CODE: PCC-CS-501

SUBJECT NAME: SIGNALS & SYSTEMS

NO OF CREDITS: 3

B.TECH 5th SEMESTER	SESSIONAL: 25
L T P	THEORY EXAM: 75
3 0 0	TOTAL : 100

Pre-requisites:

Course Objectives:

MODULE-1: INTRODUCTION TO SIGNALS AND SYSTEMS

Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples.

MODULE-2: BEHAVIOR OF CONTINUOUS AND DISCRETE-TIME LTI SYSTEMS

Impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.

MODULE-3: FOURIER, LAPLACE AND Z- TRANSFORMS

Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The DiscreteTime Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.

MODULE-4: SAMPLING AND RECONSTRUCTION

The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the concepts of continuous time and discrete time systems
2. Analyse systems in complex frequency domain
3. Understand sampling theorem and its implications.

REFERENCES:

1. **A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and systems", Prentice Hall India, 1997.**
2. **J. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms, and Applications", Pearson, 2006.**
3. **H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.**
4. **S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007.**
5. **A. V. Oppenheim and R. W. Schafer, "Discrete-Time Signal Processing", Prentice Hall, 2009.**
6. **M. J. Robert "Fundamentals of Signals and Systems", McGraw Hill Education, 2007.**
7. **B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.**

CODE: PCC-CS-501

SUBJECT NAME: DATABASE MANAGEMENT SYSTEMS

NO OF CREDITS: 3

B.TECH 5th SEMESTER	SESSIONAL: 25
L T P	THEORY EXAM: 75
3 0 0	TOTAL : 100

Pre-requisites: Operating Systems

Course Objectives:

1. To understand the different issues involved in the design and implementation of a database system.
2. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
3. To understand and use data manipulation language to query, update, and manage a Database
4. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
5. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

MODULE-1:

Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).

Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

MODULE-2:

Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server.

Relational database design: Domain and data dependency, Armstrong's axiom, Normal forms, Dependency preservation, Lossless design.

Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

MODULE-3:

Storage strategies: Indices, B-trees, hashing.

MODULE-4:

Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

MODULE-5:

Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

MODULE-6:

Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Course Outcomes

1. For a given query write relational algebra expressions for that query and optimize the developed expressions
2. For a given specification of the requirement design the databases using ER method and normalization.
3. For a given specification construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, and DB2.
4. For a given query optimize its execution using Query optimization algorithms
5. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.
6. Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling

REFERENCES:

1. **"Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.**
2. **"Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press.**
3. **"Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, Pearson Education**
4. **"Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley**

CODE: PCC-CS-506

SUBJECT NAME: FORMAL LANGUAGES & AUTOMATA

CREDITS: 3

B.TECH. 5th SEMESTER	SESSIONAL: 25
L T P	THEORY EXAM: 75
3 0 0	TOTAL : 100

Pre-requisites: Operating System

Course Objectives:

1. Develop a formal notation for strings, languages and machines.
2. Design finite automata to accept a set of strings of a language.
3. Prove that a given language is regular and apply the closure properties of languages.
4. Design context free grammars to generate strings from a context free language and convert them into normal forms.
5. Prove equivalence of languages accepted by Push Down Automata and languages generated by context free grammars
6. Identify the hierarchy of formal languages, grammars and machines.
7. Distinguish between computability and non-computability and Decidability and undecidability.

MODULE 1:

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, pumping lemma for regular languages, 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.

Course Outcomes:

1. Write a formal notation for strings, languages and machines.
2. Design finite automata to accept a set of strings of a language.
3. For a given language determine whether the given language is regular or not.
4. Design context free grammars to generate strings of context free language .

REFERENCES:

1. **John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.**
2. **Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.**
3. **Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.**
4. **Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.**
5. **John Martin, Introduction to Languages and The Theory of Computation, Tata McGraw Hill.**

CODE: PCC-CS-503

SUBJECT NAME: OBJECT ORIENTED PROGRAMMING

NO OF CREDITS: 3

B.TECH 5th SEMESTER	SESSIONAL: 25
L T P	THEORY EXAM: 75
3 0 0	TOTAL : 100

Pre-requisites: Data Structures & Algorithms

Course Objectives:

The course will introduce standard tools and techniques for software development, using object oriented approach, use of a version control system, an automated build process, an appropriate framework for automated unit and integration tests.

MODULE-1: ABSTRACT DATA TYPES

Decomposition & Abstraction, Abstraction Mechanisms – parameterization, specification, Kind of Abstractions – Procedural, Data, Type hierarchies, Iteration. ADT implementation - Concrete state space, concrete invariant, abstraction function. Implementing operations, illustrated by the Text example

MODULE-2: FEATURES OF OBJECT-ORIENTED PROGRAMMING

Encapsulation, object identity, polymorphism – Inheritance in OO design. Implementing OO language features.- Classes, Objects and variables, Type Checking, Procedures - Commands as methods and as objects, Exceptions, Polymorphic procedures, Templates, Memory management

MODULE-3: DESIGN PATTERNS

Introduction and classification. Creational Pattern – Abstract Factory Pattern, Factory Method, Singleton, Structural Pattern – Bridge, Flyweight, Behavioural Pattern - The iterator pattern, Observer pattern, Model-view-controller pattern

MODULE-4: GENERIC TYPES AND COLLECTIONS

Simple Generics, Generics and Subtyping, Wildcards, Generic Methods, Set Interface, List Interface, Queue Interface, Deque Interface, Map Interface, Object Ordering, SortedSet Interface, SortedMap Interface

MODULE-5: GUIS. GRAPHICAL PROGRAMMING WITH SCALA AND SWING

Swing components, Laying out components in a container, Panels, Look & Feel, Event listener, concurrency in swing.

MODULE-6: THE SOFTWARE DEVELOPMENT PROCESS

Requirement specification and analysis, Data Model, Design, Implementation, Testing.

Course Outcomes:

After taking the course, students will be able to:

1. Specify simple abstract data types and design implementations, using abstraction functions to document them.
2. Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.
3. Name and apply some common object-oriented design patterns and give examples of their use.
4. Design applications with an event-driven graphical user interface.

REFERENCES

1. Barbara Liskov, *Program Development in Java*, Addison-Wesley, 2001

CODE: HSMC-02

SUBJECT NAME: ECONOMICS FOR ENGINEERS

NO OF CREDITS: 3

B.TECH 5th SEMESTER	SESSIONAL: 25
L T P	THEORY EXAM: 75
3 0 0	TOTAL : 100

Prerequisites:

Course objectives:

MODULE-1:

Introduction to the subject: Micro and Macro Economics, Relationship between Science, Engineering, Technology and Economic Development. Production Possibility Curve, Nature of Economic Laws.

MODULE-2:

Time Value of Money: concepts and application. Capital budgeting; Traditional and modern methods, Payback period method, IRR, ARR, NPV, PI (with the help of case studies)

MODULE-3:

Meaning of Demand. Law of Demand, Elasticity of Demand; meaning, factors effecting it and its practical application and importance. Demand forecasting (a brief explanation)

MODULE-4:

Meaning of Production and factors of production, Law of variable proportions and returns to scale. Internal and external economies and diseconomies of scale. Concepts of cost of production, different types of costs; accounting cost, sunk cost, marginal cost, Opportunity cost. Break even analysis, Make or Buy decision (case study). Relevance of Depreciation towards industry.

MODULE-5:

Meaning of market, types of market, perfect competition, Monopoly, Monopolistic, Oligopoly. (main features). Supply and law of supply, Role of demand and supply in price determination.

MODULE-6:

Indian Economy, nature and characteristics. Basic concepts; fiscal and monetary policy, LPG, Inflation, Sensex, GATT, WTO and IMF. Difference between Central bank and Commercial banks

Course Outcomes:

REFERENCES:

1. **Jain T.R., Economics for Engineers, VK Publication**
2. **Chopra P. N., Principle of Economics, Kalyani Publishers**
3. **Dewett K. K., Modern economic theory, S. Chand**
4. **H. L. Ahuja., Modern economic theory, S. Chand**
5. **Dutt Rudar & Sundhram K. P. M., Indian Economy**
6. **Mishra S. K., Modern Micro Economics, Pragati Publications**
7. **Pandey I.M., Financial Management; Vikas Publishing House**
8. **Gupta Shashi K., Management Accounting, Kalyani Publication**

CODE: MC-01

SUBJECT NAME: CONSTITUTION OF INDIA

NO OF CREDITS: 0

B.TECH 5th SEMESTER	SESSIONAL: 25
L T P	THEORY EXAM: 75
2 0 0	TOTAL : 100

CONSTITUTION OF INDIA– BASIC FEATURES AND FUNDAMENTAL PRINCIPLES

The Constitution of India is the supreme law of India. Parliament of India can not make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of "constitutionalism" in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of "diversity". It has been said that Indian constitution reflects ideals of its freedom movement, however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be "static" and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950.

The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it "as one of the strongest court in the world".

COURSE CONTENT

1. Meaning of the constitution law and constitutionalism.
2. Historical perspective of the Constitution of India.
3. Salient features and characteristics of the Constitution of India.
4. Scheme of the fundamental rights.
5. The scheme of the Fundamental Duties and its legal status.
6. The Directive Principles of State Policy – Its importance and implementation.
7. Federal structure and distribution of legislative and financial powers between the Union and the States.
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions : National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

REFERENCES:

1. **The Constitutional Law Of India 9th Edition, by Pandey. J. N.**
2. **The Constitution of India by P.M.Bakshi**
3. **Constitution Law of India by Narender Kumar**
4. **Bare Act by P. M. Bakshi**

CODE: PCC-CS-605

SUBJECT NAME: COMPILER DESIGN

CREDITS: 3

B.TECH. 5th SEMESTER	SESSIONAL: 25
L T P	THEORY EXAM: 75
3 0 0	TOTAL : 100

Pre-requisites: Formal language & automata,

Course Objectives:

1. To understand and list the different stages in the process of compilation.
2. Identify different methods of lexical analysis
3. Design top-down and bottom-up parsers
4. Identify synthesized and inherited attributes
5. Develop syntax directed translation schemes
6. Develop algorithms to generate code for a target machine

MODULE 1:

The aim is to learn how to design and implement a compiler and also to study the underlying theories. The main emphasis is for the imperative language. Introduction: Phases of compilation and overview. Lexical Analysis (scanner): Regular languages, finite automata, regular expressions, from regular expressions to finite automata, scanner generator (lex, flex). Syntax Analysis (Parser): Context-free languages and grammars, push-down automata, LL(1) grammars and top-down parsing, operator grammars, LR(O), SLR(1), LR(1), LALR(1) grammars and bottom up parsing, ambiguity and LR parsing, LALR(1) parser generator (yacc, bison)Semantic Analysis: Attribute grammars, syntax directed definition, evaluation and flow of attribute in a syntax tree. Symbol Table: Its structure, symbol attributes and management. Run-time environment: Procedure activation, parameter passing, value return, memory allocation, and scope. Intermediate Code Generation: Translation of different language features, different types of intermediate forms. Code Improvement (optimization): Analysis: control-flow, data-flow dependence etc.; Code improvement local optimization, global optimization, loop optimization, peep-hole optimization etc. Architecture dependent code improvement: instruction scheduling (for pipeline), loop optimization (for cache memory) etc. Register allocation and target code generation Advanced topics: Type systems, data abstraction, compilation of Object Oriented features and non-imperative programming languages.

Course Outcomes

1. For a given grammar specification develop the lexical analyser
2. For a given parser specification design top-down and bottom-up parsers
3. Develop syntax directed translation schemes
4. Develop algorithms to generate code for a target machine

REFERENCES:

1. **A.V. Aho, M.S. Lam, R. Sethi, and J.D. Ullman, *Compilers:Principles, Techniques, and Tools*, Pearson Education, 2007 (second ed.).**
2. **K.D. Cooper, and L. Torczon, *Engineering a Compiler*, Elsevier, 2004.**

CODE: PCC-CS-602

SUBJECT NAME: COMPUTER NETWORKS

NO OF CREDITS: 3

B.TECH 6th SEMESTER	SESSIONAL: 25
L T P	THEORY EXAM: 75
3 0 0	TOTAL : 100

Pre-requisites: Computer Organization & Architecture, Operating Systems

Course Objectives:

1. To develop an understanding of modern network architectures from a design and performance perspective.
2. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
3. To provide an opportunity to do network programming
4. To provide a WLAN measurement ideas.

MODULE-1: DATA COMMUNICATION COMPONENTS

Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

MODULE-2: DATA LINK LAYER AND MEDIUM ACCESS SUB LAYER

Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA

MODULE-3: NETWORK LAYER

Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

MODULE-4: TRANSPORT LAYER

Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

MODULE-5: APPLICATION LAYER

Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography

Course Outcomes

After taking the course, students will be able to:

2. Explain the functions of the different layer of the OSI Protocol.
3. Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.
4. For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component
5. For a given problem related TCP/IP protocol developed the network programming.
6. Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

REFERENCES:

5. **Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGrawHill.**
6. **Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.**
7. **Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.**
8. **Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.**
9. **TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America**

CODE: BSC-01

SUBJECT NAME: BIOLOGY

NO OF CREDITS: 3

B.TECH 7th SEMESTER	SESSIONAL: 25
L T P	THEORY EXAM: 75
2 1 0	TOTAL : 100

Pre-requisites: None

Course Objectives:

MODULE 1: INTRODUCTION

Purpose: 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 18th 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.

MODULE 2: CLASSIFICATION

Purpose: To convey that classification *per se* is not what biology is all about. 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) 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.

MODULE 3: Genetics

Purpose: To convey that "Genetics is to biology what Newton's laws are to 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.

MODULE 4: BIOMOLECULES

Purpose: To convey that all forms of life has 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.

MODULE 5: ENZYMES

Purpose: 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.

MODULE 6: INFORMATION TRANSFER

Purpose: The molecular basis of coding and decoding genetic information is universal

Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA 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.

MODULE 7: MACROMOLECULAR ANALYSIS

Purpose: 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.

MODULE 8: METABOLISM

Purpose: 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 K_{eq} and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO_2 + H_2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy Charge.

MODULE 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.

Course Outcomes:

After studying the course, the student will be able to:

1. Describe how biological observations of 18^{th} Century that lead to major discoveries.
2. Convey that classification *per se* is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological
3. Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring
4. Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine
5. Classify enzymes and distinguish between different mechanisms of enzyme action.
6. Identify DNA as a genetic material in the molecular basis of information transfer.
7. Analyse biological processes at the reductionistic level
8. Apply thermodynamic principles to biological systems.
9. Identify and classify microorganisms.

REFERENCES

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**