept and application

Unit II: Creativity, Innovation and other Soft Skills

- 2.1 Developing creativity
- 2.2 Introduction to Innovation-Difference between Invention and Innovation
- 2.3 Negotiations; Networking and business communication; Time management

Unit-III: Business Opportunities Identification and Selection

- 3.1 Business Ideas: Idea Generation,
- 3.2 Sources of Business Ideas
- 3.3 Emerging opportunities in Bhutan: manufacturing, trading, services (including hospitality and tourism, IT, ITES-Information Technology Enabled Services and knowledge based business opportunities)
- 3.4 Project identification and formulation
- 3.5 Classification of projects
- 3.6 Feasibility studies in context of Bhutanese business environment

Unit IV: Business Plan

- 4.1 Need and importance of Business Plan
- 4.2 Components of Business plan: Marketing Plan; Production & Technical Plan; Organization and Management Plan; Financial Plan.
- 4.3 Guide to present the Business Plan

Unit V: New Venture Process & Problems-Challenges

- 5.1 Procedures and formalities for setting up new enterprise, Regulations governing new ventures:
- 5.2 Stages of new venture development, Success factors of New Venture Development
- 5.3 Why new ventures fail-Causes and Remedies.

Unit VI: Promoting a New Venture –Environmental Support

- 6.1 Business Incubators-Role of business incubation centres.
- 6.2 Incentives and concessions for new venture

6.3 Financial institutions supporting entrepreneurs and new venture development

Unit VII: Leadership and Growth Management

- 7.1 General Management: Managing a small scale business
- 7.2 Functional Management: Marketing, Finance and Human resource.
- 7.3 Entrepreneurial leadership-Building successful teams
- 7.4 Dimensions of Business growth and dynamics involved-different growth objectives
- 7.5 Different risks faced during growth stage-Strategies to avoid those risks

Reading Lists:

Essential Reading:

1. Hisrich, R.D, Pelters & Michal,P (2005). *Entrepreneurship* (5th ed). Tata McGraw Hill.

Additional Reading:

1. Desai, V. (2005). *Dynamics of Entrepreneurial Development and management* (5th Edition). Himalaya Publishing House.
2. Mary C. (2005). *Entrepreneurship in action* (2nd Edition). Prentice Hall India.
3. Jeffry A. Timmons & Stephen Spinelli. (2004). *New Venture Creation: Entrepreneurship for the 21st Century*. New York McGraw-Hill.
4. Timmons, J. A and Spinelli, S. (2004). *New Venture Creation* (6th Ed.). New York. Mc-Graw Hill.
5. *Economic Development Policy of The Kingdom of Bhutan*. (2010).

Date: March 3, 2016

Module Code and Title	:	NWC403 Cloud Computing
Programme	:	BE in Information Technology
Credit	:	12
Module Tutor	:	Tandin Wangchuk

General objective:

This module will provide a hands-on comprehensive study of Cloud concepts and capabilities across the various Cloud service models including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), and Business Process as a Service (BPaaS).

Learning outcomes:

On completion of the module, students will be able to:

1. Analyze the trade-offs between deploying applications in the cloud and over the local infrastructure.
2. identify pros and cons of various cloud computing platforms.
3. Deploy applications over Amazon Web Services, Windows Azure, and Google App Engine.
4. Develop data intensive parallel applications in the cloud.
5. Examines the performance, scalability and availability of cloud technologies.
6. Identify security and privacy issues in cloud computing.
7. Solve a real-world problem using cloud computing through group collaboration.

Learning and teaching approach:

Approach	Hours per Week	Total Credit Hours
Lecture	3	45
Tutorial	1	15
Case Study	2	30
Independent study/self-directed learning	2	30
Total		120

Assessment approach:

Sl. No.	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
1	Continuous Assessment (Theory)			
1.1	Term Test - Closed book, one hour duration in 5th and 10th week, units covered up to 5th week for test I, units covered from 6th - 10th week for test II.	2	30	50
1.2	Assignments - in 4th week (Units covered up to 4th week) and 11th week (Units covered from 6th week – 10th week)	2	10	
1.3	Case Study – Recent and new related topics, submission in the 14th week	1	10	
2	Semester End Examination: Closed book for 3 hours duration	1	50	50

Pre-requisite: NWC201 Computer Communication Networks

Subject matter:

Unit I: Overview of Computing Paradigm

- 1.1 Recent trends in Computing
- 1.2 Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing
- 1.3 Evolution of cloud computing
- 1.4 Business driver for adopting cloud computing

Unit II: Introduction to Cloud Computing

- 2.1 Cloud Computing (NIST Model)
- 2.2 Introduction to Cloud Computing
- 2.3 History of Cloud Computing
- 2.4 Cloud service providers: Properties, Characteristics & Disadvantages
- 2.5 Pros and Cons of Cloud Computing
- 2.6 Benefits of Cloud Computing,
- 2.7 Cloud computing vs. Cluster computing vs. Grid computing
- 2.8 Role of Open Standards

Unit III: Cloud Computing Architecture

- 3.1 Cloud computing stack
- 3.2 Comparison with traditional computing architecture (client/server),
- 3.3 Services provided at various levels,
- 3.4 How Cloud Computing Works,
- 3.5 Role of Networks in Cloud computing, protocols used,
- 3.6 Role of Web services
- 3.7 Cloud Service Models (XaaS)
 - 3.7.1 Infrastructure as a Service(IaaS)
 - 3.7.2 Platform as a Service(PaaS)
 - 3.7.3 Software as a Service(SaaS)
 - 3.7.4 Business Process as a Service (BPaaS)
- 3.8 Deployment Models: Public cloud, Private cloud, Hybrid cloud, Community cloud

Unit IV: Infrastructure as a Service (IaaS)

- 4.1 Introduction to IaaS, IaaS definition
- 4.2 Introduction to virtualization, Different approaches to virtualization
- 4.3 Hypervisors, Machine Image, Virtual Machine(VM)
- 4.4 Resource Virtualization: Server, Storage, Network
- 4.5 Virtual Machine(resource) provisioning and manageability,
- 4.6 Storage as a service, Data storage in cloud computing(storage as a service)
- 4.7 Renting, EC2 Compute Unit, Platform and Storage, pricing, customers, Eucalyptus

Unit V: Platform as a Service (PaaS)

- 5.1 Introduction to PaaS: What is PaaS, Service Oriented Architecture (SOA)
- 5.2 Cloud Platform and Management: Computation and Storage

Unit VI: Software as a Service (SaaS)

- 6.1 Introduction to SaaS
- 6.2 Web services
- 6.3 Web 2.0
- 6.4 Web OS
- 6.5 Case Study on SaaS

Unit VII: Business Process as a Service (BPaaS)

- 7.1 Overview of BPM on the Cloud (i.e., BPaaS vs. managed business services and BPO) and BPaaS sample solutions (e.g., accounts payable, media planning, order management, clinical data management, MRO process, sentiment analysis, production management)
- 7.2 BPaaS platform services (process modeler, rules engine, process portal, BAM reporting, process administration, process integration, process collaboration, PaaS management, Cloud manager process workbench, collaboration tools, application builder, etc.)
- 7.3 BPaaS vendor solutions
- 7.4 BPaaS mainstream offerings: business and technical services design and development

Unit VIII: Service Management in Cloud Computing

- 8.1 Service Level Agreements(SLAs)
- 8.2 Billing & Accounting
- 8.3 Comparing Scaling Hardware: Traditional vs. Cloud
- 8.4 Economics of scaling: Benefitting enormously
- 8.5 Managing Data
 - 8.5.1 Looking at Data, Scalability & Cloud Services
 - 8.5.2 Database & Data Stores in Cloud
 - 8.5.3 Large Scale Data Processing

Unit IX: Cloud Security

- 9.1 Infrastructure Security
 - 9.1.1 Network level security,
 - 9.1.2 Host level security,
 - 9.1.3 Application level security
 - 9.1.4 Data security and Storage: Data privacy and security Issues, Jurisdictional issues raised by Data location
- 9.2 Identity & Access Management
 - 9.2.1 Access Control
 - 9.2.2 Trust, Reputation, Risk

- 9.2.3 Authentication in cloud computing,
- 9.2.4 Client access in cloud,
- 9.2.5 Cloud contracting Model, Commercial and business considerations

Unit X: Case Study on Open Source & Commercial Clouds

- 10.1 Eucalyptus: Overview, software architecture and functionality
- 10.2 Amazon EC2: Overview, software architecture and functionality
- 10.3 Integration of Amazon Web services with Eucalyptus

Reading List:

Essential Reading

1. Sosinsky, B. (2010). *Cloud Computing Bible* (1st ed.). Wiley-India.
2. R. Buyya, J. Broberg, & A. M. Goscinski (Eds.). (2011). *Cloud Computing: Principles and Paradigms*. Wiley & Sons, Inc.

Additional Reading

1. Antonopoulos, N., & Gillam, L. (2012). *Cloud Computing: Principles, Systems and Applications* (Illustrated ed.). London: Springer.
2. Krutz, R. L., & Vines, R. D. (2010). *Cloud Security: A Comprehensive Guide to Secure Cloud Computing*. Wiley.

Date: April 4, 2016

Module Code and Title : ITM405 E-Commerce Technology
Programme : BE in Information Technology
Credit : 12
Module Tutor : Gagandeep Singh

General Objective: The module aims to provide students with knowledge about the application of electronic commerce in various businesses and its transactions. It also enables students to develop skills in translating e-business strategy into action.

Learning outcomes:

On completion of the module, students will be able to:

1. Define E-Commerce.
2. Discuss scope of e-commerce in the realm of modern business.
3. Explain E-commerce models.

4. Compare various electronic payment systems.
5. Develop an E-business strategy
6. Differentiate E-commerce and banking.
7. Examine the translation of E-Business strategy into action.
8. Discuss marketing methods used in e-commerce.
9. Analyze an E-commerce business in operation.
10. Evaluate the methods and metrics used to measure effectiveness of E-commerce activities.

Learning and teaching approach:

Approach	Hours per week	Total credit hours
Lecture	3	45
Tutorial	1	15
Independent study	4	60
Total		120

Assessment approach:

	<i>Mode of Assessment</i>	<i>Nos.</i>	<i>Marks Allocated</i>	<i>Marks (%)</i>
1	Continuous Assessment (Theory)			
1.1	Term Test -Closed book, one hour duration in 5 th week (Unit I to Unit II) and 10 th week (Unit I to Unit IV)	2	20	30
1.2	Assignments – in 4th week (Units covered up to 4th week) and 11th week (Units covered from 6th week – 10th week)	2	10	
2	Semester End Examination: Closed book for 3 hours duration	1	70	70

Pre-requisites: None.

Subject matter:

Unit I: Electronics Payment Systems

- 1.1 Overview of the Electronics payment technology.
 - 1.1.1. Electronics cash.
 - 1.1.2. Electronics checks.
 - 1.1.3. Online credit cards based system.
- 1.2. Other emerging financial instruments.

Unit II: Electronics Commerce and banking

- 2.1. Home Banking.
- 2.2. Banking via the PC using Internet/Intranet.

- 2.3. Banking via online services.
- 2.4. Banking via Web.

Unit III: Business to Business E-Commerce

- 3.1 Electronic Markets.
- 3.2 Electronic Data Interchange (EDI): Technology, Standards (UN/EDIFACT), Communications, Implementations, Agreements, Security, EDI and Business, Inter-Organizational E-Commerce.
- 3.3 Government to Citizen.

Unit IV: Electronics Commerce and Retailing

- 4.1 Changing Retail industry dynamics.
 - 4.1.1. Overbuilding and excess supply.
 - 4.1.2. Changes in consumer demographics.
 - 4.1.3. Changes in consumer behaviors.
 - 4.1.4. Technology improvements in Electronics retailing.
- 4.2 Mercantile models from consumer's perspective.

Unit V: Supply chain management

- 5.1 Supply-Chain management fundamentals.
 - 5.1.1. Pull Supply-Chain Model.
 - 5.1.2. Push Supply-Chain Model.
- 5.2 Elements of Supply-Chain Management.
- 5.2 Supply chain application software and its future.

Unit VI: Roadmaps to E-Business

- 6.1 Challenges and strategy creation.
- 6.2 Roadmaps to E-Business.

Unit VII: Translating E-Business strategy into action

- 7.1 Beginning of a virtual factor.
- 7.2 E-business blueprint creation
- 7.3 E-Business project planning checklist, an execution blueprint.
- 7.4 Failures of E-Business Initiatives.

Reading list:

Essential reading

1. Kalakota, R., & Robinson, M.(2000). *E-Business 2.0: roadmap for success* (2nded.). Hong Kong: Addison Wesley (Pearson Education Asia).

Additional reading

1. David, K., & Turban, E. (2011). *Electronic commerce 2012 global edition* (7thed.). Pearson Education.

2. Kalakota, R., & Whinston, A. B. (1997). *Electronic commerce: A manager's guide* (1sted.). Addison-Wesley Professional.
3. Kosiur, D., & Kosiur, D.R. (1997). *Understanding electronic commerce (Strategic technology)*. USA: Microsoft Press.

Date: June 10, 2016

Module Code and Title : ECD408 Embedded Systems
Programme : BE in Electronics & Communication Engineering
Credit : 12
Module Tutor : Kamal K Chapagai

General objectives:

This Module will enable the students to learn about advanced techniques of VLSI and Embedded system designs. It also intends to familiarize students on algorithms for embedded systems. Further, students will learn the application of CAD in VLSI and embedded system designs.

Learning outcomes:

On completion of the module, students will be able to:

1. Describe design issues in Embedded Systems and use it during system implementation
2. Differentiate architecture of embedded systems for various applications
3. Use appropriate CAD tools and programming software to Design and perform analysis on basic Embedded system architecture
4. Formulate pros and cons of system programming software in terms of power, speed and real time issues.
5. Implement simple algorithm programs on simulators and emulators and generate hardware architecture
6. Practice and experiment domain specific processor architecture for embedded systems using CAD tool.
7. List architecture for state of art processors and differentiate over previous versions.

Learning and teaching approach:

Approach	Hours per Week	Total Hours	Credit
Lecture	2	45	
Tutorial	1	15	
Independent study/self-directed learning	3	60	
Total		120	

Assessment approach:

Sl. No.	Mode of Assessment	Nos.	Marks Allocated	Marks (%)
1	Continuous Assessment (Theory)			
1.1	Term Test: closed book, one hour in the 5 th and 10 th week	2	20	50
1.3	Assignment: one assignment at the end of each unit and collected after one week	5	5	
1.5	Project: One project covering complete aspect of Embedded system to be completed at the end of the semester	1	25	
1.7	Presentation/Discussion	1		
2	Semester Examination	1	50	50

Pre-requisite: ECD206 Advance Microprocessor

Subject Matter:**Unit I: Introduction**

- 1.1 Architecture
- 1.2 Specifications
- 1.3 Design methodologies
- 1.4 Real time issues
 - 1.4.1 Modelling
 - 1.4.2 Specification
 - 1.4.3 Communication
 - 1.4.4 Scheduling
 - 1.4.5 Protocols
- 1.5 Hardware-Software co-design
 - 1.5.1 Introduction and motivation
 - 1.5.2 Co-design of embedded system
 - 1.5.3 Design flow
 - 1.5.4 System specification and HW-SW partition
 - 1.5.5 HW-SW specification
 - 1.5.6 Software programming and simulation
 - 1.5.7 Hardware design and simulation
 - 1.5.8 Hardware and software integration
 - 1.5.9 System testing and verification
 - 1.5.10 Design Issues
- 1.6 Memory and low power issues
 - 1.6.1 validation approaches
 - 1.6.2 Distributed embedded system

Unit II: Embedded Systems Instruction set

- 1.1 Microprocessor instruction setFormat of instructions
- 1.2 Writing assembly language programs

- 1.3 Internal and external memory data transfer
- 1.4 Boolean instructions
- 1.5 Bit testing and program branching.
- 1.6 Processor addressing modes and use of look up tables
- 1.7 Introduction to C programming for embedded systems
- 1.8 low-level versus high-level languages
- 1.9 C-code for various examples
 - 1.9.1 variable typesLibraries
 - 1.9.2 Functions
 - 1.9.3 Parameters and arguments
 - 1.9.4 Memory addressing
 - 1.9.5 Arrays
 - 1.9.6 Pointers
 - 1.9.7 Interrupts and interrupt service routines.
- 1.10 Software Program Generation
 - 1.10.1 Implementation language (C, C++, assembler).
 - 1.10.2 Compiling and optimizations for application specific processors, DSPs, etc.
 - 1.10.3 Generation of a real time kernel or adapting to an existing operating system
- 1.11 Hardware Program Generation
 - 1.11.1 Encoding in a HDL (VHDL and Verilog).
 - 1.11.2 Successive synthesis steps:
 - 1.11.3 High level
 - 1.11.4 Register transfer level
 - 1.11.5 Logic level synthesis.
- 1.12 Hardware software integration
- 1.13 Prototyping

Unit III: Domain-specific processor architecture styles

- 1.1 Platform view: a processor is part of a system
- 1.2 Architecture optimization of different platform components
- 1.3 Algorithm design
- 1.4 Data Memory Hierarchy
- 1.5 Foreground Memory Organization
- 1.6 Instruction/Configuration Memory Organization (ICMO)
- 1.7 Data path Parallelism
- 1.8 Data path - Address path
- 1.9 Putting it together: FEENECS Architecture Template Example

Unit IV: State of the Art Overview for ASIP platforms

- 1.1 Architectural components and mapping
- 1.2 Processor core
- 1.3 Data memory hierarchy
- 1.4 Instruction/configuration memory organization
- 1.5 Inter-core communication architecture
- 1.6 Platform architecture exploration
- 1.7 Exploration strategy
- 1.8 Criteria/cost metric
- 1.9 Evaluation method

Reading List:

Essential Reading:

1. Allen, P.E and Holberg, D.R. (2011), *CMOS Analog VLSI Design* (3rd Edition). Oxford University Press
2. Gajski, Vahid, Narayan and Gong. (1994), *Specification and Design of Embedded Systems* (1st Edition). Prentice Hall.
3. Geiger, R.L., Allen, P.E and Stader, N.R. (2010), *VLSI Design Techniques for Analog and Digital Circuit* (1st Edition), Tata McGraw Hill, New Delhi
4. Ismail, M and Fietz, T. (1994), *Analog VLSI Signal and Information Processing* (1st Edition). McGraw Hill.
5. Wolf, W. (2012), *Computer as Components: Principles of Embedded Computing System Design* (3rd Edition). Morgan Kaufman Publishing

Additional Reading:

1. Baker, R.J., Li, H.W and Boyce, D.E. (2000), *CMOS Circuit Design, Layout and Simulation* (3rd Edition). Prentice Hall of India,
2. Ercegovac, M., Lang, T and Moreno, J.H. (2000), *Introduction to Digital Systems* (1st Edition). McGraw Hill
3. Kang, S.M & Leblebici, Y. (2010), *CMOS Digital Integrated Circuits* (3rd Edition) Tata McGraw Hill, New Delhi
4. Martin, K. (1999), *Digital Integrated Circuit Design* (1st Edition). Oxford University Press
5. Rabaey, J.M. (2003), *Digital Integrated Circuit* (2nd Edition) Prentice Hall of India. New Delhi

Date: February 24, 2016
