Database Management System

[6th Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Information Technology	3-1-0, (4)	PC	BT106104BT

[Pre-requisites: Discrete Structures (IT103101IT), Data Structures (IT10I025IT), Computer Programming (C & C++)]

Course Objectives

1. To understand basic database concepts, including the structure and operation of the relational data model.
2. To construct simple and moderately advanced database queries using Structured Query Language (SQL).
3. To apply logical database design principles with database normalization.
4. To understand the concept of a database transaction, concurrency control, recovery, and Indexing techniques.

Course Content

UNIT 1: INTRODUCTION AND RELATIONAL DATA MODELS

Introduction to database systems, Various components of a DBMS; ER Model - Conceptual data modeling - entities, entity types, various types of attributes, relationships, relationship types, ER diagram, Concept of relations, schema-instance distinction, keys, referential integrity and foreign keys, relational algebra operators: selection, projection, cross product, various types of joins, division, example queries, tuple relation calculus, domain relational calculus, converting the database specification in ER notation to the relational schema.

UNIT 2: STRUCTURED QUERY LANGUAGE

Introduction, data definition in SQL, table, key and foreign key definitions, update behaviors. Querying in SQL - basic select-from-where block and its semantics, nested queries - correlated and uncorrelated, notion of aggregation, aggregation functions group by and having clauses, embedded SQL, Introduction to NoSQL and MongoDB.

UNIT 3: DEPENDENCIES AND NORMAL FORMS

Various Database Design Strategies, Functional Dependencies, dependency theory - functional dependencies, Armstrong's axioms for FD's, closure of a set of FD's & its applications (equivalences & canonical form), Normalization for Relational Databases: motivation for normal forms, definitions of 1NF, 2NF, 3NF and BCNF, decompositions and desirable properties of them, algorithms for 3NF and BCNF normalization, multi-valued dependencies and 4NF, join dependencies and definition of 5NF.

UNIT 4: TRANSACTION PROCESSING, ERROR RECOVERY, DATA STORAGE AND INDEXES

Transaction Processing: concepts of transaction processing, ACID property, isolation problems, schedules and recoverability, serializability of schedules. Concurrency Control: Locking based protocol, Time-stamp based protocol, multi-version schemes, Validation based protocol, Multiple granularity. Error Recovery: Failure classification, deferred update, immediate update, Shadow paging. Data Storage and Indexes: file organizations, primary, secondary index structures, various index structures - hash-based, dynamic hashing techniques, multi-level indexes, B+ trees.

Course Materials

Required Text: Text books

1. Database system concepts, Korth & Sudarshan, MH.
2. Introduction to Database Systems, C.J.Date, Pearson Education.
3. Database Management Systems, Ramakrishnan & Gehrke, MH.

Optional Materials: Reference Books

1. Principles of Database Systems, 2nd Edn., Ullman, J.O, Galgotia Publications.
2. Fundamentals of Database Systems, Elmasri & Navathe, Pearson Education.Database Design Fundamentals, Rishe, PHI.

Fluid Flow Operations

[6th Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Information Technology	3-1-0, (4)	PC	BT106105BT

[Pre-requisites: Concept of fluid statics, kinematics, dynamics and applications of fluid mechanics in biotechnology]

Course Objectives

To impart to the students knowledge on fluid properties, fluid statics, dynamic characteristics for through pipes and porous medium, flow measurement and fluid machineries

Course Content

UNIT I :

Properties of fluid, basic laws, Newtonian and non-Newtonian fluids, compressibility and bulk modulus, surface tension and capillarity, manometers, Buoyancy and floatation, flow patterns, continuity equation, vortex flow, equations of motion, Euler's equation of motion, Bernoulli's equation and its applications, streamline, streak line, path line, stream tube.

UNIT II:

Viscous and turbulent flow, Reynolds's experiment, frictional loss in pipe, velocity distribution in flow in pipes, loss of energy in pipes, boundary layer flow, boundary layer separation, wake formation, Dimensional and model analysis.

UNIT III:

Flow measurements, the displacement and current meters - variable area meter, orifice meter, venturimeter, flow nozzles, rotameter, wiers and notches - Pitot tubes - velocity meters - anemometers, turbine flow meter, current meters, hot wire anemometer, laser dopper anemometry, flow visualization

UNIT IV:

Pumping and compressing, Centrifugal Pump: Classifications, working, Introduction to vector diagram and work done by impeller. Reciprocating pump: Reciprocating pump theory, Slip and coefficient of discharges, Indicator diagram, Effect and acceleration, Introduction of positive displacement pump, blowers and fluidization, Pipe and pipe fittings, pipes and pipe standards, pipe fittings and valves

Course Materials

Text books

1. Principles McCabe and Smith, "Unit Operations in Chemical Engineering", McGraw-Hill
2. Streeter, "Fluid Mechanics"
3. "Fluid mechanics and hydraulic machines" by R. K. Bansal

Immunology

[6th Semester, Third Year]

Offered by Department	Credits	Status	Code
Biotechnology	3-1-0, (4)	PC	BT106106BT

[Pre-requisites: Basic Bioscience]

Course Objectives

The student will learn basic understanding of immunology. Importance of immunology in human health. Principles and application of immune techniques.

Course Content

UNIT-1:

Properties and overview of immune responses, Organs (primary and secondary) and tissue of the immune system, Innate Immunity, Adaptive immunity, Humoral and Cell mediated immunity

UNIT-2:

Major histocompatibility complex and complement system, Regulation of immune response, Hypersensitivity, Immunization and vaccines, Immune tolerance, Graft versus host reaction

UNIT-3:

Development, maturation, activation, regulation, differentiation and classification of T-cells and B-cells, antigen processing and presentation, theory of clonal selection, TCR; antibodies: structure and functions; antibodies genes and generation of diversity,

UNIT-4:

Immunological diseases as allergy, autoimmunity and immune deficiencies as well as the technologies that are used for diagnosis and treatment of these diseases, Polyclonal and monoclonal antibody, Antigen-antibody reaction, ELISA, western blot

Course Materials

Required Text: Text books

1. Immunology by Roitt I and Male Brostoff, 4th Edition, Publishere Mosby, 1995
2. Immunology by Janis Kuby, 3rd Edition, Publisher W H Freeman, 1997
3. Kuby Immunology by Judy Owen, Jenni Punt , Sharon Stranford , Patricia Jones, 8th Edition, Publisher W H Freeman, 2018

Optional Materials: Reference Books

1. Principle of Cellular and Molecular Immunology by Austin J M and Wood K J, Publish OUP Oxford, 1993.
2. Immunology and Immunotechnology, by Ashim K. Chakravarty, Oxford University Press, 2006
3. Immunotechnology: Principles, Concepts and Applications, by Anthony Moran, Wiley–Blackwell, 2001

Biopharmaceutical Technology

[6th Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Biotechnology	3-0-0, (3)	PE2	BT106203BT

[Pre Requisite- Industrial Biotech]

Course Objectives

1. Strong foundation on biopharmaceutical aspects in relation to drug development.
2. This course provides core responsibilities for the development and monitoring of the drug and the preparation of medicines according to the regulatory norms.
3. To gain knowledge in physicochemical properties, pharmacology and the formulation of commonly used biopharmaceuticals.

Course Content

UNIT-1: INTRODUCTION

Pharmaceutical industry & development of drugs; types of therapeutic agents and their uses; economics and regulatory aspects. Factors affecting Drug Development; Procedures followed in Drug Design

UNIT-2: DRUG ACTION AND METABOLISM

Mechanism of drug action; physico-chemical principles of drug metabolism; pharmacokinetics; pharmacodynamics. Metabolic Pathways in Drug Design

UNIT-3: DRUG MANUFACTURE

Manufacturing of drugs, process; compressed tablets; dry and wet granulation; slugging or direct compression; tablet presses and coating; capsule & ointment preparation; preservation of drugs; analytical methods and other tests used in drug manufacture; packing techniques; quality management; GMP; special requirements for bulk drug manufacture. Regulatory Norms for Drug manufacture; GMP considerations for Drug manufacture

UNIT-4: BIOPHARMACEUTICALS

Various types of therapeutics like vitamins, enzymes, laxatives, analgesics, contraceptives, antibiotics, hormones, and other biologicals. Antibiotics as Biopharmaceuticals – Broad spectrum antibiotic study. Recent Developments in antibiotic production to combat various diseases; Use of Industrial Enzymes as Biopharmaceuticals; Development of Biopharmaceutical products like Vaccines, Therapeutic Proteins and Monoclonal Antibodies

Text Books:-

1. Finkel, Richard, et al., Lippincotts Illustrated Reviews Pharmacology IVth Edition. Wolters Kluwer / Lippincott Williams and Wilkins.

Reference Books :-

2. Gareth Thomas. Medicinal Chemistry. An introduction. John Wiley.
3. Katzung B.G. Basic and Clinical Pharmacology, Prentice Hall of Int

Bioseparation Engineering

[6th Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Biotechnology	3-0-0, (3)	PE2	BT106204BT

[Pre Requisite- Cell Biology, Enzyme Technology]

Course Objectives

Understand the concept/techniques of separation of biomolecules and related mechanisms.

Course Content

UNIT-1: INTRODUCTION:

Molecules separated via bioseparation; Basis and importance of bioseparation; Overview of bioseparation techniques for separation of soluble and insoluble products. Types of Bioprocessing products, Major process steps in Bio-separations

UNIT-2: PHENOMENA OF BIOSEPARATION:

Adsorption; Dialysis; Filtration; Precipitation; Coagulation; Flocculation; Crystallization and Drying, Cell Disruption (Mechanical & chemical methods); Diffusion; Osmosis; Extraction (single and two-phase), Biological methods of Cell Disruption.

UNIT-3: ADVANCED BIOSEPARATION PROCESSES:

FPLC, Hydrophobic interaction chromatography, Reversed-phase chromatography; Chromatography scale-up**;** Affinity ultrafiltration; Field-flow fractionation, Bioseparations for biopharmaceutical products, HPLC, Adsorption chromatography, Ion exchange chromatography, Gel filtration chromatography.

UNIT-4: SPECIFIC TOPICS :

Centrifugation/ultracentrifugation, Membrane based bioseparation, Microfiltration, ultrafiltration, nanofiltration, evaporation, distillation, electrophoresis techniques and molecular size exclusion, Reverse Osmosis, Concentration Polarization and Fouling in Membrane separation process

Text Books:-

1. Roger G. Harrison, Paul W. Todd, Scott R. Rudge, and Demetri P. Petrides. Bioseparations Science and Engineering.
2. B. Sivasankar. Biosperations: principles and techniques (PHI learning PVT. LTD.)
3. M.R. Ladisch, Bioseparations Engineering, Wiley Interscience.

Reference Books :-

1. Kennedy and Cabral, Recovery processes for biological materials.
2. Heinemann, Product Recovery in Bioprocess Technology, Butterworth Publication

Membrane Technology

[6th Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Biotechnology	3-0-0, (3)	PE3	BT106205BT

[Pre-Requisite- Membrane synthesis & characterization, application of membrane in medical and biotechnological industries]

Course Objectives

To learn the principles of membrane technology and engineering aspects of membrane separation processes, including pervaporation, reverse osmosis, ultrafiltration, microfiltration, and dialysis.

Course Content

UNIT I:

Concept of membrane filtration, types of membrane process, membrane materials and properties, membrane modules, energy for membrane process, Membrane preparation; dense membranes, symmetric membranes, Asymmetric membranes, composite membranes, Inorganic and ceramic membranes, Hollow fiber membranes; Membrane characterization, porosity, pore size distribution, bubble point method, water permeability, perporometry, molecular weight cut-off

UNIT II:

Membrane process for liquid separation, microfiltration, ultrafiltration, nanofiltration, dead-end filtration, cross flow filtration, pervaporation, osmosis and reverse osmosis theoretical principles and their industrial applications, membrane fouling and cleaning, investigation of membrane fouling

UNIT III:

Membrane process for medical applications; concept of blood purification, dialysis, hemodialysis, electrodialysis and hemofiltration, theoretical principles and applications, membrane modules and materials of construction

UNIT IV:

Application of membranes, wastewater treatment, removal and recovery of heavy metals, oily-wastewater separation, membrane bioreactor for wastewater treatment, food industries; fruit juice clarification, aroma recovery; Biotechnology, biomass separation, separation of fungus, bacteria, virus, application to microbial fuel cell

Text Books:-

1. M. Mulder, “Basic principles of membrane technology”, Kluwer Academic Publishers, Dordrecht, The Netherlands, 2nd Edition, 1996.
2. J.D. Seader, E. J. Henley, “Separation process principles”, John Wiley & Sons, Inc, 2 nd Edition.
3. R.W. Baker, “Member technology and applications”, John Wiley & Sons Ltd, 2 nd Edition.
4. A.K. Pabby., S.S. H. Rizvi., A. M. Sastre, “Hand book of membrane separations: Chemical, Pharmaceutical, Food, and Biotechnological Applications”, CRC press, Taylor & Francis Group, 2009.

Stem Cell and Tissue Engineering

[6th Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Biotechnology	3-0-0, (3)	PE3	BT106206BT

[Pre Requisite- Cell Biology, Analytical Techniques]

Course Objectives

1.Understand the structure and organization of tissues, the construction of scaffolds and other transplant engineering biocompatible materials for tissue engineering.

2.Imparting the basic knowledge of students about stem cell, culturing, therapy, and its clinical applications

Course Content

UNIT-1: BASIC OF STEM CELLS

Introduction; Types, source, and differentiation pathway of stem cell; Potency, plasticity, characters of stem cells; Stem cell isolation, culturing, subculturing, storage; Stem cell markers & their analysis; regulation of stem cell-engineered products and ethical issues.

UNIT-2: TECHNIQUES AND ENGINEERED DISEASE MODELS

In vivo cell & tissue engineering; Design of artificial organs like- artificial skin, artificial blood vessels, artificial pancreas, artificial liver, regeneration of bone and muscle, nerve regeneration.

UNIT-3: INTRODUCTION TO TISSUE ENGINEERING:

Current scope; Use in therapeutics; Tissue appearance and component, Tissue types and properties; Tissue organization, dynamics and morphogenesis; ECM component, Mechanical measurements; Tissue repair; Stem cells in tissue engineering and regenerative medicine.

UNIT-4: BIOMATERIALS IN TISSUE ENGINEERING

Biopolymers and scaffold; Classes and properties of biomaterials; Characterization of materials; Host reactions to biomaterials; Biocompatible Materials; Microtechnology Tools; 3D Tissue Printing; Implantable devices.

Text Books:-

1. Tissue Engineering, Senior Editor Ulrich Martin , Springe.
2. Stem Cells Handbook, Editor: Stewart Sell ,Humana Press.

Reference Books :-

1. Bernard N. Kennedy (editor). New York : Nova Science Publishers, c2008.Stem cell transplantation, tissue engineering, and cancer applications.
2. Stem Cell Biology ,Editors: Daniel R. Marshak, Richard L. Gardner and David Gottlieb Cold Spring Harbor Laboratory Press,

Cold Spring Harbor NY, USA

Intellectual Property Rights

[6th Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Biotechnology	3-0-0, (3)	OE2	BT106302BT

[Pre Requisite- Microbiology, plant & animal cell culture, molecular biology & RDT]

Course Objectives

1. To follow professional ethics and practices in the careers of student
2. To create awareness about IPR and develop responsibilities about the society

Course Content

UNIT-1: ETHICS AND BIOETHICS

Ethics, its origin & evolution bioethics; Ethical reasoning and the justification of moral beliefs; Necessity of bioethics; Different bioethics theory & paradigms- International & National; Ethical issues in genetic engineering, cloning, genetic testing & screening; Bioethics & social responsibility; Legal & socio-economic impact of ethics in Biotech

UNIT-2: INTELLECTUAL PROPERTY (IP) AND RIGHTS

IP; Patents; Trademarks; Copyright & Related Rights; Industrial Design; Registration and piracy; Traditional Knowledge; Geographical Indications; IP as a factor in R&D; Protection of GMOs; Relevance IPs to Biotechnology; Rights of an IP developer and patentee.

UNIT-3: AGREEMENTS, TREATIES, AND ACTS

History of GATT & TRIPS Agreement; Madrid Agreement; Hague Agreement, WIPO Treaties; Budapest Treaty; Patent Cooperation Treaty (PCT), Indian Patent Act 1970 & amendments; Concept of Prior Art; Invention in context of "prior art".

UNIT-4: PATENT DATABASES AND FILING

Patentability search; Patent Databases; Country-wise patent searches (EPO, WIPO, IPO, USPTO, etc.); National & International patent filing procedure; Time frame, form & fee; Status of filed patent; Patenting precautions–disclosure/non-disclosure; Financial assistance for patent; Patent licensing & agreement; Patent infringement; Litigation and case studies.

Text Books:-

1. Bonnie Steinbock; The Oxford Handbook of Bioethics (Oxford Handbooks): Oxford University Press, USA; Latest edition
2. Intellectual Property Rights" by Neeraj Pandey and Khushdeep Dharni.

Reference Books :-

1. Mike Martin & Roland Schinzinger, "Ethics in Engineering",McGraw Hill, New York.
2. BAREACT, Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., Latest edition.

Database Management System Lab

[6th Semester, Third Year]

Course Description			
Offered by Department	Credits	Status	Code
Information Technology	0-0-2, (1)	Laboratory	BT106403BT

List of 10 -15 Assignment/Practical will be allotted by the Instructor in the respective Lab.

Immunology Lab

[6th Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Biotechnology	0-0-2, (1)	Laboratory	BT106404BT

[Pre-requisites: Biochemistry, Basic Biosciences, Cell and Molecular Biology Lab]

Course Objectives

After completing the course, the student will be able to perform different immuno assays that are used in clinical diagnostics and research

Course Content

1. Isolation of serum from blood
2. Identification of ABO and Rh blood type
3. Purification of antibody from serum (Affinity Chromatography)
4. To learn the technique of Ouchterlony double diffusion
5. Determination of antibody titre by ELISA
6. Separation of plasma proteins by electrophoresis technique
7. Differential count of WBC, RBC
8. Western Blotting
9. Detection of typhoid infection by WIDAL test
10. Antigen–Antibody precipitation test

Course Materials

Required Text: Text books

1. David Wild, The Immunoassay Handbook: Theory and Applications of Ligand Binding, ELISA and Related Techniques, Elsevier Science, 2013, 4th EditionA Handbook of Practical & Clinical Immunology, Vol 1, 2E, Cbs Publisher, 2012

Optional Materials: Reference Books

1. Immunology, The experimental Series –II by W. Luttmann, K. Bratke, M. Kupper, Myrtek, USA, Elsevier, Academic Press; 2006
2. A handbook of practical and clinical immunology by G. P. Talwar, S. K. Gupta, 2nd ed. Vol. I & II; 2006
3. Manual of clinical laboratory Immunology by N. R. Rose, R. G. Hamilton, B. Detrick, 6thedition, ASM Press, 2002