Centurion University of Technology and Management Odisha

Choice Based Credit System

Course Structure & Syllabus

Biotechnology

School of Engineering & Technology

2022

Basket IV

Core Courses

Biotechnology

Course Code	Course Title	Credits	Type T+P+PJ	Prerequisite
CUTM2362	Fermentation Biotechnology	4	2-1-1	
CUTM1120	Microbial Biotechnology	5	3-1-1	
CUTM2368	Genetic Engineering	4	2-1-1	
CUTM2363	Plant Tissue Culture Engineering	4	3-1-0	
CUTM2364	Biosafety Engineering	3	2-0-1	
CUTM1124	Cell Biology	4	3-0-1	
CUTM1125	Molecular Biology	4	3-0-1	
CUTM1126	Biochemistry	4	3-0-1	
CUTM1127	Immunology	4	3-0-1	
CUTM2365	Animal Biotechnology	4	3-0-1	
CUTM2366	Cancer Biology	5	3-1-1	
CUTM2367	Introduction to Biotechnology	3	3-0-0	
CUTM1174	Bioanalytical Technique	4	2-1-1	
CUTM1058	Programming in Java/(Same as Java Technologies)	3	2-1-0	
CUTM1059	Database Management Systems	3	2-1-0	
	Total Credits	**58**		

Basket IV Core Course Syllabus

Fermentation Biotechnology

Code	Course Title	Credit	T-P-PJ	Prerequisite
CUTM2362	Fermentation Biotechnology	4	2-1-1	Biochemistry

Objective

- To study the design and construction of fermentor and parameters to be monitored and controlled in fermentation process
- To study the principle of sterilization necessary for fermentation
- To study the cell growth and product formation
- To evaluate the kinetics and mechanism of microbial growth

Course outcome

- This subject puts emphasis on the basic engineering principles of Fermentation Technology. It also highlights the application of fermentation in biotechnological industry.

Course content

Module I: Title (4 hrs) Introduction to fermentation

Introduction to fermentation; History and development of fermentation industry; General requirements of fermentation processes; Isolation, preservation and improvement of industrially important micro- organisms.

Module II: Title (4 hrs) Preparation of microorganisms (microbial cells) for fermentation.

Development of inoculate for industrial fermentations; Kinetics of microbial growth and death; Air and media sterilization

Module III: Title (4 hrs) Basic design of fermentor

Fermentor; Basic design and construction of fermentor and ancillaries; Different types of fermentations

Module IV: Title (4 hrs) Types of fermentation process

An overview of aerobic and anaerobic fermentation processes and their application in the biotechnology industry solid-substrate fermentation and its applications.

Module V: Title (4 hrs) Measurement of Parameters

Measurement and control of bioprocess parameters Analysis of batch, fed-batch and continuous bioreactions; Bioreactor configuration - batch, continuous stirred-tank, tubular, plug flow, packed bed, air lift, fluidized bed

Module VI: Title (5 hrs) Bioreactors and types

General considerations in the design of a bioreactor; Specialized bioreactors; Pulsed, fluidize photobioreactors. Biological system parameters; Processes involving microbial flocs; Bioreactors containing microbial films; Basic concept of scale-up of bioreactors.

Module VII: Title (5 hrs) Microbial Bioreactors

Stability of microbial reactors; Mixed microbial populations; Bioreactor design and optimum operations – Mixing characteristics; Residence time distribution, Concentration distribution and Temperature distribution; Biological system parameters.

Practice

1. Fermentor and its use
2. Preparation of fermented product
3. Batch culture of microbes
4. Continuous culture

Text Books:

1.Murray Moo -Young , Comprehensive Biotechnology, Vol. 1 & III-latest ed.
2.Microbes & Fermentation, A. Lel and Kotlers Richard J. Mickey, Oriffin Publication
3.Industrial Fermentations- Leland, N. Y. Chemical Publishers.
4. Prescott and Dunn's- Industrial Microbiology, 4 th, ed.

Note: 1 credit theory=10 hrs lecture, 1 credit practice/project=12.5 hrs lab/workshop/field work in a semester

Microbial Biotechnology

Code	Course Title	Credit	T-P-PJ	Prerequisite
CUTM1120	Microbial Biotechnology	5	3-1-1	Cell biology

Objective

- To highlight the roles and characteristics of microorganisms in field of Biotechnology
- To impart knowledge on the basic concept of multiplication in microorganism
- To study in detail the growth, genetic organization of microorganisms and impact of environment on their growth
- To evaluate explicitly, the metabolic pathways, role of microbes in public health; insight into the physical and chemical control of microorganisms.

Course outcome

- To impart knowledge on types of microorganisms used in the field of Biotechnology for product development.

Course content

Module I: Title (4 hrs): Introduction to microbial World

Microbial World; Microscope and its types, Phase contrast microscope, Electron microscope, SEM, TEM, STEM; Microscopic examination of microorganisms.

Module II: Title (5 hrs): Classification of microbes

Classification and Identification of microorganisms; Bacteria, morphology and fine structure of bacteria, cultivation of bacteria, reproduction & growth, pure cultures and cultural characteristics.

Module III: Title (4 hrs): Importance of virus in our environment

General characteristics-Morphology and structure of Virus, Classification- isolation and identification-fatal diseases associated with viruses in animals.

Module IV: Title (5 hrs): Genetic organization of other microbes and importance

Algae, Fungi, molds and Protozoa – importance, characteristics, morphology, reproduction, physiology cultivation & their association with other organisms. Genome organization of bacteria, virus, algae and fungi,

Module V: Title (4 hrs): Classification of microbes using genome mapping

DNA and RNA present as genetic material in microbes. Types and division of microbes according to their genetic organization. Classification of microbes according to genotyping.

Module VI: Title (4 hrs): Metabolism in microbes

Enzymes and their regulation, Microbial metabolism energy production, utilization of energy & biosynthesis, bacterial genetics.

Module VII: Title (4 hrs): Application of microbes in Biotechnology

Application of microbes in fuel industry; Agriculture, aquatic microbiology; Study of domestic water and waste water.

Practice:

1. Microscope and its use
2. Isolation of bacteria
3. Isolation and Identification of algae, fungi and Protozoa
4. Antibiotic Assay - Antimicrobial Sensitivity Test (Disc Diffusion Method)
5. Growth Kinetics (Bacterial Growth Curve)

Text Books:

1. *R.K. Sahoo: Introduction to Microbiology, Year 2020, Kindle publication, Amazon, 1st Edition*
2. *B. Ray, A. Bhunia: Fundamental food microbiology, CRC press, 5th Edition.*

Reference Books:

1. *Michael Pelczar JR, E.C.S. Chan, Noel R. Krieg:Microbiology, Mc Graw Hill, 6th Edition.*
2. *Foster WM, Food Microbiology, CBS publishers, 2018 Edition*

Note: 1 credit theory=10 hrs lecture, 1 credit practice/project=12.5 hrs lab/workshop/field work in a semester

Genetic Engineering

Code	Course Title	Credit	T-P-PJ	Prerequisite
CUTM2368	Genetic Engineering	4	2-1-1	Molecular biology

Objective

- To strengthen the knowledge on various cloning and expression vectors
- To impart the importance of vectors in genetic engineering experiments
- To strengthen the knowledge on various Strategies of gene cloning

Course outcome

- Understand and explain the concept of the course of genetic engineering including the techniques, applications and limitations.
- Demonstrate the ability to design recombinant molecules and apply information extracted from various sources to solve the problems.

Course content

Module I:Introduction to Cloning (4hrs)

Overview of Cloning, Purification and Separation of Nucleic Acids – cutting and joining DNA and vectors. Plasmid vectors, phage vectors,cosmids .

Module II: **Genetic manipulation (4hrs)**

Manipulation of DNA–Restriction and Modification enzymes, Design of linkers and adaptors.

Module III: Cloning Vectors and their application (4hrs)

Characteristics of cloning and expression vectors based on plasmid and bacteriophage, Vectors for yeast, insect and mammalian systems, Prokaryotic and eukaryotic expression host systems,

Module IV: DNA sequencing (5hrs)

Maxxam-Gilbert- Sanger methods. Automated DNA sequencing. PCR technology - concept- types- primer design- analysis of products and applications. DNA-finger printing, SYBR green assay, Taqman assay, Molecular beacons.

Module V: cDNA arrays and Micro array technology (4 hrs)

Strategies for the production of recombinant proteins - insulin- human growth hormone- industrially important proteins. Construction of genomic library- cDNA library

Module VI: Analysis and manipulation of Gene expression(4hrs)

Analysis of gene expression, analyzing transcription and translation, Analysis of gene function, site Directed Mutagenesis,Transposon Mutagenesis

Module VII: Cloning Application(5hrs)

applications – vaccines – human and genetic diseases – transgenics, Small double stranded RNAs; siRNA technology; Micro RNA; Construction of siRNA vectors; Principle and application of gene silencing.

Practice(Credit 1) (any five)

1. Restriction enzyme digestion of plasmid DNA or lambda DNA

2. Gel purification of RE digested DNA

3. Ligation of DNA fragments with cloning vector pUC18 or pBR322.

3. Preparation of competent cells and Transformation into E.coli with recombinant vector.

4. Isolation of recombinants and confirmation of insert DNA in vector.

5. Primer design for PCR and amplification of DNA by PCR.

6. Southern Hybridisation (Demonstration only)

Text Books:

1. S.B. Primrose, R.M. Twyman and R.W.Old; Principles of Gene Manipulation. 6th Edition, S.B.University Press,
2. J. Sambrook and D.W. Russel; Molecular Cloning: A Laboratory Manual, Vols 1-3, CSHL,

Reference Books:

1. Brown T. A. Gene Cloning, Blackwell Science Publishers.
2. Ernst L and Winnacker. Genes to Clones, Panima Publishing House, New Delhi.

Note: 1 credit theory=10 hrs lecture, 1 credit practice/project=12.5 hrs lab/workshop/field work in a semester

Plant Tissue Culture Engineering

Code	Course Title	Credit	T-P-PJ	Prerequisite
CUTM 2363	Plant Tissue Culture Engineering	4	3-1-0	Cell Biology

Objective

- To understand a procedure that is often used to propagate many plants of the same genetic background.
- To make the students understand the concept of this techniques and its application

Course outcome

- To grasp the information of transgenic plants in addition to industrial and agricultural applications of plant biotechnology.

Course content

Module I: Plant genomes and plant tissue culture (4hrs)

Introduction-gene structure and genome size and organization, Brief history of plant tissue culture, Scope of plant tissue culture,Laboratory instructions and maintenance of sterilization, composition of media, nutrient and hormone requirement, mode of action of auxin and cytokinin. Plant tissue culture plasticity and totipotency

Module II: Types of tissue culture(4hrs)

Criteria of cell selection, factor affecting the culture of cells. Cell, Callus & Suspension cultures. Somatic Embryogenesis and Hybridization.Haploid Production through Anther and ovule culture; Embryo culture.

Module III: Invitro mutagenesis and germplasm Conservation(4hrs)

Somaclonal variation; In vitro mutation methods; Micropropagation somatic hybrid and cybrid,Plant regeneration. Germ plasm conservation, production of secondary metabolites; Sources of plant secondary metabolite

Module IV: Biotransformation(5hrs)

Gene constructs, Vectors for the production of transgenic plants, Introduction- Agrobacterium mediated gene transfer –Ti-plasmid-process of T-DNA transfer and integration, transformation in plant, Direct and indirect gene transfer methods. Binary vectors- basic features of vectors-optimization-clean gene technology.

Module V: Transgenic Plants (5hrs)

Herbicide and Pest resistance,Herbicide resistance-use of herbicide in modern agriculture strategies for engineering herbicideResistance environment impact, pest resistance-nature and scale of insect / pest damage to crop. GM strategies-Bt approach to insect resistance-copy nature strategy-insect resistant crops and food safety.

Module VI: Molecular farming (4hrs)

Introduction –carbohydrates and lipid production, molecular farming of proteins, economic considerations for molecular farming.GM crops- current status concerns about GM crops-regulations on GM crops and products, Greener genetic engineering.

Module VII: Plant molecular biology(4Hrs)

Genome organization in prokaryotes and eukaryotes. Transcription and post-transcriptional regulation. Translation and post-translational process. Molecular basis of mutations.

Practice (Any 5)

1.Laboratory setup and instrumentation
2.Sterilization Technique
3.Media preparations: MS media,and rooting media
4.Explant preparation, inoculation and initiation of tissue culture
5.Callus formation, multiplication and organogenesis
6.suspension culture
7.Meristem Culture
8.Culture types
a.Anther Culture
b. Ovary culture

Text Books:

3. Bhojwani,Sant Saran,Dantu,Prem Kumar, Plant tissue culture: An introductory text,Springer publication,3rd Edition

4. Slater.A., Nigel W.S,Flower. R.Mark , Plant Biotechnology: The Genetic Manipulation of Plants, 2009, Oxford Univesity Press.

Reference Books:

3. H.S Chawla,Introduction to Plant Biotechnology oxford and ibh publishing,third edition
4. Robert H.Smith,Plant tissue culture techniques and experiments,third edition,Aademic Press

Note: 1 credit theory=10 hrs lecture, 1 credit practice/project=12.5 hrs lab/workshop/field work in a semester

Biosafety Engineering

Code	Course Title	(Credit)	T-P-PJ
CUTM2364	Biosafety Engineering	3	2-0-1

Objective

- To introduce the biosafety regulations and ethical concepts in biotechnology
- To emphasize on IPR issues and need for knowledge in patents in biotechnology

Course outcome

- Interpret basics of biosafety and bioethics and its impact on all the biological sciences and the quality of human life
- recognize importance of biosafety practices and guidelines in research
- comprehend benefits of GM technology and related issues
- 4. recognize importance of protection of new knowledge and innovations and its role in business

Course content

Module I: Introduction to Intellectual Property (6hrs)

Historical perspectives and need for the introduction of Intellectual Property RightTypes of IP: Patents, Trademarks, Copyright & RelatedRights, Industrial Design, Traditional Knowledge, Geographical Indications, Protection of GMOs IP as a factor in R&D;

Module II: Agreements and Treaties (5hrs)

History of GATT & TRIPS Agreement; Madrid Agreement; Hague Agreement; WIPO Treaties; Budapest Treaty; PCT; Indian Patent Act 1970 & recent amendments

Module III: Basics of Patents (6hrs)

Fundamentals of patents, copyrights, geographical indications, Types of patent applications: Ordinary, PCT, Conventional, Divisional and Patent of Addition; Specifications:Provisional and complete; designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection.

Module IV: Patent filing procedures (6hrs)

National & PCT filing procedure; Time frame and cost; Status of the patent applications filed; Precautions while patenting–disclosure/non-disclosure; financial assistance for patenting-introduction to existing schemes, Patent licensing and agreement Patent infringement- meaning, scope, litigation

Module V Biosafety(6hrs)

Introduction; Historical Backround; Introduction to Biological Safety Cabinets; Primary Containment for Biohazards; Biosafety Levels; Biosafety Levels of Specific Microorganisms; Recommended Biosafety Levels for Infectious Agents and Infected Animals;

Module VI :Biosafety guideline(6hrs)

Government of India; Definition of GMOs & LMOs; Roles of Institutional Biosafety Committee, RCGM, GEAC etc. for GMO applications in food and agriculture; Environmental release of GMOs; Risk Analysis; Risk Assessment; Risk management and communication; Overview of National Regulations and relevant International Agreements including; Cartegana Protocol.

Module VII:Bioethics(5hrs)

Ethical implications of biotechnological products and techniques. Social and ethical implications of biological weapons.

Practice(credit 1)(Any 5)

1.Assessment of risk during laboratory research
2.Risk Assessment of Biotechnology Products
3.Biosafety During Industrial Production
4.Protection of Biotechnological Inventions
5.Planned Introduction of GMOs
6.Patenting of Genes and DNA sequences

Text Books:

1. Deepa GoelShomini Parashar,IPR, Biosafety and Bioethics,Pearson Education India
2. Kankanala C., Genetic Patent Law & Strategy, 1st Edition, Manupatra Information Solution Pvt. Ltd

Reference Books:

1. H.S Chawla,Introduction to Plant Biotechnology oxford and ibh publishing,third edition

2 Neeraj Pandey and Khushdeep Dharni ,"Intellectual Property Rights" ; 1 edition PHI Learning

Note: 1 credit theory=10 hrs lecture, 1 credit practice/project=12.5 hrs lab/workshop/field work in a semester

Cell Biology

Code	Course Title	(Credit)	T-P-PJ
CUTM 1124	Cell Biology	4	3-0-1

Objective

- To study cell structure and functions of organelle functions
- Exposure on transportations through cell membrane
- To focus on different receptors and model of signaling
- To introduce the concept of cell signaling

Course outcome

- The course is aimed to make the student understand the basic concept of cell structure, membrane, cellular functions of different types of cell, modes of cellular signaling and signal amplification

Course content

Module I: 1. Structural organization of cell (4hrs)

An Overview of Cells:History, Cell theory, Structure and Function of Cell and its Organelles: Biological membranes – architecture, Cell types: prokaryotes vs. eukaryotes; from single cell to multi-cellular organism; Different molecules of cell- water, salt and mineral ions etc.

Module II: Cell Organalles(5hrs)

Nucleus - Nuclear envelope, transport across nuclear membrane, Nucleolus, Mitochondria, Chloroplasts, Lysosomes, Gloxysomes and Peroxisomes**,** endoplasmic reticulum, ribosomes, Golgi complex (Structural organization, function, marker enzymes of the above organelles),

Module III: Cell division-molecular approach(5hrs)

Cell cycle and its regulation, Cellular communication and cell mobility: Cell cycle: G0/G1, S, G2 and M phages (Cell Division: Mitosis, meiosis and cytokinesis); regulation of cell cycle;

Module IV: Cell Junction (4Hrs)

Cell adhesion and roles of different adhesion molecules, gap junctions, Extra- Cellular Matrix (ECM), Cell-cell interaction and cell- ECM interaction, The cytoskeleton, Microtubule- based movement and microfilament -based movement

Module V :Cell signalling (5hrs)

Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors (G-PCR), Tyrosine Kinase, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two-component systems, bacterial chemotaxis,

Module VI : Programmed Cell Death (4hrs)

Programmed Cell Death (Apoptosis),Intrinsic and Extrinsic apoptotic pathway, Caspase enzyme,

Module VII: Basics Oncology(4hrs)

Biology and elementary knowledge of development and causes of cancer; Tumor viruses, Oncogenes and tumor suppressor genes,

Text Books:

1. Geoffrey M.Cooper, The Cell: A molecular approach, Sixth edition.
2. Watson et al., Molecular Biology of the gene, 5th Edition, Pearson Prentice Hall. USA

Reference Books:

1.B. M. Turner, Chromatin & Gene regulation, 1st Edition, Wiley- Blackwell,
2.Benjamin Lewin, Gene IX, 9thEdition, Jones and Barlett Publishers,

Note: 1 credit theory=10 hrs lecture, 1 credit practice/project=12.5 hrs lab/workshop/field work in a semester

Molecular Biology

Code	Course Title	Credit	T-P-PJ
CUTM1125	Molecular Biology	4	3-0-1

Objective

•To provide depth knowledge of biological or medicinal processes through the investigation of the underlying molecular mechanisms.
• Understanding of chemical and molecular processes that occur in and between cells.
•Understanding will become such that , can be able to describe and explain processes and their meaning for the characteristics of living organisms.

Course outcome

•To gain complete knowledge of the physiological activity of the cells in molecular level

Course content

Module I: Introduction to molecular biology (4hrs)

Introduction to molecular biology, Evolution and Molecular structure of cell and its organelles.Types of cells. Including different kinds of Prokaryotic and eukaryotic cells.

Module II: Molecular Biology Of cell (4hrs)

Cell growth, Cell adhesion, cell junctions and extra cellular matrix organelles, Cell cycle, Cell membrane and its structure (fluid-mosaic model). Factors influencing on membrane fluidity, asymmetry of membrane and membrane transport (active and passive)

Module III: Molecular Nature of the Genetic Material (4hrs)

Molecular Nature of the Genetic Material in Prokaryotic and Eukaryotic Cells:Molecular biology of Genes, DNA: Molecular structure, types: Primary, secondary and tertiary, Double helix, types, Transferring information from DNA to RNA,Synthesis of RNA, TranslationRNA: Molecular structure, types. Evolution of DNA and RNA, Gene and genetic codes

Module IV: Regulation of the Gene Expression (4hrs)

General Concept on Regulation of the Gene Expression,Regulating the Metabolism:The Lac- Operon system, Catabolic repression, Trp Operon system: regulating the biosynthesisof the tryptophan, Gene expression in Eukaryotic cells, Plasmids: types, maintenance and functions

Module V: DNA Replication and Gene Expression (5hrs)

DNA Replication and Gene Expression: DNA Replication: Semi conservative Nature of DNA Replication,DNA Replication in prokaryotic Cells,DNA Replication in Eukaryotic cell, Enzymes involved in DNA Replication: DNA polymerases,Proofreading, post-replication Modification of DNA.

Module VI: Transcription(5hrs)

Transferring information from DNA to RNA,Synthesis of RNA(Transcription), RNA polymerase, Initiation and Termination of Transcription, Post and co- transcription modification of the RNA

Module VII : Translation (4hrs)

Protein Biosynthesis**:** Translation of the genetic code,Translation of m RNA,Role of r-RNA in protein synthesis, Forming the polypeptides- elongation,Termination of the protein biosynthesis.

Practice:

- In vitro DNA replication process principle with procedure and requirement
- DNA amplification by PCR technique
- Building blocks of protein with structure
- Quantitative analysis of protein by different methods

All the practice components can be performed by simulation as well as virtual labs.

Online Source: Udemy, Coursera, article library, NCBI,Study.com, You tube, Frontier, Febs, unacademy,academia and Amrita Vlab etc.

Suggested Readings:

1. Molecular Biology of the gene(7th Ed) by James D. Watson.
   E-booklink-https://www.pdfdrive.com/molecular-biology-of-the-gene-e158278674.html
2. Genes XII by Lewin's.
   E-book link- https://www.pdfdrive.com/lewins-genes-xii-e168024578.html
3. Molecular cell biology (5th Ed) by Lodish H.
   E-booklink-https://www.pdfdrive.com/molecular-cell-biology-lodish-5th-ed-e15674865.html

Note: 1 credit theory=10 hrs lecture, 1 credit practice/project=12.5 hrs lab/workshop/field work in a semester

Biochemistry

Code	Course Title	Credit	T-P-PJ
CUTM1126	Biochemistry	4	3-0-1

Objective

- To understand the concept of metabolism of carbohydrates
- To understand the significance of amino acids, proteins
- Use of enzymes in enhancing metabolic reactions
- Role of lipids

Course outcome

- After completion of the course the student will be developed a very good understanding of various biomolecules which are required for development and functioning of cells.
- Would have understood the significance of carbohydrates in energy generation and as storage food molecules for cells.
- They would have understood the significance of proteins and enzymes in accelerating various metabolic activities.
- The conceptual understanding of the subject provides opportunities for skill enhancement and scopes for higher education.

Course content

Module I: Structure of enzyme (4hrs)

Apoenzyme and cofactors, prosthetic group-TPP, coenzyme NAD, metal cofactors, Classification of enzymes.

Module II: Mechanism of action of enzymes(4hrs)

Active site, transition state complex and activation energy. Lock and key hypothesis, and Induced Fit hypothesis.Enzyme inhibition, enzyme kinetics.

Module III: Diagnostic value of serum enzymes (4hrs)

Creatinine kinase, Alkaline phosphatase, Acid phosphatase, LDH, SGOT, SGPT, Amylase, Lipase, Carbonic anhydrase etc.

Module IV: Carbohydrates (4hrs)

Biomedical importance & properties of Carbohydrates, Classification,Families of monosaccharides: aldoses and ketoses, trioses, tetroses, pentoses, and hexoses. Stereo isomerism of monosaccharides, epimers, Haworth projection formulae for glucose; chair and boat forms of glucose.

Module V: Metabolism (5 hrs)

Glycogenesis & glycogenolysis, Glycolysis, citric acid cycle & its significance, Components of respiratory chain, energy relationships during cell respiration, types of respiration. HMP shunt & Gluconeogenesis, regulation of blood glucose level.

Module VI: Amino acids (5 hrs)

Classification, essential & non-essential amino acids. Chemistry of Proteins & their related metabolism, Classification, biomedical importance. Metabolism: Ammonia formation & transport, Transamination, Decarboxylation, Urea cycle, metabolic disorders in urea cycle, catabolism of amino acids.

Module VII: Chemistry of Lipids & their related metabolism (4 hrs)

Classification, biomedical importance, essential fatty acids. Brief out line of metabolism: Beta oxidation of fatty acids, fatty liver, Ketogenesis, Cholesterol & it's clinical significance, Lipoproteins in the blood composition & their functions in brief, Atherosclerosis.Diabetes mellitus: its types, features, gestation diabetes mellitus, glucose tolerance test, glycosuria, Hypoglycaemia& its causes.

Practice:

- Study of enzyme kinetics;
- Study effect of temperature, pH and Heavy metals on enzyme activity
- Qualitative/Quantitative tests for carbohydrates, reducing sugars, non-reducing sugars
- Practice: Qualitative/Quantitative tests for proteins

All the practice components can be performedby simulation as well as virtual labs.

Amrita Vlab (https://www.youtube.com/channel/UC1ouqR_dIY_WPDPSZo0e8Wg**).**

*Online Source:*Labs for life, Coursera, article library, NCBI,Study.com, You tube, Frontier, Febs, unacademy, academia

Suggested Readings:

1. Victor W. Rodwell, David A. Bender, Kathleen M. Botham, Peter J. Kennelly, P. Anthony Weil (2018) Harper's Illustrated Biochemistry. Mc Graw Hill.
   (e-Book link: https://www.pdfdrive.com/harpers-illustrated-biochemistry-d176838999.html)
2. Nelson DL and Cox MM. (2008). Lehninger Principles of Biochemistry, 5th Ed., W.H. Freeman and Company.
   (e-Book link: https://www.pdfdrive.com/lehninger-principles-of-biochemistry-5th-edition-d164892141.html)
3. Donald Voet, Judith G. Voet (2011) Biochemistry 4th Edition. Wiley Publishers.
   (e-Book link: https://www.pdfdrive.com/biochemistry-4th-edition-e165192126.html)
4. Jeremy M. Berg, John L. Tymoczko, LubertStryer. Biochemistry 7th Edition. W.H. Freeman and Company, New York.

(e-Book link: https://www.pdfdrive.com/biochemistry-seventh-edition-e167675390.html)

Note: 1 credit theory=10 hrs lecture, 1 credit practice/project=12.5 hrs lab/workshop/field work in a semester

Immunology

Code	Course Title	Credit	T-P-PJ
CUTM1127	Immunology	4	3-0-1

Objective

- Clinically relevant serological analysis for deeper understanding of antigen-antibody interaction.
- Understanding the concept of Innate & adaptive immune system; complement system; Hypersensitivity.

Course outcome

- Application of Immunology in disease diagnosis.
- Complement system followed by the body on encountering an Antigen.
- Immune Response produced on encounter with foreign body.

Course content

Module I: Title (hrs): Overview of the immune system

Immunity: Classification, Measurement of immunity, Local immunity, Herd immunity.

Module II: Title (hrs) Immunoglobulin structure and functions

Antigens: Types of antigen, Antigenic Determinant or Epitope, Tolerogens, Biological Classes of antigens, Superantigens.Immunoglobulins: Antibody structure, Immunoglobulin classes, Antigenic Determinants on Immunoglobulins.

Module III: Title (hrs) Antigen-Antibody interaction

Principal pathways of Complement activation, Quantitation of Complement (C) and its Components. Biosynthesis of complement, Complement Deficiencies.Antigen-Antibody Reactions, Antigen-Antibody measurement. Serological Reactions and their parameters.

Module IV: Title (hrs) Types of Immune response

Immune Response: Types of Immune response, Humoral immunity, Production of Antibodies, Cell-mediated Immune Responses.

Module V: Title (hrs) Immune system in health and disease

Cytokines. Immunological tolerance.Hypersensitivity Reactions

Module VI: Title (hrs) Classification of hypersensitivity reactions

Classification of hypersensitivity reactions, Type I Hypersensitivity (IgE Dependent), Type II Hypersensitivity (Cytolytic and Cytotoxic), Type III Hypersensitivity (Immune Complex-mediated), Type IV Hypersensitivity (Delayed Hypersensitivity).

Module VII: Title (hrs) Vaccines

Vaccines, Types and their production

Immunology (Practice) (Credit-1)

1) Blood grouping.
2) Preparation of O and H antigen
3) Quantitative VIDAL test
4) ASO, C-Reactive Protein,
5) Rheumatoid factor (RF),
6) RoseWaalertest
7) ELISA- qualitative
8) Agglutination,
9) Precipitation,
10) Neutralization,
11) flocculation

Text Books:

1. N. Arumugam, Dulsy Fatima, Immunology, Saras Publication, First Edition

2. Sunil Kumar Mohanty, Textbook Of Immunology, Jaypee Brothers Medical Publishers 2nd Edition

Reference Books:

1. Kuby Immunology by Richard A. Golds by Tharmas J. kindt Sixth edition Barbara Osborne. W.H.freeman and company.

2. Fundamental Immunology 7th Edition by Paul, Wolters Kluwer | Lippincott Williams and Wilkins.

Note: 1 credit theory=10 hrs lecture, 1 credit practice/project=12.5 hrs lab/workshop/field work in a semester

Animal Biotechnology

Subject Name	Code	Type of course	T-P-Pr (Credit)	Prerequisite
Animal Biotechnology	CUTM2365	Theory-Practice-Project	3-0-1	Cell Biology

1. Objective

- To provide the fundamentals of animal cell culture, details of disease and therapy

2. Course outcome

- This course deals with animal cell culture, embryo transfer, recombinant vaccines, lactation and milk production

3. Evaluation Systems

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Midterm Test	*10*	Written examination
	Assignment	*10*	Report and Presentation
	Experiments		Lab work, report
	Project	*30*	Report and presentation
	Quiz		Surprise/preannounced ones
External Examination		*50*	Written examination
Total		*100*	

4. Course outline

Module I

Animal Cell Culture

Introduction to basic tissue culture techniques; chemically defined and serum free media; animal cell cultures, their maintenance and preservation; various types of cultures; suspension cultures, continuous flow cultures, immobilized cultures;

Module II

Somatic cell fusion

Somatic cell fusion; cell cultures as a source of valuable products

Module III

Organ cultures

Information about organs; culture techniques and preservations

Module IV

Animal diseases and their Diagnosis

Bacterial and viral diseases in animals; monoclonal antibodies and their use in diagnosis; molecular diagnostic techniques like PCR, in-situ hybridization; northern and southern blotting; RFLP.

Module V

Therapy of Animal Diseases

Recombinant cytokines and their use in the treatment of animal infections; monoclonal antibodies in therapy; vaccines and their application in animal infections; gene therapy for animal diseases.

Module VI

Micromanipulation of Embryo's

What is micromanipulation technology; equipment's used in micromanipulation; enrichment of x and y bearing sperms from semen samples of animals; artificial insemination and germ cell manipulation; invitro fertilization and embryo transfer; micromanipulation technology and breeding of farm animals.

Module VII

Transgenic Animals

Concepts of transgenic animal technology;strategies for the production of transgenic animals and their importance in biotechnology; stem cell cultures in the production of transgenic animals

5. Reference

Text Books:

1. Animal biotechnology by P.Ramadas
2. Embryonic stem cells by Kursad and Turksen. 2002. Humana Press.

Reference Books

1. Louis-Marie Houdebine, Transgenic animals: Generation and Use 7th Edition, CRC Press.

Cancer Biology

Subject Name	Code	Type of course	T-P-Pr (Credit)	Prerequisite
Cancer Biology	CUTM2366	Theory & Practice	3-1-1	Biochemistry

1. Objective

- To impart basic concepts of cancer biology, various stages in carcinogenesis, molecular cell biology of cancer, cancer metastasis, and cancer therapy.

2. Course outcome

- To provide knowledge about biological aspects of cancer

3. Evaluation Systems

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Midterm Test	*10*	Written examination
	Assignment	*10*	Report and Presentation
	Experiments	*30*	Lab work, report
	Project		Report and presentation
	Quiz		Surprise/preannounced ones
External Examination		*50*	Written examination
Total		*100*	

4. Course outline

Module I: Cancer Cell Biology

Introduction to Cancer --Cell cycle—pRb--Tumor suppressor genes--Knudson's two-hit hypothesis--p53--Myconcoprotein--TGF-b --Cell cycle and cancer-- Different forms of cancer--Diet and Cancer

Module II: Carcinogenesis

Stages of Carcinogenesis-Environment, Genetics, and Cancer—Causes of cancer—Classes and Types of Carcinogens—Ecogenetics and Cancer risk— Carcinogen Metabolism—Epigenetics--DNA repair, pathways, and Human Cancer

Module III: Signal Transduction: Cell Division, Differentiation, And Apoptosis Signal Transduc
signaling— Apoptosis—Cancer stem cells

ModuleIV:MetastasisandAngiogenesis

Tumor microenvironment in cancer progression—Invasion and Metastasis-Stages in metastasis and the factors involved in the invasive process—Angiogenesis- VEGF signalling

Module V: Cancer Therapy, Prevention and Diagnosis
Current modalities of treatment-Radiation therapy-Surgery-Chemotherapy- Classification of properties of chemotherapeutic drugs—Biological therapy-Cancer prevention and early detection
-Imaging and cancer

Cancer Biology Practice:

1. Tumor cell isolation using MACS
2. Tumor cell growth in different media.
3. Tumor cell growth with different proteins
4. Tumor cell regression using plan extract.
5. Morphological analysis of different cancer cell lines.

5. Reference

Text Books:

1. Robert A. Weinberg, “The Biology of Cancer,” Garland Science; 1 Cdr Edition, 2010.

Reference Books:

1. Lauren Pecorino, “Molecular Biology of cancer: Mechanisms, Targets, and Terapeutics,” Oxford University Press. 3rd edition, 2012.

Introduction to Biotechnology

Subject Name	Code	Type of course	T-P-Pr (Credit)	Prerequisite
Introduction to Biotechnology	CUTM2367	Theory & Practice	3-0-0	NIL

1. Objective

- To introduce student’s basic knowledge about Biotechnology

2. Course outcome

- To impart a sound knowledge on the principles of Biotechnology involving the different application oriented topics required for all engineering branches

3. Evaluation Systems

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Midterm Test	*20*	Written examination
	Assignment	*20*	Report and Presentation
	Experiments		Lab work, report
	Project		Report and presentation
	Quiz		Surprise/preannounced ones
External Examination		*60*	Written examination
Total		*100*	

4. Course outline

Module I: Biochemistry

Component of the cell, structure and biochemical functions

Module II: Biomolecules

Carbohydrates, Lipids, Proteins, Nucleic acids, Structure and classification of enzymes.

Module III: Cell Biology

Eukaryotic and Prokaryotic cells, Cell cycle-Mitosis and Meiosis, Cell fractionation and flow cytometry

Module IV: Introduction to nucleic acids

Nucleic acids as genetic material, structure and physiochemical properties of elements in DNA and RNA, Biological significance of differences in DNA and RNA

Module V: Immunology

Cells of immune system, Development, maturation, activation and differentiation of T cells and B cells, Phagocytosis process

Module VI: Introduction to cloning

Overview of cloning, Purification and separation of Nucleic acids-cutting and joining DNA and vectors, analysis of gene expression, applications.

ModuleVII: Biotechnology Application

Industrial production, Drug Discovery and development, GMO, Bioremediation.

List of Experiments:

1. pH measurements and preparation of buffers.
2. Microscopic study of cell and cell organelles
3. Blood grouping
4. DNA and RNA isolation
5. Restriction enzyme digestion of plasmid DNA

Reference:

Text books:

1. Lehninger A.L., Nelson D.L. and M.M. Principles of Biochemistry.CBS publishers and distributers.

2. Murray R.K., Granner D.K., Mayes P.A and Rodwell V.W.Harpers Biochemistry. Appleton and Lange, Stanford, Conneticut.

Reference Books:

1. Lodish,Harvey *et al*., "Molecular Cell Biology", 6th Edition.W.H Freeman,2008.

2. Alberts,Bruce, "Molecular Biology of Cell",5th Edition, Garland Science,2008.

3. Satyanarayana,U. "Biotechnology" Books & Allied(P) Ltd.,2005.

4. Friefelder, David. "Molecular Biology".Narosa Publications, 2004.

Programming in Java(Same as Java Technologies)

Code	Course Title	Credit	T-P-PJ
CUTM1058	Programming in Java(Same as Java Technologies)	3	2-1-0

Objective

- Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
- Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
- Be aware of the important topics and principles of software development
- Have the ability to write a computer program to solve specified problems
- Have the ability to write a computer program to solve specified problems
- Be able to use the Java SDK environment to create, debug and run simple Java programs

Course outcome

- Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs
- Read and make elementary modifications to Java programs that solve real-world problems
- Identify and fix defects the common safety issues in code
- Document a Java program using Javadoc
- Use a version control system to track source code in a project
- Qualify confidently any interview process where Java is the requirement

Course content

Module I: Introduction to Java (8 hrs)

Features and Installation, Java Programming Basics, Decision Making and Looping, Class and Object, Inheritance
Practice 1 (1 Hr)
Practice 2 (1 Hr)

Module II: Package and Safe Code (5 Hr)

Interfaces, Packages and Access Protection, Exception Handling (Fault Tolerant Programming)

Practice 3 (1 Hr)

Module III: Collection and Threads (5 Hr)

ArrayList, Vector, Set, Map, Multi-threaded Programming, Synchronization

Practice 4 (1 Hr)

Module IV: Language and Utility Packages (5 Hr)

String Handling, Wrappers, Runtime Memory Management, Cloning, Calendar, Date and Time

Facilities, Scanner, Internationalization

Practice 5 (1 Hr)

Practice 6 (1 Hr)

Module V: Input/ Output and Applets (5 Hr)

Byte and Character Stream I/O, Persistence, Applet: Architecture, Skeleton, and Implementation

Practice 7 (1 Hr)

Practice 8 (1 Hr)

Module VI: GUI Programming (5 Hr)

AWT: Container, Components, Layout Managers, Event Handling

Practice 9 (1 Hr)

Practice 10 (1 Hr)

Module VII: Networking and Advanced (5 Hr)

Networking Fundamental, Client-Server Communication, Remote Method Invocation (RMI), Java Virtual Machine (JVM) Tuning, Java Profiler

Practice 11 (1 Hr)

Practice 12 (1 Hr)

Text Book(s):

1. Java The Complete Reference, Fifth Edition, C25 Herbert Schildt, McGraw-Hills

Reference Book(s):

1. Murach's Java Programming, 5th Edition, Joel Murach, Mike Murach & Associates, 2011, ISBN-78-1-943872-07-7

2. Introduction to Java Programming, Comprehensive, 10th ed., Y. Daniel Liang, 2014. ISBN-10: 0133813460, ISBN-13: 9780133813463

https://nqr.gov.in/qualification-title?nid=3002
https://www.cdac.in/index.aspx?id=DAC&courseid=0#
https://canvas.harvard.edu/courses/63117/assignments/syllabus
https://canvas.harvard.edu/courses/69911/assignments/syllabus
https://xid.harvard.edu/xid-apps/submitAccountForm.do

YouTube Resources: freeCodeCamp.org
Codearchery
Edureka
free project
Jenkov

Online Source(s):

1. https://docs.oracle.com/javase/tutorial/java/index.html

2. https://www.programiz.com/java-programming

3. https://marcus-biel.com/

Software/Tool(s): Java 8, Eclipse IDE

Online Compiler: https://ideone.com/

Online Coding Practice: https://www.hackerrank.com/

List of Practices:

Practice 1 (Module-I)

Program-1:

Write a program that computes the standard deviation of a set of floating point numbers that the user enters. First the user says how many numbers N are to follow. Then the program asks for and reads in each floating point number. Finally it writes out the standard deviation. The standard deviation of a set of numbers Xi is:

SD = Math.sqrt(avgSquare - avg2)

Here, avg is the average of the N numbers, and avg2 is its square.

avgSquare is the average of Xi * Xi. In other words, this is the average of the squared value of each floating point number.

For example, if N = 4, say the numbers were:

Xi Xi * Xi

2.0 4.0

3.0 9.0

1.0 1.0

2.0 4.0

sum 8.0 18.0

Now:

avg = 8.0/4 = 2.0

avg2 = 4.0

avgSquare = 18.0/4 = 4.5

SD = Math.sqrt(4.5 - 4.0) = Math.sqrt(.5) = 0.7071067812

To do this you will need to do several things inside the loop body for each floating point value as it comes in: add it to a sum, square it and add it to a sum of squares. Then after the loop is finished apply the formula.

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

Practice 2 (Module-I)

Program-1:

Better encapsulation of the Goods class would call making instance variables private and using getter and setter methods to access them. A further refinement would be to make the class abstract and to define additional child classes. Here is a revised Goods class:

```
public abstract class GoodsSGA
{
private String description;
private double price;
private int quantity;
public GoodsSGA( String des, double pr, int quant )
{description = des;
```

price = pr;

quantity = quant;}

double getPrice()

{return price;}

void setPrice(double newPrice)

{price = newPrice;}

int getQuantity()

{return quantity;}

void setQuantity (int newQuantity)

{quantity = newQuantity;}

public String toString()

{return "item: " + description + " quantity: " + quantity + " price: " + price ;}

Revise the source code for the classes Food, Toy, and Book. (Perhaps call the revised classes FoodSG, ToySG, and BookSG.) create a new class ToiletrySG for things like bubble bath. Create a new testing class, StoreSG to test your revised classes.

Note: the child classes will need to use the getter and setter methods to access the instance variables that are declared as private in GoodsSG.

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

Practice 3 (Module-II)

Program-1:

User-Friendly Division Practice:

Put in a loop so that the user is repeatedly asked for the numerator and the divisor. For each set of data, the program prints out the result, or an informative error message if there is a problem (division by zero or poor input data).

The program continues looping, even if there is a problem Exit the loop when data entered for the numerator start with characters "q" or "Q". Don't print out an error message in this case.

Don't ask for the divisor if the user just asked to quit.

Here is sample output from one run:

Enter the numerator: 12

Enter the divisor: 4

12 / 4 is 3

Enter the numerator: 12

Enter the divisor : 0

You can't divide 12 by 0

Enter the numerator: glarch

You entered bad data.

Please try again.

Enter the numerator: quit

You will need to use the method charAt() from the String class.

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

Practice 4 (Module-III)

Program-1:

In mathematics, several operations are defined on sets. The union of two sets A and B is a set that contains all the elements that are in A together with all the elements that are in B. The intersection of A and B is the set that contains elements that are in both A and B. The difference of A and B is the set that contains all the elements of A except for those elements that are also in B.

Suppose that A and B are variables of type set in Java. The mathematical operations on A and B can be computed using methods from the Set interface. In particular:

A.addAll(B) computes the union of A and B; A.retainAll(B) computes the intersection of A and B; and A.removeAll(B) computes the difference of A and B. (These operations change the contents of the set A, while the mathematical operations create a new set without changing A, but that difference is not relevant

to this exercise.)

For this exercise, you should write a program that can be used as a “set calculator” for simple operations on sets of non-negative integers. (Negative integers are not allowed.) A set of such integers will be represented as a list of integers, separated by commas and, optionally, spaces and enclosed in square brackets. For example: [1,2,3] or [17, 42, 9, 53,108]. The characters +, *, and - will be used for the union, intersection, and difference operations. The user of the program will type in lines of input containing two sets, separated by an operator. The program should perform the operation and print the resulting set.

Here are some examples:

Input Output

---------- ----------

[1, 2, 3] + [3, 5, 7] [1, 2, 3, 5, 7]

[10,9,8,7] * [2,4,6,8] [8]

[5, 10, 15, 20] - [0, 10, 20] [5, 15]

To represent sets of non-negative integers, use sets of type TreeSet<Integer>. Read the user’s input, create two TreeSets, and use the appropriate TreeSet method to perform the requested operation on the two sets. Your program should be able to read and process any number of lines of input. If a line contains a syntax error, your program should not crash. It should report the error and move on to the next line of

input. (Note: To print out a Set, A, of Integers, you can just say System.out.println(A). We've chosen the syntax for sets to be the same as that used by the system for outputting a set.)

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

Practice 5 (Module-IV)

Program-1:

Password Checker:

Write a program that repeatedly asks the user for a proposed password until the user enters an acceptable password. When the user enters an acceptable password, the program writes a message and exits.

Acceptable passwords:

Are at least 7 characters long.

Contain both upper and lower case alphabetic characters. Contain at least 1 digit. The logic of this program can be quite tricky. Hint: use toUpperCase(), toLowerCase, and equals(). You will also need nested ifs.

Here is a run of the program:

Enter your password:

snowflake

That password is not acceptable.

Enter your password:

SnowFlake

That password is not acceptable.

Enter your password:

snowflake47

That password is not acceptable.

Enter your password:

Snowflake47

Acceptable password.

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

Practice 6 (Module-IV)

Program-1:

Secret Code:

A text message has been encoded by replacing each character of the message with an integer. Each integer is an index into a key-phrase that contains all the lower case letters of the alphabet as well as the space character. The key-phrase may contain the same character in several locations. The encoded text is series of integers, like this:

35 10 10 33 9 24 3 17 41 8 3 20 51 16 38 44 47 32 33 10 19 38 35 28 49

To decode the message, look up each integer in the key-phrase and output the corresponding character.

For example, say that the key-phrase is this (the index of each character has been written above it):

1111111111222222222233333333334444444444 55

0123456789012345678901234567890123456789012345678901

six perfect quality black jewels amazed the governor

using each integer from the encoded text as an index into the phrase results in the decoded message:

attack the bridge at dawn

Write a program that decodes a secret message contained in a text file. The first line of the text file contains the key-phrase. Then the file contains a sequence of integers, each of which indexes the key-phrase. Find the character corresponding to each integer and output the secret message. Note if a character character such as 'e' occurs several places in the key-phrase it may be encoded as different integers in different parts of the secret message.

(The recipient of the secret message gets only the file of integers and must put the key-phrase at the top of the file.) For example, here is the contents of a secret message file ready for the program:

six perfect quality black jewels amazed the governor

35 10 10 33 9 24 3 17 41 8 3 20 51 16 38 44 47 32 33 10 19 38 35 28 49

Here is a sample run of the program:

C:\> java Decode < secretFile.txt

attack the bridge at dawn

You will need the charAt() method of String.

Here is another secret message file, with key-phrase inserted, that you can use to test your program:

six perfect quality black jewels amazed the governor

31 16 2 3 4 42 48 7 27 9 10 43 12 13 35 15 1 40 18 3

20 15 33 23 24 32 26 29 28 27 21 31 25 14 34 14 36

42 38 19 40 41 27 3 44 50 46 42 48 49 50 6

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

Practice 7 (Module-V)

Program-1:

Stop Word Remover:

Write a program that reads in a file of text, perhaps the text of a novel. The program copies the same text to an output file, except that all the useless words such as "the", "a", and "an" are removed. (Decide on what other words you with to remove. The list of words removed is called a stop list.) Do this by reading the text file token by token using hasNext() and next(), but only writing out tokens not on the stop list. Prompt the user for the names of the input and output files.

Fairly Easy: The output file will have only N tokens per line. Do this by counting tokens as you output them. N will be something like 10 or 12.

Improved Program: Preserve the line structure of the input file. Do this by reading each line using nextLine() and then creating a new Scanner for that line. (Look at the on-line documentation for Scanner.) With each line's Scanner, use hasNext() and next() to scan through its tokens.

Harder: Write out no more than N characters per line. N will be something like 50. Do this by keeping count of the number of characters written out per line. The length() method of String will be useful. If X characters has already been written to the current line, and if X plus the length of the current token exceeds N, then start a new line.

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

Practice 8 (Module-V)

Program-1:

E-Mail Address Extractor:

Write a program that scans a text file for possible e-mail addresses. Addresses look like this: someone@somewhere.net

Read tokens from the input file one by one using hasNext() and next(). With the default delimiters of Scanner, an entire e-mail address will be returned as one token. Examine each token using the indexOf()

method of String. If a token contains an at sign @ followed some characters later by a period, regard it as a possible e-mail address and write it to the output file.

Programs such as this scan through web pages looking for e-mail addresses that become the targets of spam. Because of this, many web pages contain disguised e-mail addresses that can't easily be automatically extracted.

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

Practice 9 (Module-VI)

Program-1:

User-friendly Fat Calculator, with Advice:

Further modify the calories from fat calculator so that it includes another TextField that will be set with the text "Too many fat calories" if the percentage of calories from fat is equal or greater than 30 percent, or to "Healthy amount of fat" if the percentage is less than that.

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

Practice 10 (Module-VI)

Program-1:

Three Button Monte:

Write a program to implement a game:

There are three buttons in the frame. Two of the buttons cause the program to quit using System.exit(0); the remaining button changes the frame to green (a win!) The winning button is different each time the game is played.

The easy way to do this (although it seems unfair to the user) treats each button the same way. The actionPerformed() method does not check which button was clicked. When any button is clicked, the method picks a random integer from 0 to 2 and performs the "winning" action if the integer happens to be 0. Otherwise, it performs the "losing" action. To the user, it seems like there is a "winning" button and two "losing" buttons. But, in fact, it does not matter which button was clicked.

This is similar to some electronic gambling devices in casinos, where it appears to the user that there are "winning moves" and "losing moves" but in fact the machine actually ignores what the user has done and just declares a "win" every now and then, according to predetermined odds.

You will need the Random class:

```
Random randNum = new Random(); // create a Random number object
int someInt = randNum.nextInt(3); // someInt gets a number from 0 to 2
```

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

Practice 11 (Module-VII)

Content Delivery with Networking:

Write a Client-Server program where the client queries with a name of file and the server delivers the content of requested files to the client over the network.

(Improve the program by making the server multi-threaded)

Practice 12 (Module-VII)

Greet the user with Remote Method Invocation:

Write a program using RMI, where the user invokes a method on remote object with username as parameter and receives a greeting message based on time of the day along with username.

Projects

However, not limited to:

1. Chat application
2. Text Editor application
3. GUI based Scientific Calculator
4. Paint application
5. Slam book

(*PROJECT REVIEWS WILL COMMENCE BEYOND CLASS HOURS)

Monitoring:
Credit will be received only on making an honest effort. It is expected that students will finish watching all lecture video and complete all challenge problems by the end of

each lecture week.
Borrowing code from other sources is allowed only with proper attribution and credit given to the original author(s).

List of Common Programs to solve using Java:

1.Program to calculate area of a triangle
2.Program to solve quadratic equation

3.Program to swap two zariables (with and without using third variable)

4.Program to generate random numbers in various ways

5.Program to convert miles to kilometers and vice-versa

6.Program to convert celsius to fahrenheit and vice-versa

7.Program to check if a number is odd or even

8.Program to check if input year is leap year

9.Program to test primality

10.Program to print all prime numbers in an interval using "Sieve of Eratosthenes"

11.Program to generate factorial of all elements in an array

12.Program to display the multiplication table up to 20

13.Program to print the fibonacci sequence

14.Program to check armstrong number, perfect number, Harshad number

15.Program to generate armstrong numbers in an Interval

16.Program to find the sum of Harshad numbers in an interval

17.Program to display powers of two Using lambda

18.Program to perform conversions among decimal to binary, octal and hexadecimal

19.Program to display ASCII table

20.Program to find HCF/GCD and LCM

21.Program to find factors of given natural number

22.Program to make a simple calculator

23.Program to shuffle deck of cards

24.Program to generate fibonacci sequence using recursion

25.Program to find sum of natural numbers using recursion

26.Program to find factorial of number using recursion

27.Program to convert decimal to binary using recursion

28.Program to add two matrices

29.Program to obtain transpose of a matrix

30.Program to multiply two matrices

31.Program to check if a string is palindrome

32.Program to remove punctuations from a string

33.Program to sort words lexicographically

34.Program to illustrate different set operations

35.Program to count frequency of each vowel in a string

36.Program to find hash value of a file

Database Management Systems

Code	Course Title	Credit	T-P-PJ
CUTM1059	Database Management Systems	3	2-1-0

Objective

- To understand the different issues involved in the design and implementation of a database system.
- To study the physical and logical database designs, database Modeling,relational,hierarchical, and network models
- To understand and use data manipulation language to query, update, and manage a database
- To develop an understanding of essential Peoperties of DBMS concepts such as: database security,integrity, concurrency
- To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

Course outcome

- Describe the fundamental elements of relational database management systems
- Explain the basic concepts of relational data model, entity-relationship model,relational database design, relational algebra and SQL
- Design ER-models to represent simple database application scenarios
- Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data
- Improve the database design by normalization

- Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing

Course content

Module-1: **DBMS Concepts [5 Hrs]**
Data Abstraction - Data models and data independence. Instances and Schemas. Components of a DBMS and overall structure of a DBMS- Life Cycle of a DBMS application- Database terminology.

Module-2: Data Modeling [5Hrs]
Basic concepts- Types of data models- Conceptual, physical and logical database models- E-R data model and Object-oriented data model. Components of ER Model- ER Modeling symbols. Entity and entity sets- Relations and relationship sets- E-R Diagrams- Reducing E-R Diagrams into tables.

Practice
Assume we have the following application that models soccer teams, the games they play, and the
players in each team. In the design, we want to capture the following:
• We have a set of teams, each team has an ID (unique identifier), name, main stadium, and to which city this team belongs.
• Each team has many players, and each player belongs to one team. Each player has a number (unique identifier), name, DoB, start year, and shirt number that he uses.
• Teams play matches, in each match there is a host team and a guest team. The match takes place
in the stadium of the host team.
• For each match we need to keep track of the following:
• The date on which the game is played
• The final result of the match

• The players participated in the match. For each player, how many goals he scored, whether or not he took yellow card, and whether or not he took red card.
• During the match, one player may substitute another player. We want to capture this substitution and the time at which it took place.
• Each match has exactly three referees. For each referee we have an ID (unique identifier), name, DoB, years of experience. One referee is the main referee and the other two are assistant referee.
Design an ER diagram to capture the above requirements. State any assumptions you have that affects your design (use the back of the page if needed). Make sure cardinalities and primary keys are clear.

Module-3: Relational DBMS Model [5 Hrs]
Basic concepts, Attributes and domains- Intention and extensions of a relation- concept of integrity and referential constraints- Relational Query Languages (Relational algebra and relational calculus (Tuple and domain relational calculus).

Module-4: Relational Database Design [6 Hrs]
Notion of normalized relations- Normalization using Functional Dependency- First Normal form- Second Normal Form- Third Normal form- BCNF.

Practice
Perform NF on the given table

CLICK HERE FOR TABLE

Module-5: SQL [6 Hrs]
Structure of a SQL query- DDL and DML, TCL- SQL queries and sub queries- Tables, views and indexes.

Practice
To study DDL-create and DML-insert commands.

(i) Create tables according to the following definition.

CREATE TABLE DEPOSIT (ACTNO VARCHAR2(5) ,CNAME VARCHAR2(18) , BNAME VARCHAR2(18) , AMOUNT NUMBER(8,2) ,ADATE DATE);
CREATE TABLE BRANCH(BNAME VARCHAR2(18),CITY VARCHAR2(18)); CREATE TABLE CUSTOMERS(CNAME VARCHAR2(19) ,CITY VARCHAR2(18));
CREATE TABLE BORROW(LOANNO VARCHAR2(5), CNAME VARCHAR2(18), BNAME VARCHAR2(18), AMOUNT NUMBER (8,2));
(ii) Insert the data as shown below.

DEPOSIT
CLICK HERE FOR TABLE
BRANCH
CLICK HERE FOR TABLE
CUSTOMERS
CLICK HERE FOR TABLE
BORROW
CLICK HERE FOR TABLE
(1) Describe deposit, branch.
(2) Describe borrow, customers.
(3) List all data from table DEPOSIT.
(4) List all data from table BORROW.
(5) List all data from table CUSTOMERS.
(6) List all data from table BRANCH.
(7) Give account no and amount of depositors.
(8) Give name of depositors having amount greater than 4000.
(9) Give name of customers who opened account after date '1-12-96'.

Module-6:Aggregate functions [4 Hrs]

Set Operations, predicates and joins, Set Membership- Tuple variables- Set comparison- Database modifications using SQL.

Practice
Create the below given table and insert the data accordingly.

Create Table Job (job_id, job_title, min_sal, max_sal)

COLUMN NAME DATA TYPE
job_id Varchar2(15)
job_title Varchar2(30)
min_sal Number(7,2)
max_sal Number(7,2)
Create table Employee (emp_no, emp_name, emp_sal, emp_comm, dept_no)

COLUMN NAME DATA TYPE
emp_no Number(3)
emp_name Varchar2(30)
emp_sal Number(8,2)
emp_comm Number(6,1)
dept_no Number(3)
Create table deposit(a_no,cname,bname,amount,a_date).

COLUMN NAME DATA TYPE
a_no Varchar2(5)
cname Varchar2(15)
bname Varchar2(10)
amount Number(7,2)
a_date Date

Create table borrow(loanno,cname,bname,amount).

COLUMN NAME DATA TYPE
loanno Varchar2(5)

cname Varchar2(15)
bname Varchar2(10)
amount Varchar2(7,2)

Insert following values in the table Employee.

emp_n emp_name emp_sal emp_comm dept _no
101 Smith 800 20
102 Snehal 1600 300 25
103 Adama 1100 0 20
104 Aman 3000 15
105 Anita 5000 50,000 10
106 Sneha 2450 24,500 10
107 Anamika 2975 30
Insert following values in the table job.

CLICK HERE FOR TABLE
Insert following values in the table deposit.
CLICK HERE FOR TABLE
Perform following queries
(1) Retrieve all data from employee, jobs and deposit.
(2) Give details of account no. and deposited rupees of customers having account opened between dates 01-01-06 and 25-07-06.
(3) Display all jobs with minimum salary is greater than 4000.
(4) Display name and salary of employee whose department no is 20. Give alias name to name of employee.
(5) Display employee no,name and department details of those employee whose department lies in(10,20)
To study various options of LIKE predicate

(1) Display all employee whose name start with ‘A’ and third character is ‘ ‘a’.

(2) Display name, number and salary of those employees whose name is 5 characters long and first three characters are ‘Ani’.
(3) Display the non-null values of employees and also employee name second character should be ‘n’ and string should be 5 character long.

(4) Display the null values of employee and also employee name’s third character should be ‘a’.
(5) What will be output if you are giving LIKE predicate as ‘%_%’ ESCAPE ‘\’

To Perform various data manipulation commands, aggregate functions and sorting concept on all created tables.
(1) List total deposit from deposit.
(2) List total loan from karolbagh branch
(3) Give maximum loan from branch vrce.
(4) Count total number of customers
(5) Count total number of customer’s cities.
(6) Create table supplier from employee with all the columns.
(7) Create table sup1 from employee with first two columns.
(8) Create table sup2 from employee with no data
(9) Insert the data into sup2 from employee whose second character should be ‘n’ and string should be 5 characters long in employee name field.

(10) Delete all the rows from sup1.
(11) Delete the detail of supplier whose sup_no is 103.
(12) Rename the table sup2.
(13) Destroy table sup1 with all the data.
(14) Update the value dept_no to 10 where second character of emp. name is ‘m’.
(15) Update the value of employee name whose employee number is 103.

To study Single-row functions.

(1) Write a query to display the current date. Label the column Date

(2) For each employee, display the employee number, job, salary, and salary increased by 15% and expressed as a whole number. Label the column New Salary
(3) Modify your query no 4.(2) to add a column that subtracts the old salary from the new salary. Label the column Increase
(4) Write a query that displays the employee's names with the first letter capitalized and all other letters lowercase, and the length of the names, for all employees whose name starts with J, A, or M. Give each column an appropriate label. Sort the results by the employees' last names.
(5) Write a query that produces the following for each employee:
earns monthly
(6) Display the name, hire date, number of months employed and day of the week on which the employee has started. Order the results by the day of the week starting with Monday.
(7) Display the hiredate of emp in a format that appears as Seventh of June 1994 12:00:00 AM.
(8) Write a query to calculate the annual compensation of all employees (sal+comm.).

Displaying data from Multiple Tables (join)

(1) Give details of customers ANIL.
(2) Give name of customer who are borrowers and depositors and having living city nagpur
(3) Give city as their city name of customers having same living branch.
(4) Write a query to display the last name, department number, and department name for all employees.
(5) Create a unique listing of all jobs that are in department 30. Include the location of the department in the output
(6) Write a query to display the employee name, department number, and department name for all employees who work in NEW YORK.
(7) Display the employee last name and employee number along with their manager's last name and manager number. Label the columns Employee, Emp#, Manager, and Mgr#, respectively.

(8) Create a query to display the name and hire date of any employee hired after employee SCOTT.

Module-7: Transaction Management [8 Hrs]
Subqueries,Manupulating Data,Transaction management and Concurrency control
Practice
To apply the concept of Aggregating Data using Group functions.

(1) List total deposit of customer having account date after 1-jan-96.
(2) List total deposit of customers living in city Nagpur.
(3) List maximum deposit of customers living in bombay.
(4) Display the highest, lowest, sum, and average salary of all employees. Label the columns Maximum, Minimum, Sum, and Average, respectively. Round your results to the nearest whole number.
(5) Write a query that displays the difference between the highest and lowest salaries. Label the column DIFFERENCE.
(6) Create a query that will display the total number of employees and, of that total, the number of employees hired in 1995, 1996, 1997, and 1998
(7) Find the average salaries for each department without displaying the respective department numbers.
(8) Write a query to display the total salary being paid to each job title, within each department.
(9) Find the average salaries > 2000 for each department without displaying the respective department numbers.
(10) Display the job and total salary for each job with a total salary amount exceeding 3000, in which excludes president and sorts the list by the total salary.

(11) List the branches having sum of deposit more than 5000 and located in city bombay.

To solve queries using the concept of sub query.

(1) Write a query to display the last name and hire date of any employee in the same department as SCOTT. Exclude SCOTT
(2) Give name of customers who are depositors having same branch city of mr. sunil.
(3) Give deposit details and loan details of customer in same city where pramod is living.
(4) Create a query to display the employee numbers and last names of all employees who earn more than the average salary. Sort the results in ascending order of salary.
(5) Give names of depositors having same living city as mr. anil and having deposit amount greater than 2000
(6) Display the last name and salary of every employee who reports to ford.
(7) Display the department number, name, and job for every employee in the Accounting department.
(8) List the name of branch having highest number of depositors.
(9) Give the name of cities where in which the maximum numbers of branches are located.
(10) Give name of customers living in same city where maximum depositors are located.

Manipulating Data

(1) Give 10% interest to all depositors.
(2) Give 10% interest to all depositors having branch vrce
(3) Give 10% interest to all depositors living in n
agpur and having branch city bombay.
(4) Write a query which changes the department number of all employees with empno 7788's job to employee 7844'current department number.
(5) Transfer 10 Rs from account of anil to sunil if both are having same branch.
(6) Give 100 Rs more to all depositors if they are maximum depositors in their respective branch.
(7) Delete depositors of branches having number of customers between 1 to 3.
(8) Delete deposit of vijay.
(9) Delete borrower of branches having average loan less than 1000.

To apply the concept of security and privileges.

To study Transaction control commands

VIRTUAL LAB

TEXT BOOKS

Database Management Systems: Raghu Ramakrishnan
ORACLE PL/SQL Programming – Scott Urman BPB Publications.

REFERENCES

Database Systems Concepts – Henry F Korth, Abraham Silberschatz.
Database Management Systems – Alexis Leon, Mathews Leon – Leon, Vikas Publications

Note: 1 credit theory=12 hrs lecture, 1 credit practice/project=15 hrs lab/workshop/field work in a semester