

Semester VII (Fourth year)

Subject wise Detail Syllabus

(Seventh semester onwards)

Undergraduate Degree in Engineering & Technology

Branch/Course:

**COMPUTER SCIENCE &
ENGINEERING**

Bihar Universities

ARYABHATTA KNOWLEDGE UNIVERSITY
Chanakya National Law University Campus
Mithapur, Patna-800001 www.akubihar.ac.in

Semester VII (Fourth year)

Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				Lecture	Tutorial	Practical	
1	Professional Elective Courses	PEC CS 7XX	Elective-III	3	0	0	3
2	Open Elective courses	OEC-CS 7XX	Open Elective-I	3	0	0	3
3	Basic Science Courses	BSC 701	Biology for Engineers	2	1	0	3
4	Massive Open Online Courses	MOOC CS 701	MOOCs / SWAYAM / NPTEL etc. Courses - 2	3	0	0	3
5	Project and Seminar	PNS-CS-701	Project-II	0	0	12	6
6	Summer Industry Internship	SI 701	Summer Industry Internship - 3	-	-	-	8
7	Professional Elective Laboratory	PEL CS 7XX	Professional Elective Lab II	0	0	2	1
				Total credits			27

Professional-Elective-Lab II

Advance Networking
(Cisco)

Python as tool for Machine learning

Working on R

Image Processing Lab

Advanced AI Laboratory

Professional Elective – 3 7thSem	Advanced Algorithms	Parallel and Distributed Algorithms	Internet-of-Things	Distributed Systems	Data Mining	Information Theory and Coding	ECommerce And ERP	
Open Elective – 1 7thSem	Soft Skills and Interpersonal Communication	History of Science and Technology in India	Economic Policies in India	Cyber Law and Ethics	Cyber security	Virtual Reality	Robotics and Robot Application	Digital Signal Processing

	Real Time Systems	Multi-agent Intelligent Systems	Introduction to Communication Systems					
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Professional Elective – III

	Data Mining	3L:0T:0P	3 Credits
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Detailed Contents

Module 1

Lecture 8 hrs.

Data Warehousing and Business Analysis: - Data warehousing Components –Building a Data warehouse –Data Warehouse Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.

Module 2

Lecture 8 hrs.

Data Mining: - Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation- Architecture Of A Typical Data Mining Systems- Classification Of Data Mining Systems.

Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.

Module 3

Lecture 8 hrs.

Classification and Prediction: - Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Selection.

Module 4

Lecture 8 hrs.

Cluster Analysis: - Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High-Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.

Module 5

Lecture 8 hrs.

Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web.

Text Book

1. Jiawei Han, Micheline Kamber and Jian Pei, “Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2011.

Reference Books

1. Alex Berson and Stephen J. Smith “Data Warehousing, Data Mining & OLAP”, Tata McGraw – Hill Edition, Tenth Reprint 2007.
2. K.P. Soman, Shyam Diwakar and V. Ajay “Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2006.
3. G. K. Gupta “Introduction to Data Mining with Case Studies”, Easter Economy Edition, Prentice Hall of India, 2006.
4. Pang-Ning Tan, Michael Steinbach and Vipin Kumar “Introduction to Data Mining”, Pearson Education, 2007.

Professional Elective – III

	Information Theory and Coding	3L:0T: 0P	3 Credits
Pre-requisites	PCC-CS 602		

Objectives of the course:

1. To understand information theoretic behaviour of a communication system.
2. To understand various source coding techniques for data compression
3. To understand various channel coding techniques and their capability.
4. To analyze performance of communication system with coding and modulation.

Module 1

Lecture: 8 hrs.

Information Theory: Introduction, measure of Information, Mutual information, Joint and conditional Entropy. Coding Theory: Classification of codes, Kraft McMillan inequality, Source coding theorem, Shannon-Fano coding, Huffman coding, Mutual information - Discrete memoryless channels

Module 2

Lecture: 9 hrs.

Channel capacity, Channel coding theorem, Differential entropy and mutual Information for continuous ensembles, Information Capacity theorem, Linear Block Codes: Syndrome and error detection, Error detection and correction capability, Standard array and syndrome decoding, Encoding and decoding circuit, Single parity check codes, Repetition codes and dual codes, Hamming code, Golay Code.

Module 3

Lecture: 7 hrs.

Galois field, Primitive element & Primitive polynomial, Minimal polynomial and generator polynomial, Description of Cyclic Codes, Generator matrix for systematic cyclic code, Encoding for cyclic code, Syndrome decoding of cyclic codes

Module 4**Lecture: 8 hrs.**

Binary BCH code, Generator polynomial for BCH code, Decoding of BCH code, RS codes, generator polynomial for RS code, Decoding of RS codes, Cyclic Hamming code and Golay code, CRC code

Module 5**Lecture: 8 hrs.**

Introduction of convolution code, State diagram, Polynomial description of convolution code, Generator matrix of convolution code, Tree diagram, Trellis diagram, Sequential decoding and Viterbi decoding, Known good convolution code **Suggested Books/Reference Books:**

1. Ranjan Bose, "Information Theory coding and Cryptography", McGraw-Hill Publication
2. J C Moreira, P G Farrell, "Essentials of Error-Control Coding", Wiley Student Edition

Suggested Books/Reference Books:

1. BernadSklar, "Digital Communication Fundamentals & applications", Pearson Education. Second Edition.
2. Simon Haykin, "Communication Systems", John Wiley & Sons, Fourth Edition.
3. Shu lin and Daniel j, Cistellojr., "Error control Coding" Pearson, 2nd Edition.
4. Todd Moon, "Error Correction Coding : Mathematical Methods and Algorithms", Wiley Publication
5. Khalid Sayood, "Introduction to Data compression", Morgan Kaufmann Publishers

Course outcomes

1. Perform information theoretic analysis of communication system.
2. Design a data compression scheme using suitable source coding technique.
3. Design a channel coding scheme for a communication system.
4. Evaluate performance of a communication system.

Professional Elective – III

	E-Commerce and ERP	3L:0T:0P	3 Credits
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Detailed Contents**Module 1****Lecture: 10 hrs.**

Introduction to E- Commerce: Evolution of E-commerce, Advantage and Disadvantage of E Commerce, Roadmap of E-Commerce in India. Business Models of E-Commerce: Model Based On Transaction Party: B2B, B2C, C2B, C2C.

Module 2**Lecture: 10 hrs.**

E marketing: The scope of E-Marketing, Identifying Web Presence goals, Uniqueness of the web, Meeting the need of website visitors, Website Design Issues: Factors that make People Return to Your Site, Strategies for Website Development. Site Adhesion: Content, format and access: maintaining a Website, E- Advertising, E-Branding,

Module 3

Lecture: 10 hrs.

E-Payment System: Digital Payment Requirement, Digital Token based E-Payment System, Electronic Cash, Smart card and Electronics payment system: Credit and Debit Card, Virtual Currency, Digital wallet, Risk of Electronics payment system, Digital Signature.

E Security: Security On the Internet: Network and Website Security Risk: Denial-of-Service attack, Viruses, Unauthorized access to computer Network. Security Standards: Firewall, Cryptography, Key Management, Password Systems, Digital certificates, Digital signatures.

Module 4

Lecture: 10 hrs.

Enterprise Resource Planning (ERP): Introductory Concepts, Advantages & disadvantages of ERP, ERP and Related Technologies: - Business Process Reengineering, Data Warehousing, Data Mining, Supply Chain Management. **ERP Implementation:** ERP Implementation Life Cycle – Implementation Methodology, Hidden Costs , Organizing Implementation – Contracts with Vendors, Consultants and Users , Project Management and Monitoring.

Module 5

Lecture: 7 hrs.

ERP Business Modules: Introduction to basic Modules of ERP System, Business Modules in an ERP Package- Finance – Manufacturing – Human Resource – Plant Maintenance – Materials Management – Quality Management – Sales and Distribution.

Case Study: Recent business issues on E-Commerce Perspective.

Text Books:

1. Alexis Leon, “ERP Demystified”, Tata McGraw Hill.
2. E-Commerce An Indian Perspective by P.T.Joseph, PHI

Reference Books

1. K.K. Bajaj, D. Nag “E-Commerce”, 2nd Edition, McGraw-Hill Education, New Delhi.
2. Bhaskar Bharat, “Electronic Commerce-Technology and Application”, McGraw-Hill Education, New Delhi.
3. Mary Sumner, “Enterprise Resource Planning”, 2005, PHI Learning India Pvt. Ltd. /Pearson Education, New Delhi.
4. Chan, “E-Commerce fundamentals and Applications”, Wiley India, New Delhi.
5. Vinod Kumar Garg and N.K .Venkata Krishnan, “Enterprise Resource Planning – concepts and Planning”, Prentice Hall, 1998.

Open Elective – I

OEC CS 601	Soft Skills and Interpersonal Communication	3L:0T:0P	3 Credits
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Detailed contents:

Module 1 **Lecture 8 hrs.**

Self-Analysis: Swot Analysis, Who am I, Attributes, Importance of Self Confidence, Self Esteem.

Module 2 **Lecture 8 hrs.**

Creativity: Out of Box Thinking, Lateral Thinking.

Module 3 **Lecture 8 hrs.**

Attitude: Factors Influencing Attitude, Challenges and Lessons from Attitude, Etiquette; Motivation: Factors of Motivation, Self-Talk, Intrinsic & Extrinsic Motivators.

Module 4 **Lecture 8 hrs.**

Goal Setting: Wish List, Smart Goals, Blue Print for Success, Short Term, Long Term, Life Time Goals; Time Management: Value of Time, Diagnosing Time Management, Weekly Planner, To Do List, Prioritizing Work.

Module 5 **Lecture 8 hrs.**

Interpersonal Skills: Gratitude - Understanding the relationship between Leadership Networking & Team work. Assessing Interpersonal Skills Situation description of Interpersonal Skill. Team Work - Necessity of Team Work Personally, Socially and Educationally.

Text Book:

1. Soft Skills, 2015, Career Development Centre, Green Pearl Publications.

Reference

1. Covey Sean, Seven Habits of Highly Effective Teens, New York, Fireside Publishers, 1998.
2. Carnegie Dale, How to win Friends and Influence People, New York: Simon & Schuster, 1998.

Open Elective – I

	History Of Science and Technology in India	3L:0T:0P	3 Credits
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Detailed contents

Module 1

Lecture 7 hrs.

Concepts and Perspectives

- Meaning of History
- Objectivity, Determinism, Relativism, Causation, Generalization in History; Moral judgment in history
- Extent of subjectivity, contrast with physical sciences, interpretation and speculation, causation verses evidence, concept of historical inevitability, Historical Positivism.
- Science and Technology-Meaning, Scope and Importance, Interaction of science, technology & society, Sources of history on science and technology in India.

Module 2

Lecture 7 hrs.

Historiography of Science and Technology in India

- Introduction to the works of D.D. Kosambi, Dharmapal, Debiprasad Chattopadhyay, Rehman, S. Irfan Habib, Deepak Kumar, Dhruv Raina, and others.

Module 3

Lecture 7 hrs.

Science and Technology in Ancient India

- Technology in pre-historic period
- Beginning of agriculture and its impact on technology
- Science and Technology during Vedic and Later Vedic times □ Science and technology from 1st century AD to C-1200.

Module 4

Lecture 7 hrs.

Science and Technology in Medieval India

- Legacy of technology in Medieval India, Interactions with Arabs
- Development in medical knowledge, interaction between Unani and Ayurveda and alchemy
- Astronomy and Mathematics: interaction with Arabic Sciences □ Science and Technology on the eve of British conquest

Module 5**Lecture 7 hrs.****Science and Technology in Colonial India**

- Science and the Empire
- Indian response to Western Science
- Growth of techno-scientific institutions

Module 6**Lecture 7 hrs.****Science and Technology in a Post-Independent India**

- Science, Technology and Development discourse
- Shaping of the Science and Technology Policy
- Developments in the field of Science and Technology
- Science and technology in globalizing India
- Social implications of new technologies like the Information Technology and Biotechnology

Open Elective – I

OECS 608	Economic Policies in India	3L:0T:0P	3 Credits
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Detailed contents**Module 1****Lecture 10 hrs.**

Framework of Indian Economy: National Income - Trends and Structure of National Income, Demographic Features and Indicators of Economic Growth, Development Rural-Urban Migration and issues related to Urbanization, Poverty debate and Inequality, Nature, Policy and Implications, Unemployment-Nature, Central and State Government's policies, policy implications, Employment trends in Organized and Unorganized Sector

Module 2**Lecture 10 hrs.**

Development Strategies in India: Agricultural- Pricing, Marketing and Financing of Primary Sector, Economic Reforms- Rationale of Economic Reforms, Liberalization, Privatization and Globalization of the Economy, Changing structure of India's Foreign Trade, Role of Public Sector- Redefining the role of Public Sector, Government Policy towards Public Sector, problems associated with Privatization, issues regarding Deregulation-Disinvestment and future of Economic Reforms

Module 3**Lecture 10 hrs.**

The Economic Policy and Infrastructure Development: Energy and Transport, Social Infrastructure-

Education, Health and Gender related issues, Social Inclusion, Issues and policies in Financing Infrastructure Development, Indian Financial System- issues of Financial Inclusion, Financial Sector Reforms-review of Monetary Policy of R.B.I. Capital Market in India.

Module 4

Lecture 10 hrs.

The Economic Policy and Industrial Sector: Industrial Sector in Pre-reforms period, Growth and Pattern of Industrialization, Industrial Sector in Post-reform period- growth and pattern of Micro, Small, Medium Enterprises s, problems of India's Industrial Exports, Labor Market- issues in Labor Market Reforms and approaches to Employment Generation.

Text Books

1. Dhingra, Ishwar C. [2006], 'Indian Economy,' Sultan Chand and Sons, New Delhi.
2. Datt, Ruddar and Sundaram, K.P.M. [Latest edition] , 'Indian Economy,' S. Chand and Co, New Delhi.

Reference Books

1. Brahmananda, P.R. and V.A. Panchmukhi. [2001], Ed. 'Development Experience in Indian Economy, Inter-state Perspective,' Bookwell, New Delhi.
2. Gupta, S.P. [1989], 'Planning and Development in India: A Critique,' Allied Publishers Private Limited, New Delhi.
3. Bhagwati, Jagdish. [2004], 'In Defense of Globalization,' Oxford University Press, U.K.

Open Elective – I

	Cyber Law and Ethics	3L:0T: 0P	3 credits
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Objectives of the course:

1. Discuss the structure of the legal system and how it enforces laws governing the Internet.
2. Evaluate the ethical responsibilities of Internet users, service providers, and content providers.
3. Examine the constitutional considerations concerning free speech and content controls in Cyber Space.
4. Investigate a security breach and the legally required responses to a breach.

Detail contents

Module 1

Lecture 8 hrs.

Introduction: Computers and its Impact in Society, Overview of Computer and Web Technology, the Internet and online resources, Security of information, Introduction to ethical theory and its application to the Internet, Definition of Cyber Security. Search Engines, E – mails and WWW, E – commerce & M – commerce System Security, Government Regulation of the Internet.

Module 2

Lecture 10 hrs.

Cyber Crimes & Legal Framework: Distinction between Cyber Crime and Conventional Crime, Cyber Criminals and their Objectives, Kinds of Cyber Crime: Hacking, Digital Forgery, Cyber Stalking/Harassment, Identity Theft &

Fraud, Cyber terrorism, Cyber Defamation, Computer Vandalism etc. Cyber Crimes against Individuals, Institution and State, Issues in Data and Software Privacy, Cyber Forensics.

Module 3 **Lecture 12 hrs.**

Introduction to Indian Cyber Law: Overview of General Laws and Procedures in India, Different offences under IT Act, Overview of Information Technology Act, 2000 and Information Technology (Amendment) Act, 2008. National Cyber Security Policy 2013, Offences in Cyber Space under the Indian Penal Code, 1860, Intellectual Property Issues in Cyber Space, Interface with Copyright Law, Interface with Patent Law, Trademarks & Domain Names Related issues.

Module 4 **Lecture 10 hrs.**

Constitutional & Human Rights Issues in Cyberspace: Freedom of Speech and Expression in Cyberspace, Right to Access Cyberspace, Access to Internet, Right to Privacy, Right to Data Protection, Issues with cybercrime using social networking sites. Electronic Commerce, Digital Signatures - technical and legal issues. Electronic Contracts, Law relating to Hardware and Software Layout & Design.

Suggested reference books:

1. Jonathan Rosenoer, "Cyberlaw: the Law of the Internet" Springer-Verlag New York Inc.
2. Pavan Duggal, "Cyber Law - An exhaustive section wise Commentary on the Information Technology Act along with Rules, Regulations, Policies, Notifications etc.", Universal Law Publishing.
3. Deborah E. Bouchoux, "Intellectual Property: The Law Of Trademarks, Copyrights, Patents, And Trade Secrets", Cenage Learning.
4. M. K. Bhandari, "Law Relating to Intellectual Property Rights", Central Law Publications.
5. Vivek Sood, "Cyber Law Simplified", McGraw Hill Education. 6. Prashant Mali, "Cyber Law & Cyber Crimes Simplified", Cyber Infomedia.

Course outcomes

After the completion of course, students can able to demonstrate a critical understanding of the Cyber law and Cyber-crime with respect to IT Act.

Open Elective – I

	Digital Signal Processing	3L:0T:0P	3 Credits
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Detailed contents

Module 1 **Lecture 8 hrs.**

Introduction: Characterization and classification of signals, typical signal processing operations, Review of discrete-time signal and system analysis; Advantages and typical applications of DSP.

Module 2 **Lecture 8 hrs.**

Sampling and Quantization: Sampling and discrete-time processing of continuous time signals, Sampling of low-pass and band-pass signals; Uniform and non-uniform quantization, Lloyd-Max algorithm, Log-companding, A-law, μ -law; Adaptive quantization and prediction

Module 3

Lecture 8 hrs.

Orthogonal transforms: Properties and applications of DFT, implementing linear time invariant systems using DFT, circular convolution, linear convolution using DFT; Fast Fourier Transform, FFT algorithms: Decimation in time, decimation in frequency; Goertzel algorithm; Application of transform in speech, audio, image and video coding, Karhunen-Loeve Transform, DCT, JPEG and MPEG coding standards

Module 4

Lecture 8 hrs.

Digital Filter design techniques: IIR and FIR filters, filter design specifications; Design of digital IIR filters: Impulse invariant, and bilinear transformation techniques for Butterworth and Chebyshev filters; Design of FIR filters: Windowing, frequency sampling filter design, optimum approximations of FIR filters

Module 5

Lecture 6 hrs.

Multi-rate Signal Processing: Fundamentals of multirate systems, Decimation and interpolation, application of Multirate DSP in sampling rate conversion; Filter banks; Polyphase structures; Quadrature-mirror filter bank; Wavelet transform and its relation to multi-rate filter banks; applications to speech and audio coding.

Module 6

Lecture 4 hrs.

Basic concept of Adaptive Digital Signal Processing: Adaptive Wiener filter and LMS algorithm; Applications of adaptive filtering to echo cancellation and equalization. **Text**

Books:

1. Digital Signal Processing-A Computer Based Approach, Mitra, S.K.,
2. Discrete Time Signal Processing, Oppenheim, A.V. and Schafer, R.W. with Buck, J.R
3. Digital Signal Processing: A Practical Approach, Iffachor, E.C. and Jervis, B.W

Reference Books:

1. Digital Signal Processing: Principles, Algorithm and Applications, Proakis, J.G. and Manolakis, D.G
2. Multirate Systems and Filter Banks, Vaidyanathan, P.P

Open Elective – I

	Real Time Systems	3L:0T:0P	3 Credits
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Detailed contents

Module 1

Lecture 10 hrs.

Introduction: Hard vs. Soft real time systems, A reference model of real time system. Real-time scheduling: Clock driven approach, Weighted Round-robin approach, Priority driven approach, Dynamic vs. static system, Effective Release Times and Deadlines, EDF and LST algorithm, Optimality and Non-Optimality of the EDF and LST algorithms, Off line vs. online Scheduling.

Module 2

Lecture 6 hrs.

Clock-Driven Scheduling: Static, Time-Driven scheduler, General structure of Cyclic Schedules, Cyclic Executives, Improving the Average Response Time Of Aperiodic Jobs, Scheduling Sporadic Jobs.

Module 3

Lecture 7 hrs.

Priority Driven Scheduling Of Periodic Tasks: Fixe-priority vs. Dynamic priority algorithms, Maximum Schedulable Utilization, Optimality of the RM and DM algorithms, A Schedulability test for fixed-priority tasks with short response times, Sufficient Schedulability conditions for the RM and DM algorithms.

Module 4

Lecture 6 hrs.

Scheduling Aperiodic and Sporadic Jobs in Priority-Driven Systems: Assumptions and Approaches, Deferrable Servers, Sporadic Servers, Constant Utilization, Total Bandwidth and Weighted Fair-Queueing Servers.

Module 5

Lecture 8 hrs.

Resources and Resource Access control: Resource contention, resource access control, Non-preemptive critical section, Basic Priority-Inheritance protocol, Basic Priority Ceiling Protocol, Stack based, Priority-ceiling protocol, preemption ceiling protocol.

Module 6

Lecture 5 hrs.

Multiprocessor scheduling, Resource Access Control, and Synchronization: Model of multiprocessor & distributed systems, task assignment, multiprocessor Priority-ceiling protocol, Elements of Scheduling Algorithms For End-to-End Periodic Tasks- IPS protocols, PM protocols, MPM protocol.

Suggested Books:

1. Real-Time system by Jane W. S. Liu, Pearson Education
2. Real-Time Systems by C. M. Krishna and K. G. Shin, McGraw Hill

Course Outcome:

After learning this subject, students will learn various types of Real Time Systems, Periodic and Aperiodic tasks, different types of scheduling algorithms in RTS(Clock Driven, Priority Driven), Priority Driven Scheduling Of Periodic Tasks, Priority Driven Scheduling of Aperiodic and Sporadic Jobs, Different protocols for resource access controls, Scheduling approach in multiprocessor Real Time Systems etc.

BSC 701	Biology for Engineers	2L:1T:0P	3 Credits
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Module 1: Introduction

Lecture: 2 hrs.

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

Lecture: 3 hrs.

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, lithotrophs (d) Ammonia excretion – aminotelic, uricotelic, ureotelic (e) Habitata- aquatic or terrestrial (f) 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. elegans, A. Thaliana, M. musculus.

Module 3: Genetics

Lecture: 4 hrs.

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

Lecture: 4 hrs.

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

Lecture: 4 hrs.

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

Lecture: 4 hrs.

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

Lecture: 5 hrs.

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

Lecture: 4 hrs.

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 exergonic reactions. Concept of ΔG and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to $\text{CO}_2 + \text{H}_2\text{O}$ (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

Lecture: 3 hrs.

Purpose: 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.

Suggested 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

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

1. Describe how biological observations of 18th 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.

Bihar Universities