Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
B. Tech. in Computer Science and Business Systems
(Applicable from the Academic Session 2020-2021)

Curriculum Structure
Second Year Fourth Semester

Theory

Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				L	T	P	
1		HSMC-401	Introduction to Innovation, IP Management & Entrepreneurship	2	1	0	3
2	Professional Core Courses	PCC-CSBS401	FORMAL LANGUAGE & AUTOMATA THEORY	2	1	0	3
3	Professional Core Courses	PCC-CSBS402	OBJECT ORIENTED PROGRAMMING	2	1	0	3
4	Professional Core Courses	PCC-CSBS403	COMPUTER ORGANIZATION & ARCHITECHTURE	2	1	0	3
5	Basic Science course	*BSC 401*	Biology	2	1	0	3
6	Mandatory Course	MC 401	Environmental Science	1	0	0	1
							16

Practical

Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				Lecture	Tutorial	Practical	
1		ESC-481	DESIGN THINKING	0	1	3	2.5
2		PCC -492	Object Oriented Programming with C++ Lab	0	0	4	2
3		PCC- CSBS 493	COMPUTER ORGANIZATION & ARCHITECHTURE Lab	0	0	3	1.5
			Total credits				**6**
			TOTAL CREDITS(Theory+Practical)				**22**

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
B. Tech. in Computer Science and Business Systems
(Applicable from the Academic Session 2020-2021)

Introduction to Innovation, IP Management & Entrepreneurship (HSMC-401)

Course Pre Requisite(s):
Good knowledge of Fundamentals of Management

Course Outcome(s):
The major emphasis of the course will be on creating a learning system through which management students can enhance their innovation and creative thinking skills, acquaint themselves with the special challenges of starting new ventures and use IPR as an effective tool to protect their innovations and intangible assets from exploitation.
As a part of this course, students will:

- Learn to be familiar with creative and innovative thinking styles
- Learn to investigate, understand and internalize the process of founding a startup
- Learn to manage various types of IPR to protect competitive advantage

Topics to Be Covered:

UNIT – I
Innovation: What and Why?
Innovation as a core business process, Sources of innovation, Knowledge push vs. need pull innovations.

Class Discussion- Is innovation manageable or just a random gambling activity?

UNIT – II
Building an Innovative Organization
Creating new products and services, Exploiting open innovation and collaboration, Use of innovation for starting a new venture.
Class Discussion- Innovation: Co-operating across networks vs. 'go-it-alone' approach

UNIT – III
Entrepreneurship:

- Opportunity recognition and entry strategies
- Entrepreneurship as a Style of Management
- Maintaining Competitive Advantage- Use of IPR to protect Innovation

UNIT – IV
Entrepreneurship- Financial Planning:

- Financial Projections and Valuation
- Stages of financing
- Debt, Venture Capital and other forms of Financing

UNIT – V
Intellectual Property Rights (IPR)

- Introduction and the economics behind development of IPR: Business Perspective
- IPR in India – Genesis and Development

- International Context
- Concept of IP Management, Use in marketing

UNIT – VI
Types of Intellectual Property

- Patent- Procedure, Licensing and Assignment, Infringement and Penalty
- Trademark- Use in marketing, example of trademarks- Domain name
- Geographical Indications- What is GI, Why protect them?
- Copyright- What is copyright
- Industrial Designs- What is design? How to protect?

Class Discussion- Major Court battles regarding violation of patents between corporate companies

Home Assignment:
Case study materials book will be given to students. Students are required to meet in groups before coming to class and prepare on the case for the day. Instructor may ask the student groups to present their analysis and findings to the class.

Further, the topic for class discussion will be mentioned beforehand and students should be ready to discuss these topics (in groups) in class. Students are required to meet in groups before coming to class and prepare on the topic. Few topics are mentioned below as examples. Instructor can add or change any topic as per requirement.

Topic 1- Is innovation manageable or just a random gambling activity?
Topic 2- Innovation: Co-operating across networks vs. 'go-it-alone' approach
Topic 3- Major Court battles regarding violation of patents between corporate companies

Text Books:
1. Joe Tidd, John Bessant. Managing Innovation: Integrating Technological, Market and Organizational Change
2. Case Study Materials: To be distributed for class discussion

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
B. Tech. in Computer Science and Business Systems
(Applicable from the Academic Session 2020-2021)

FORMAL LANGUAGE & AUTOMATA THEORY (PCC-CSBS401)

Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.

Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, Kleene's theorem, pumping lemma for regular languages, Myhill-Nerode theorem and its uses, minimization of finite automata.

Context-free languages and pushdown automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs.

Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.

Turing machines: The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators.

Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.

Basic Introduction to Complexity: Introductory ideas on Time complexity of deterministic and nondeterministic Turing machines, P and NP, NP- completeness, Cook's Theorem, other NP - Complete problems.

Text Books:

1. Introduction to Automata Theory, Languages, and Computation John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman.

Reference Books:

1. Elements of the Theory of Computation, Harry R. Lewis and Christos H. Papadimitriou.
2. Automata and Computability, Dexter C. Kozen.
3. Introduction to the Theory of Computation, Michael Sipser.
4. Introduction to Languages and the Theory of Computation, John Martin.
5. Computers and Intractability: A Guide to the Theory of NP Completeness, M. R. Garey and D. S. Johnson.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
B. Tech. in Computer Science and Business Systems
(Applicable from the Academic Session 2020-2021)

OBJECT ORIENTED PROGRAMMING (PCC-CSBS402)

Procedural programming, An Overview of C: Types Operator and Expressions, Scope and Lifetime, Constants, Pointers, Arrays, and References, Control Flow, Functions and Program Structure, Namespaces, error handling, Input and Output (C-way), Library Functions (string, math, stdlib), Command line arguments, Pre-processor directive

Some difference between C and C++: Single line comments, Local variable declaration within function scope, function declaration, function overloading, stronger type checking, Reference variable, parameter passing – value vs. reference, passing pointer by value or reference, #define constant vs const, Operator new and delete, the typecasting operator, Inline Functions in contrast to macro, default arguments

The Fundamentals of Object Oriented Programming: Necessity for OOP, Data Hiding, Data Abstraction, Encapsulation, Procedural Abstraction, Class and Object.

More extensions to C in C++ to provide OOP Facilities: Scope of Class and Scope Resolution Operator, Member Function of a Class, private, protected and public Access Specifier, this Keyword, Constructors and Destructors, friend class, error handling (exception)

Essentials of Object Oriented Programming: Operator overloading, Inheritance – Single and Multiple, Class Hierarchy, Pointers to Objects, Assignment of an Object to another Object, Polymorphism through dynamic binding, Virtual Functions, Overloading, overriding and hiding, Error Handling

Generic Programming: Template concept, class template, function template, template specialization

Input and Output: Streams, Files, Library functions, formatted output

Object Oriented Design and Modeling: UML concept, Use case for requirement capturing, Class diagram, Activity diagram and Sequence Diagram for design, Corresponding C++ code from design

Text Books:
1. The C++ Programming Language, Bjarne Stroustrup, Addison Wesley.
2. C++ and Object-Oriented Programming Paradigm, Debasish Jana, PHI Learning Pvt. Ltd.

Reference Books:
1. Programming – Principles and Practice Using C++, Bjarne Stroustrup, Addison Wesley.
2. The Design and Evolution of C++, Bjarne Stroustrup, Addison Wesley.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
B. Tech. in Computer Science and Business Systems
(Applicable from the Academic Session 2020-2021)

COMPUTER ORGANIZATION & ARCHITECHTURE (PCC-CSBS403)

Revision of basics in Boolean logic and Combinational/Sequential Circuits.

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit.

Instruction set architecture of a CPU: Registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Outlining instruction sets of some common CPUs.

Data representation: Signed number representation, fixed and floating point representations, character representation.

Computer arithmetic: Integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and-add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic, IEEE 754 format.

Introduction to x86 architecture.

CPU control unit design: Hardwired and micro-programmed design approaches, design of a simple hypothetical CPU.

Memory system design: Semiconductor memory technologies, memory organization.

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers – program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces – SCII, USB

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.
Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

Text Books:

1. Computer System Architecture M. M. Mano:, 3rd ed., Prentice Hall of India, New Delhi, 1993.
2. Computer Organization and Design: The Hardware/Software Interface, David A. Patterson and John L. Hennessy.
3. Computer Organization and Embedded Systems, Carl Hamacher.

Reference Books:

1. Computer Architecture and Organization, John P. Hayes.
2. Computer Organization and Architecture: Designing for Performance, William Stallings.
3. Computer System Design and Architecture, Vincent P. Heuring and Harry F. Jordan.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
B. Tech. in Computer Science and Business Systems
(Applicable from the Academic Session 2020-2021)

Biology
Code: BSC 401
Contacts: 2L+1T

Name of the Course:	***Biology***	
Course Code: BSC-401	*Semester: IV*	
Duration: 6 months	*Maximum Marks:100*	
Teaching Scheme		***Examination Scheme***
Theory: 2hrs./week		*Mid Semester exam: 15*
Tutorial: 1 hour		*Assignment and Quiz: 10 marks*
		Attendance: 5 marks
Practical: NIL		*End Semester Exam: 70 Marks*
Credit Points:	*3*	
Objective:		
1	*Bring out the fundamental differences between science and engineering*	
2	*Discuss how biological observations of 18_{th} Century that lead to major discoveries*	
Pre-Requisite:		
1	*Basic knowledge of Physics ,Chemistry and mathematics*	

Unit	*Content*	*Hrs/Unit*	*Marks/Unit*
1	*To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18_{th} Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.*	*2*	

2	*The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c)*	*3*	
	energy and Carbon utilisation -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus		
3	*To convey that "Genetics is to biology what Newton'slawsareto Physical Sciences" Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.*	***4***	
4.	*Biomolecules: To convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA.Two carbon units and lipids.*	***4***	

5	*Enzymes: To convey that without catalysis life would not have existed on earth* *Enzymology: How to monitor enzyme catalysed reactions. How does an enzyme catalyse reactions? Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters.* *Why should we know these parameters to understand biology? RNA catalysis.*	***4***	
6	*Information Transfer:The molecular basis of coding and decoding genetic information is universal* *Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA*	***4***	
	structure- from single stranded to double helix to nucleosomes. Concept of genetic code. *Universality and degeneracy of genetic code.* *Define gene in terms of complementation and recombination.*		
7	*Macromolecular analysis: How to analyse biological processes at the reductionist level* *Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.*	***5***	
8	*Metabolism: The fundamental principles of energy transactions are the same in physical and biological world.* *Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keqand its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO2 + H2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO2 and H2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge*	***4***	

9	*Microbiology Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.*	***3***	

Text books/ reference books:

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

Course Outcomes:

On completion of the course students will be able to

BSC-401.1 Describe how biological observations of 18_{th} Century that lead to major discoveries.

BSC-401.2 Convey that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological

BSC-401.3 Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring

BSC-401.4 Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine

BSC-401.5 Classify enzymes and distinguish between different mechanisms of enzyme action.

BSC-401.6 Identify DNA as a genetic material in the molecular basis of information transfer.

BSC-401.7 Analyse biological processes at the reductionistic level

BSC-401.8 Apply thermodynamic principles to biological systems.

BSC-401.9 Identify and classify microorganisms.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
B. Tech. in Computer Science and Business Systems
(Applicable from the Academic Session 2020-2021)

Environmental Sciences
Code: MC-401
Contacts: 1L

Name of the Course:	***Environmental Sciences***	
Course Code: MC-401	*Semester: IV*	
Duration:6 months	*Maximum Marks:100*	
Teaching Scheme		***Examination Scheme***
Theory:1hrs./week		*Mid Semester exam: 15*
Tutorial: NIL		*Assignment and Quiz : 10 marks*
		Attendance : 5 marks
Practical: NIL		*End Semester Exam :70 Marks*
Credit Points:	*1*	
Objective:		
1	*Be able to understand the natural environment and its relationships with human activities.*	
2	*Be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk.*	
3	*Be able to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues.*	
4	*Be able to solve scientific problem-solving related to air, water, noise & land pollution*	
Pre-Requisite:		
1	*Basic knowledge of Environmental science*	

Unit	Content	Hrs/Unit	Marks/Unit
1	Basic ideas of environment, basic concepts, man, society & environment, their interrelationship (1L) Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development. (2L) Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function. (1L) Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic	6	
	degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering. (2L)		
2	Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function. (1L) Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web.(2L) Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. (1L) Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.(2L)	**6**	

3	Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. (1L) Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.(1L) Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Earth's heat budget.(1L) Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).(2L) Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.(2L) Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria	**11**	
	pollutant. Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. (2L) Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green-house gases, effect of ozone modification. (1L) Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference). (1L)		

4.	Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. (2L) River/Lake/ground water pollution: River: DO, 5-day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river [deoxygenation, reaeration], COD, Oil, Greases, pH. (2L) Lake: Eutrophication [Definition, source and effect]. (1L) Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only)(1L) Standard and control: Waste water standard [BOD, COD, Oil, Grease], Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. (2L) Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic (1L)	**9**	
5	Lithosphere; Internal structure of earth, rock and soil (1L)	**3**	
	Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling. Solid waste management and control (hazardous and biomedical waste).(2L)		

6	Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] (1L) Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L10 (18hr Index) ,n Ld.Noise pollution control. (1L)	**3**	
7	Environmental impactassessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol. (2L)	**2**	

Text books/ reference books:

1. M.P. Poonia & S.C. Sharma, Environmental Studies, Khanna Publishing House (AICTE Recommended Textbook – 2018)
2. Masters, G. M., "Introduction to Environmental Engineering and Science", *Prentice-Hall of India Pvt. Ltd.,1991.*
3. De, A. K., "Environmental Chemistry", New Age

International ***Course Outcomes:***

On completion of the course students will be able to

MC-401.1 To understand the natural environment and its relationships with human activities.

MC-401.2 To apply the fundamental knowledge of science and engineering to assess environmental and health risk.

MC-401.3 To develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations.

MC-401.4 Acquire skills for scientific problem-solving related to air, water, noise& land pollution.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
B. Tech. in Computer Science and Business Systems
(Applicable from the Academic Session 2020-2021)

Course: Object Oriented Programming with C++ Lab
Code:
Contact: 4P
Credit: 2

Name of the Course:	Object Oriented Programming with C++ Lab		
Course Code:		**Semester:**	V
Duration:	6 months	**Maximum Marks:**	100
Teaching Scheme:			
Theory:	0 hrs./week	Continuous Internal Assessment	
Tutorial:	NIL	**External Assessment:**	60
Practical:	4 hrs./week	**Distribution of marks:**	40
Credit Points:	2		

Unit 1.1:

Basic UNIX/Linux Operating System Commands & Editor [2P]
Introduction of UNIX/Linux Operating System which includes preliminary commands, start-up & shutdown methodology, file handling as well as introduction to editors like Vi editor.

Unit 1.2:

C & C++ Compiler [2P]
Introduction to GNU C & C++ compiler, as well as introduction to GNU & GDB script.

Unit 2.1:

C++ Language Basics, Control Statements [2P]
Introduction to C++, basic loop control, executing programs, writing functions, selection statements.

Unit 2.2:

Function & Recursion [2P]
Review of functions and parameters, command line arguments, recursion.

Unit 2.3:

IO, Pointer & String [4P]
I/O streams, arrays and string manipulation, pointers, structures & unions.

Unit 3.1:

Basics of OOPs and Constructors & Destructors [4P]
Object-Oriented Programming in C++, fundamentals of classes, constructors-destructors. Dealing with member functions.

Unit 3.2:

Polymorphism & Inheritance [6P]
Function & operator overloading and polymorphism (both static & dynamic), Dealing with inheritance, derived class handling, abstract class, virtual class, overriding.

Unit 4.1:

Template & Dynamic Memory Allocation [6P]
Template class, name-space & exception handling, Dynamic memory allocation, implementation of Linked Lists, using C++.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
B. Tech. in Computer Science and Business Systems
(Applicable from the Academic Session 2020-2021)

Computer Organization & Architecture Lab
Subject Code: PCC-CSBS493
Credit:1.5

Objectives of the course:
This course will expose students to the following
1.To be able to understand the behavior logic gates, adder, decoder and multiplexer.
2. How Computer Systems work & the basic principles.

Detailed contents: All laboratory assignments are based on Hardware Description Language (VHDL or Verilog) Simulation

Module	**Content**
1	HDL introduction.
2	Basic digital logic based programming with HDL.
3	8-bit Addition, Multiplication, Division.
4	Design a BCD adder.
5	Design an 8×1 multiplexer.
6	Design a Decoder.
7	8-bit Register design.
8	Memory unit design and perform memory operations.
9	8-bit simple ALU design.
10	8-bit simple CPU design.
11	Interfacing of CPU and Memory.

Course Outcome:
1. Understand basic logic gates and efficiently verify the behavior of the circuit.
2. Acquire in-depth knowledge to implement different arithmetic operations.
3. Understand the working principle of the memory system.
4. Understand the working principle of CPU, and interfacing of CPU and Memory.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
B. Tech. in Computer Science and Business Systems
(Applicable from the Academic Session 2020-2021)

Course Code	Course Title	L	T	P	J	C
ESC 481	**Design Thinking**	**0**	**10**	**3**	**0**	**2.5**
Pre-requisite	**NIL**					

Course Objectives:

1. Recognize the importance of design thinking and its various phases
2. Apply design thinking phases to create successful prototypes
3. Understand that both agile and design thinking process complement each other

Expected Course Outcome:

After the successful completion of the course the student should be able to

1. Understand the importance of design thinking and its different phases
2. Empathize with user situations and be able to define clear problem statements
3. Use the different ideation methods and come with different feasible and viable ideas for solving theproblem statements.
4. Create prototypes for clear understanding of the problem statement.
5. Test the created prototypes and be able to iterate if the design does not meet the customer requirement
6. Complement agile process with design thinking for efficient delivery process.

	Lab Experiments	
1	Immersion Activity	3 hours
2	Problem Definition	3 hours
3	Different Points of View	3 hours
4	Brainstorming session	3 hours
5	Drawing Mind Maps	3 hours
6	Ideation Games	3 hours
7	Creating Prototype	3 hours
8	Planning and working on video storyboard	3 hours
9	Completing the prototype as per schedule	3 hours
10	Testing the prototype	3 hours
	Total Lecture hours:	**30 hours**

Text Book(s)

1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires, 1st Edition, HarperCollins, 2009.
2. Eli Woolery, Design Thinking Handbook, Invision, 2019.

Reference Books

1. Nir Eyal , Hooked: How to build habit-forming, 2014
2. Rod Judkins, The Art of Creative Thinking, Sceptre; 1st edition, 2015.