Syllabus and Curriculum
of

B.Tech in Engineering
Common to all branches

(Combined 1st and 2nd semesters)

University of Calicut
(2014 admission)
# SCHEME OF COMBINED I & II SEMESTERS B.Tech

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<td>Engineering Mathematics I</td>
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<td>Mechanical Workshops</td>
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<td>Electrical &amp; Civil Workshops</td>
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EN14 101 ENGINEERING MATHEMATICS I  
(Common for all B.Tech. programmes)

Teaching scheme 
2 hours lecture and 1 hour tutorial per week

Credits: 4

Objective

- To provide an avenue to scientific knowledge which opens new vistas of mental activity.

A sound knowledge of engineering mathematics is a “sine qua non” for the modern engineer to attain new heights in all aspects of engineering practice

- To provide the student with plentiful opportunities to work with and apply the concepts, and to build skills and experience in mathematical reasoning and engineering problem solving.

Module I: Differential Calculus (18 hours)

Indeterminate forms – L’Hopitals rule – Radius of curvature in Cartesian form (No proof) – Center of curvature (No proof) – Evolute – Functions of more than one variables - Idea of Partial Differentiation – Euler’s theorem for Homogeneous functions – Chain rule of Partial differentiation – Jacobians – Maxima and Minima of functions of two variables.

Module II: Infinite Series (18 hours)


Module III: Matrices (24 hours)


Module IV: Fourier series and Harmonic Analysis (18 hours)

Reference books


Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)  
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.  
10% - Attendance and Regularity in the class

University Examination Pattern

**PART A:** Analytical/problem solving SHORT questions  8 x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions  4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
EN14 102 ENGINEERING MATHEMATICS II
(Common for all B.Tech. Programmes)

Teaching scheme
2 hours lecture and 1 hour tutorial per week

Credits: 4

Objective

- To apply the subject at the proper place and time, while keeping him/her aware to the needs of the society where he/she can lend his/her expert service, and also to those who can be useful to the community without even going through the formal process of drilling through rigorous treatment of mathematics.

Module I: Ordinary Differential Equations (24 hours)

Equations of first order – Separable, Homogeneous, reducible to Homogeneous and Linear, Bernoulli’s and Exact Equations – Orthogonal trajectories – Linear second order equations – Homogeneous Linear equation of second order with constant coefficients – Non-Homogeneous Linear equation of second order with constant coefficients – Solutions of Linear equations of second order with variable coefficients (Only Cauchy’s equation) – method of variation of parameters.

Module II: Laplace transforms (18 hours)


Module III: Vector Differential Calculus (18 hours)


Module IV: Vector Integral Calculus (18 hours)

Line, Surface and Volume integrals – Line integrals independent of the Path – Green’s Theorem in the plane – Gauss Divergence Theorem – Stoke’s Theorem (Proofs of these theorems are excluded).

Reference books

9. Thomas A. Garrity, All the Mathematics you missed, Cambridge University Press.
Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

*PART A: Analytical/problem solving SHORT questions*  
8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall e bminimum of TWO and maximum of THREE questions from each module with total TEN questions.

*PART B: Analytical/Problem solving DESCRIPTIVE questions*  
4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EN 14 103: ENGINEERING PHYSICS
(Common to all Branches)

Teaching scheme : 2 hours per week

Credits: 3

Objectives

☐ To impart the basic concepts and ideas in physics.

☐ To develop scientific attitudes and enable the students to correlate the concepts of physics with the core programmes.

Module-1 (13 hours)


Diffraction of light-Fresnels and Fraunhoffer classes-Diffraction grating-Simple theory of plane transmission grating (normal incidence)-Resolving and dispersive powers of a grating with expressions (no derivation)-Determination of wavelength of monochromatic light using plane transmission grating.

Ultrasonics -Properties of ultrasonic waves- Piezo-electric and magnetostriction effect-Production of ultrasonic waves by piezo-electric effect method. Accoustic grating-Determination of velocity of ultrasonic waves in a liquid using ultrasonic diffractometer.- Important engineering applications of ultrasonic waves.

Module-2. (13 hours)

Polarisation-Basic concepts-Production of polarised light-Double refraction-Optic axis and principle plane-Huyghens explaynation of double refraction in uniaxial crystals-Positive and negative crystals-Nicol prism-Construction and working (as polarizer and analiser)-Quarter wave and Half wave plates-Superposition of plane polarised light-Theory (analytical analysis) of elliptical and circularly polarised light- Experimental methods for producing and detecting linearly, elliptically and circularly polarized lights-Polaroids-Optical activity-Biot’s laws-specific rotation-Laurent’s half shade polarimeter-Determination of concentration of sugar solution-Applications of plane polarised light.

Quantum mechanics-Introduction-Duality of radiation and matter-Uncertainty principle-Concept of wave packet-Group and phase velocities -Wave function in quantum mechanics and its physical significance-Operators in quantum mechanics (basic concepts only)-Schroedinger equation for a free particle, time dependant and independent (steady/stationary) forms and their derivations -Expectation values-Application-Particle in one dimensional box (potential well) -Eigen values and eigen functions.

Statistical mechanics -Introduction-Macroscopic and microscopic systems -Phase space-Statistical distributions-Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics-Basic postulates and distribution functions (no derivation)-Bosons and fermions.

Module-3. (13 hours)

Laser-Introduction-Spontaneous and stimulated emissions-Population inversion-Optical resonant cavity -Basic component of a laser- Characteristics of laser-Intensity, spatial and temporal coherence-
coherence length-monochromaticity-convergence-Einstein coefficients and the analysis of lasing conditions-Different laser system-Construction, working and features of Ruby, He-Ne, Nd:YAG and Semi conductor lasers Application of lasers in medicine-industry, science and communications-Holography-Basic principle-Construction and reconstruction of hologram-Applications.

Optical fibre-Basic structure-Light propagation through optic fibre-Step index and graded index fibres-Single mode and multi mode fibres-Acceptance angle and numerical aperture of a fibre. Expression for numerical aperture for a step index fibre.-Normalised frequency number (V number) of a fibre-Transmission losses in fibres-Attenuation and distortion-Fibre optic communication system-application of optic fibres.

Nano science-Basic ideas-Nano clusters-variation of properties of nano materials-Carbon nano tubes-Applications of nano materials and nano technology (qualitative ideas only).

Module-4. (13 hours)

Semi conductor physics-Formation energy bands in solids and their classifications-Intrinsic and extrinsic semi conductors-Density of states functions of electrons and holes in the energy bands (expressions only)-Concentration of electrons in the conduction band and holes in valence band-Fermi energy - Fermi level in intrinsic and extrinsic semiconductors-Donor and acceptor levels-Variation of Fermi level with temperature and doping


Superconductivity-Introduction-Transition temperature-Effect of magnetic field (magnetic field and critical current density)-Meissner effect-Type I and type II super conductors-Isotopic effect-Persistent current-Flux quantization-Josephons effects-SQUID-High temperature super conductivity-Applications of super conductivity.

Text Books


Reference books.

3. Introduction to solid state physics- Charles Kittel-Wiley Eastern
5. Lasers and non linear optics-B.B.Laud-Wiley Eastern

University of Calicut B.Tech Syllabus - Combined First & Second Semesters - 2014
6. Introduction to Semiconductor materials and Devices - Tyagi M.S. John Wiley and Sons.
9. Engineering Physics - G.S. Raghuvanshi - Prentice Hall of India
10. Book of Optics - Brijlal and Subramanyam - S. Chand publishers

**Internal Continuous Assessment (Maximum Marks - 50)**

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

**University Examination Pattern**

**PART A:** Analytical/problem solving SHORT questions 8 x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EN 14 103 (P): ENGINEERING PHYSICS  LAB
(Common for all branches)

Teaching scheme: 1 hour practical per week  Credit: 1

Objectives
- To develop scientific and experimental skills of the students
- To correlate the theoretical principles with application based studies.

List of experiments:
1. Young’s modulus of a bar by non-uniform bending
2. Rigidity modulus – Torsion pendulum
3. Study of surface tension of liquids (capillary method)
4. Characteristics of a solar cell
5. Study of Zener characteristics
6. Voltage regulation using Zener diode
7. LED characteristics
8. Determination of band gap energy in semi conductor using a reverse biased p-n junction.
10. Diameter of a thin wire or thickness of a thin strip of paper using air wedge method.
11. Determination of the refractive indices of ordinary and extra ordinary rays in quarts/calcite prism using spectrometer.
12. Determination of spectral lines of a composite source using diffraction grating and spectrometer.
13. Determination of resolving power of a plane transmission grating.
14. Determination of dispersive power of a plane transmission grating.
15. Determination of specific rotatory power or concentration of cane sugar solution using polarimeter.
16. Wave length and velocity measurement of ultrasonic waves in a liquid using ultrasonic diffractometer
17. Wave length measurement of laser using plane transmission grating standardized by sodium light
18. Static characteristics of a transistor in common emitter configuration.
19. Frequency of electrically maintained tuning fork (transverse and longitudinal modes)
20. Measurement of numerical aperture of an optical fibre

(Any 10 experiments should be done at the minimum)
Only one record need to be written by the students and there is no need of separate rough record and fair record.

Reference books:-
1. Practical physics with viva voce, Dr. S.L. Gupta and Dr. V. Kumar, Pragati Prakashan publishers
2. Experiments in Engineering Physics
   M.N. Avadhanulu, A.A. Dani and R.M. Pokley, S. Chand & Co.

Internal Continuous Assessment (Maximum Marks-50)
50% - Laboratory practical and record
40% - Test
10% - Regularity in the class
EN 14 104: ENGINEERING CHEMISTRY
(Common for all branches)

Teaching scheme
2 hours lecture per week

Credits: 3

Objectives
- To familiarize the students on application oriented themes like the chemistry of materials used in engineering discipline
- To focus the students on the chemistry of compounds resulting from pollution, waste generation and environmental degradation and to apply the knowledge in solving these current environmental problems effectively.

Module I (15 hours)

Organo Metallic Compounds: Definition – classification based on the nature of metal-carbon bond. Metal carbonyls – 18 electron rule – Mononuclear and polynuclear carbonyls (give examples of Fe, Co, Ni). (3 Hrs.)

Bio-Inorganic chemistry: Metal ions in biological system – trace and bulk metal ions – Haemoglobin and myoglobin (elementary idea only). (3 Hrs.)

Green chemistry – Goals of green chemistry – Limitations. Twelve principles of green chemistry with their explanations and examples – Designing a green synthesis – Prevention of waste / byproducts – Atom economy (maximum incorporation of materials used in the process) – Minimization of hazardous / toxic products – prevention of chemical accidents – Green synthesis (9 Hrs.)

Module II (15 hours)

Polymers – classification – Types of polymerization – addition, condensation, co-polymerisation, co-ordination polymerization. Polymerisation techniques – Bulk, solution, suspension and emulsion. Concept of Tg, Factors affecting Tg, Crystallinity in polymers, physical and mechanical properties (density, tensile, tear, abrasion resistance, resilience). (9 Hrs.)

Lubricants – Theories of friction – Mechanism of lubrication Thick film, thin film, extreme pressure. Classification – solid, liquid, semisolid – properties – viscosity, flash point, fire point, cloud and pour point, Aniline point, corrosion stability. (3 Hrs.)

Fuels: Classification-Calorific Value -Cracking and Reforming-Petrol Knock and octane number-Diesel knock and cetane number. Bio-Diesel. (3 Hrs.)

Module III (11 hours)


Module IV (11 hours)


University of Calicut B.Tech Syllabus - Combined First & Second Semesters - 2014
Reference Books.
1. Industrial Chemistry – B K Sharma
11. V. Kumar, Introduction to Green Chemistry, Vishal Publishing House.

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8 x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
EN 14 104 (P): ENGINEERING CHEMISTRY LAB
(Common for all branches)

Teaching scheme
1 hour practical per week  Credit: 1

Objectives
- To equip the students with the working knowledge of chemical principles, nature and transformation of materials and their applications.
- To develop analytical capabilities of students so that they can understand the role of chemistry in the field of Engineering and Environmental Sciences

1. Estimation of iron in Mohr’s salt using standard K₂Cr₂O₇
2. Estimation of iron in a sample of iron ore
3. Estimation of copper in a given sample of brass
4. Estimation of total hardness in a given sample of water using EDTA.
5. Estimation of chloride ions in domestic water
6. Determination of dissolved oxygen present in a given sample of water (Winkler’s Method)
7. Determination of available chlorine in a sample of bleaching powder
8. Determination of flash point and fire point of an oil using Pensky Martens flash point apparatus
9. Determination of EMF of a cell by Poggendorf’s compensation method
10. Preparation of buffers and standardization of pH meter
11. Estimation of iron, chromium, lead and Cadmium in water – Colorimetrically
12. Preparation of urea – formaldehyde and phenol formaldehyde resin

- Minimum 8 experiments should be completed.
- Only one record need to be written by the students and there is no need of separate rough record and fair record.

Reference Books

Internal Continuous Assessment (Maximum Marks-50)

50% - Laboratory practical and record
40% - Test
10% - Regularity in the class
EN 14 105: ENGINEERING MECHANICS
(Common for all branches)

Teaching scheme
2 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To acquaint with general approach of solving engineering problems.
- To illustrate the application of the theory learned in Mechanics in practical engineering problems.
- To lay clear fundamentals to core Engineering Subjects

Units: System International

Module I (20 hours)
Introduction to engineering mechanics - units - dimensions - vector and scalar quantities - laws of mechanics - elements of vector algebra - important vector quantities - equivalent force systems - translation of a force to a parallel position - resultant of a force system - simplest resultant of special force systems - distributed force systems - equations of equilibrium - free body diagrams - free bodies involving interior sections - general equations of equilibrium - problems of equilibrium - static indeterminacy. (Both vector and scalar formulations are to be introduced to solve problems.)

Module II (20 hours)

Moment of inertia of a rigid body and lamina (derivation of MI for cylinder, rod and sphere).

Module III (18 hours)
Kinematics of particles - rectilinear motion - curvilinear motion – motion of a projectile - tangential and normal acceleration
Work, power and energy –work-energy equation – transformation and conservation of energy – impulse and momentum.

Module IV (20 hours)
Kinematics rigid bodies - rotation of a rigid body about a fixed axis - plane motion of a rigid body - instantaneous center. Kinetics of rigid bodies - equations of motion of a rigid body rotating about a fixed axis – rotation under the action of a constant moment - D’Alembert’s principle – equations of motion for general plane motion - principle of work and energy.
Application of Graphical Methods in Mechanics – Force Poligons – Applications in truss analysis, centroid and moment of inertia

Text Books
4. V. Jayakumar, M Kumar, Engineering Mechanics, Prentice Hall Of India
Reference Books

Internal Continuous Assessment *(Maximum Marks-50)*
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EN 14 106: BASICS OF CIVIL AND MECHANICAL ENGG.
(Common for all branches)

Teaching scheme
2 hours lecture

Credits: 4

SECTION 1: BASICS OF CIVIL ENGINEERING

1 hour lecture per week

Objective
• To give a basic knowledge of the topics in Civil Engineering.
(In - depth treatment is not required)

Module I (13 hours)
Scope of Civil Engineering- Role of Civil Engineers in nation building.
Brief description of Engineering properties and applications of the following construction

Timber, Iron & steel. (Study on laboratory tests not expected, detailed manufacturing processes of materials not expected).

Stone and brick masonry construction- bonds used in general constructions- Cement mortar and Cement Concrete - Properties and applications- Reinforced Cement Concrete Fundamentals - points to be observed during masonry construction and concreting (Only brief description is expected).

Module II (13 hours)
Introduction to Surveying - brief description of the following instruments (i) chain and accessories (ii) Dumpy level (iii) Theodolite. Use of levelling instrument for determining reduced levels of various stations- Simple problems on levelling - use of theodolite for measuring horizontal angles – Simple problems on horizontal distance and plane area. (Only brief description is expected).

Building drawing- plan, section and elevation of a single room building with RCC roof (sketching in the paper/note book only is expected).

Type and functions of the following structural components of buildings

Text Books
2. Pumia. B.C —Basic Civil Engineering. Laxmi Publications
3. PC Varghese—Building materials, Prentice Hall, India
4. PC Varghese—Building Construction, Prentice Hall, India

Reference Books
1. Mimi Das saikia, Bhargab Mohan Das, Madan Mohan Das—Elements of Civil Engineering]-Prentice Hall, India
4. Pumia. B.C - Building Constructio, Laxmi Publications
5. Rajput. R.K.- Engineering Materials, S. Chand and Company
7. Satheesh Gopi - Basic Civil Engineering, Pearson

University of Calicut B.Tech Syllabus - Combined First & Second Semesters - 2014
Internal Continuous Assessment *(Maximum Marks-25)*
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern for Section 1

**PART A: Analytical/problem solving SHORT questions**  
4x 5 marks=20 marks

Candidates have to answer FOUR questions out of FIVE. There shall be minimum of TWO and maximum of THREE questions from each module with total FIVE questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**  
2 x 15 marks=30 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 50*

Note: Section 1 and Section 2 are to be answered in separate answer books Maximum 50 marks each for Section 1 and Section 2
SECTION 2: BASICS OF MECHANICAL ENGINEERING

Teaching scheme
1 hour lecture per week

Objectives

- **Gives an introduction as well as an overview on the concepts and applications of Mechanical Engineering**

Module I (13 hrs)


Power Plants: Introduction – Layout and working of Diesel, Nuclear and Hydel power plants

Manufacturing process – Introduction – Elementary ideas of rolling and extrusion

Machining operations – Turning, shaping, milling and drilling

Power transmission – introduction – belt, rope, chain and gear drives, terminology, classification; advantages, disadvantages and applications

Module II (13 hrs)

Thermodynamic processes – isobaric, isochoric, isothermal, adiabatic and polytropic – workedone, P-V diagrams.

Otto cycle, Diesel cycle (derivation not required) – IC Engines – SI and CI engines, 4S and 2S engines, comparison; MPFI & CRDI Engines

Refrigeration: Introduction – working of vapour compression refrigeration system, Ton of refrigeration, COP

Hydraulic turbines – Pelton, Francis and Kaplan turbines (applications only).

Pumps – Introduction, classification – reciprocating and centrifugal – (brief description and working only).

Text Books

1. P.Balachandran – Basic Mechanical Engineering – Owl Books - Thiruvananthapuram
2. J.Benjamin – Basic Mechanical Engineering – Pentx
3. Pravin kumar – Basic Mechanical Engineering – Pearson
6. V. Prabhuraja – Basic Mechanical Engineering – Scitech Publishers
Internal Continuous Assessment *(Maximum Marks-25)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern for Section 2

*PART A: Analytical/problem solving SHORT questions*  
4x 5 marks = 20 marks

Candidates have to answer FOUR questions out of FIVE. There shall be minimum of TWO and maximum of THREE questions from each module with total FIVE questions.

*PART B: Analytical/Problem solving DESCRIPTIVE questions*  
2 x 15 marks = 30 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 50*

Note: Section 1 and Section 2 are to be answered in separate answer books  
Maximum 50 marks each for Section 1 and Section 2
EN14 107: BASICS OF ELECTRICAL, ELECTRONICS & COMMUNICATION ENGINEERING  
(Common for all branches)

Teaching scheme  
2 hours lecture per week

Credits: 4

Objective

- This course provides a quick overview of the concepts and results in Basic analysis that may be useful in engineering. Also it gives an introduction to very basic concept and theory of Electrical Engineering.

Module I: Basic Laws in Electrical Engineering (13 Hours)

What is electrical Engineering? Kirchhoff’s Laws, Solution of series and parallel circuits with DC excitation. Voltage and current division rule. (2 Hrs)

Magnetic circuits – MMF, Flux, Reluctance. Comparison of electric and magnetic circuits. (2 Hrs)

Faradays laws, Lenz’s Law, Thump rules. Statically and dynamically induced EMF, Self and Mutual Inductance, Coefficient of Coupling. (2 Hrs)

AC circuits: - Single phase AC circuits – generation of sinusoidal EMF, cycle, frequency, time, period. Average, RMS value and Maximum value, Form factor, peak factor of sine wave only. Analysis of simple R, L, C, RL, RC, LC, and RLC circuits (Equations and waveforms in AC only). Reactance and Impedance, active, reactive and apparent power (Phasor diagram), Power factor. (4 Hrs)

Three phase circuits – generation of 3 phase wave form, star and delta connection, voltage and current relationship in star and delta (Balanced case only), star to delta and delta to star conversion. (3 Hrs)

Module II: Basic Concepts of Transformers and Machines (13 Hours)

Single Phase Transformer – Construction (Core & Shell), principle of operation, EMF equation, Transformation Ratio, Ideal Transformer. (3 Hrs)

DC Generators and Motors: - Constructional details, Types and Configurations, EMF equation. Application of DC Motors. (3 Hrs)

3 Phase Induction Motors – Parts of Induction machine (squirrel cage and Wound rotor type), Concept of Rotating magnetic field, principle of operation, slip, synchronous frequency. Application. (3 Hrs)

Synchronous generator – construction, salient pole, cylindrical rotor type, principle of operation. (3 Hrs)

Basic structure of power system (block diagram only). (1 Hr)

Text Books:
1. Edward Hugs – Electrical & Electronic Technology, Pearson Education
2. Vincent Del Toro, Electrical Engineering Fundamentals, Pearson Education
3. SK Bhattacharya, Basic Electrical & Electronics Engineering, Pearson

University of Calicut B.Tech Syllabus - Combined First & Second Semesters - 2014
Reference:
2. JB Gupta, A course in electrical engg. SK. Kataria & Sons
3. BL Theraja, Electrical Technology Vol. 1,
4. K Uma Rao, Basic Electrical Engineering, Pearson

**Internal Continuous Assessment** *(Maximum Marks-25)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class

**University Examination Pattern for Section 1**

**PART A:** Analytical/problem solving SHORT questions  
4x 5 marks=20 marks

Candidates have to answer FOUR questions out of FIVE. There shall be minimum of TWO and maximum of THREE questions from each module with total FIVE questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions 2 x 15 marks=30 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 50*

**University Examination Pattern – for Section 1**

Note: Section 1 and Section 2 are to be answered in separate answer books Maximum 50 marks each for Section 1 and Section 2
SECTION 2: BASICS OF ELECTRONICS AND COMMUNICATION ENGINEERING

Objectives

- To impart knowledge about basic electronic and digital systems
- To give basic ideas about various communication systems (Only system level block diagram approach, no analysis required)

Module I (13 hours)

Amplifiers: Principle of electronic amplifiers – Block diagram representation – Classification – Significance of input impedance, output impedance, output power, power gain, voltage gain and frequency response – noise in amplifiers – cascaded amplifiers – concept of differential amplifiers and operational amplifiers –concept of oscillators. (6 Hours)

Digital Systems : Logic gates – logic states – Boolean algebra – algebraic logic minimisation – generating logic diagram from Boolean expression – introduction to TTL and CMOS logic – programmable logic devices .(4 Hours)

Measurements and Data Acquisition Systems: Working and block diagram of CRO – sensors – actuators – principle of digital voltmeter –principle of ADC and DAC.(3 Hours)

Module II (13 hours)


Text Books

2. Santhiram Kal, _Basic Electronics-Devices, Circuits & IT fundamentals_, PHI, New Delhi.
5. David A. Bell, _Electronic Instrumentation & Measurements_, PHI, New Delhi.
Internal Continuous Assessment *(Maximum Marks-25)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern for Section 1

**PART A:** Analytical/problem solving SHORT questions \[4 \times 5 \text{ marks}=20 \text{ marks}\]

Candidates have to answer FOUR questions out of FIVE. There shall be minimum of TWO and maximum of THREE questions from each module with total FIVE questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions \[2 \times 15 \text{ marks}=30 \text{ marks}\]

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 50*

**Note:** Section 1 and Section 2 are to be answered in separate answer books

Maximum 50 marks each for Section 1 and Section 2
EN14 108: ENGINEERING GRAPHICS
(Common for all branches)

Teaching scheme
1 hour lecture and 3 hours practical/drawing per week

Credits: 6

Objectives
By going through the contents student will be able to:
• Understand systems of drawing.
• Produce orthographic drawing of points, lines and solids.
• Produce isometric views of any object.
• Develop skill to produce perspective views of any object.
• Develop skill to convert the pictorial views of simple engineering objects into orthographic views.

Module – I (8 Hours; 2Drawing Exercises)
Drawing instruments and their use - Different types of lines - Lettering and dimensioning – Scales - Familiarization with current Indian Standard Code of practice for general engineering drawing - Construction of Conic sections - Construction of Cycloid, Involutes and Helix (For internal work assessment only, not for University Examination)

Module-II (27 Hours; 5 Drawing exercises)
a) Introduction to projections - Systems of projections - Vertical, Horizontal and Profile planes - Principles of first and third angle projections - Projections of points in different quadrants - Orthographic projections of straight lines parallel to both reference planes - Perpendicular to one of the reference planes - Inclined to one and parallel to other reference plane - Inclined to both the reference planes and occupied in one quadrant - Traces of lines - True length and inclination of a line with reference planes - Line occupied in more than one quadrant - Line inclined to the two reference planes but parallel to the profile plane.
b) Projections of plane lamina of geometrical shapes - Plane lamina parallel to one of the reference planes - Inclined to one and perpendicular to the other reference plane - Inclined to both the reference planes - Inclined to the two reference planes but perpendicular to the profile plane.

Module- III (24 Hours; 5 Drawing exercises)
a) Projections of Polyhedra, Solids of revolution and Frustums - Projections of solids with axis parallel to one and inclined to the other reference plane - Axis inclined to both the reference planes - Projections of solids on auxiliary planes (Solids to be drawn: Cube, Prisms, Pyramids, Tetrahedron, Cone and Cylinder)
b) Sections of solids - Sections by cutting planes parallel to the reference planes - Cutting plane inclined to one and perpendicular to other reference plane - True shape of the section by projecting on auxiliary plane (Solids to be drawn: Cube, Prisms, Pyramids, Tetrahedron, Cone and Cylinder)

Module- IV (18 Hours; 4 Drawing exercises)
a) Development of surfaces of solids - Method of parallel line and radial line developments - Development of Polyhedra, Cylinder, Cone and sectioned solids - Development of solids having hole or cut
b) Introduction to isometric projection - Isometric scale - Isometric views - Isometric projections of Prisms, Pyramids, Cylinder, Cone, Spheres, sectioned solids and combination of them.
Module- V (19 Hours; 4 Drawing exercises)
a) Introduction to perspective projections - Classification of perspective views - Visual ray and vanishing point method of drawing perspective projection - Perspective views of plane figures such as polygons and circles - Perspective views of solids like Prisms, Pyramids and Cube.

b) Introduction to multiview projection of objects - The principle of the six orthographic views - Conversion of pictorial views of simple engineering objects into orthographic views.
c) Conventional representation of threaded fasteners - Drawing of nuts, bolts, washers and screws - Locking arrangements of nuts - Bolted and screwed joints - Foundation bolts.

Module- VI (8 Hours; 2 Drawing exercises)
a) Introduction to Computer Aided Drafting (CAD) - Preparation of engineering drawings by using any software capable of drafting and modelling - Creation of simple figures like polygon and general multiline figures - Drawing of front view and top view of solid like Prism, Pyramid and Cylinder and dimensioning - Drawing of front view and top view of objects from pictorial view.
(For internal work assessment only, not for University Examination)

NOTE: All drawing exercises mentioned above are for class work. Additional exercises where ever necessary may be given as home assignments

Text Books

Reference Books.

Internal Continuous Assessment (Maximum Marks-50)
60% - Drawing exercises (Best 15 sheets)
40% - Tests (minimum 2)

University Examination Pattern
No question from modules I and VI

PART A
Q I Two questions (a) and (b) of 20 marks each from module II, one from module II (a) and one from module II(b), with choice to answer any one.
Q II Two questions (a) and (b) of 20 marks each from module III, one from module III(a) and one from module III(b), with choice to answer any one.
Q III Two questions (a) and (b) of 20 marks each from module IV, one from module IV(a) and one from module IV(b), with choice to answer any one.

PART B
Q IV 3 Questions (a), (b) and (c) of 20 marks each from module V, one from module V(a), one from module V(b) and one from module V(c), with choice to answer any two.
EN14 109: HUMANITIES AND COMMUNICATION SKILLS
(Common to all branches)

Teaching scheme
2 hour lecture and 1 hour tutorial per week

A minimum of 12 Tutorial hours can be utilized for Language lab/extra mural lectures on communication and other topics of social and technical importance.

Objectives
- To identify the most critical issues that confronted particular periods and locations in history;
- To identify stages in the development of science and technology;
- To understand the purpose and process of communication;
- To produce documents reflecting different types of communication such as technical descriptions, proposals, and reports;
- To develop a positive attitude and self-confidence in the workplace; and
- To develop appropriate social and business ethics.

Module I (16 hours)

Module II (23 hours)
Concept of communication: The speaker/writer and the listener/reader, medium of communication, barriers to communication, accuracy, brevity, clarity and appropriateness Reading comprehension: Reading at various speeds, different kinds of text for different purposes, reading between lines. Listening comprehension: Comprehending material delivered at fast speed and spoken material, intelligent listening in interviews Speaking: Achieving desired clarity and fluency, manipulating paralinguistic features of speaking, task oriented, interpersonal, informal and semi formal speaking, making a short classroom presentation. Group discussion: Use of persuasive strategies, being polite and firm, handling questions and taking in criticisms on self, turn-taking strategies and effective intervention, use of body language.

Module III (23 hours)
Written Communication: Note making and taking, summarizing, notes and memos, developing notes into text, organization of ideas, cohesion and coherence, paragraph writing, ordering information in space and time, description and argument, comparison and contrast, narrating events chronologically. Writing a rough draft, editing, proof reading, final draft and styling text.
Module IV (16 hours)
Human relations and Professional ethics: Art of dealing with people, empathy and sympathy, hearing and listening. Tension and stress, Methods to handle stress
Responsibilities and rights of engineers- collegiality and loyalty – Respect for authority – Confidentiality – conflicts of interest – Professional rights, Rights of information, Social responsibility
Senses of ethics – variety of moral issues – Moral dilemma – Moral autonomy – Attributes of an ethical personality – right action – self interest

Reference Books

3. Subrayappa, *History of Science in India*, National Academy of Science, India
11. Encyclopaedia Britannica, *History of Science, History of Technology*
13. Sanjay Kumar and Pushpalata, *Communication skills, Oxford University Press, 2011*

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

*PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks*
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

*PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks*
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
EN 14 110 (P): MECHANICAL WORKSHOPS
(Common for all branches)

Teaching scheme
2 hours practical per week

Credits: 2

Objectives
- To inculcate engineering aptitude, confidence and experience towards technical skills
- To train the students mentally and physically for industries
- To impart knowledge and technical skills on basic manufacturing methods

A. Carpentry: study of tools and joints – planing, chiselling, marking and sawing practice, different joints, use of power tools

B. Fitting: study of tools, chipping, filing, cutting, drilling, tapping, male and female joints, stepped joints

C. Smithy: study of tools, forging of square prism, hexagonal bolt

D. Foundry: study of tools, sand preparation, moulding practice

E. Sheet Metal work: study of tools, selection of different gauge sheets, types of joints, trays and containers

F. Welding: study of tools, different types of joints, practice

At least 3 models should be completed by the student in each section.

Internal Continuous Assessment (Maximum Marks-100)
50% - Laboratory practical and record
40% - Test
10% - Regularity in the class
EN 14 111(P) ELECTRICAL AND CIVIL WORK SHOPS  
(Common for all branches)

Teaching scheme  
2 hours of practical per week  

Credits: 2

SECTION 1: ELECTRICAL ENGINEERING WORK SHOP

Objective

• To impart a basic knowledge of electrical circuits, machines and power systems.

List of experiments

1. Familiarization of various types of Service mains – Wiring installations – Accessories and house hold electrical appliances.
2. Methods of earthling- Measurement of earth resistance- Testing of electrical installations- Precautions against and cure from electric shock
3. Practice of making different joints (Britannia, Married and T- Joints) on copper/ aluminium ba
4. Wiring practice of a circuit to control two lamps by two SPST switches.
5. Wiring practice of a circuit to control one lamp by two SPDT switches.
6. Wiring practice of a circuit to control one fluorescent lamp and one three pin plug socket.
7. Wiring practice of a main switch board consisting of ICDP switch, DB, MCB’s and ELCB’s.
8. Familiarization of various parts of electrical motors and wiring of three phase and single phase motor with starter.
9. Familiarization of energy meter and measurement of energy consumption by a single phase load.
10. Familiarization of various electrical and electronic components such as transformers, resistors, AF and RF chokes, capacitors, transistors, diodes, IC’s and PCB.
11. Assembling and soldering practice of single phase full wave bridge rectifier circuit with i) capacitor circuit ii) regulator IC

Internal Continuous Assessment (Maximum Marks-50)
50% - Laboratory practical and record
40% - Test
10% - Regularity in the class
SECTION 2: CIVIL ENGINEERING WORK SHOP

Objectives
- To provide experience on plotting, measuring/determining horizontal distances, level differences between stations and horizontal angles
- To provide experience on setting out for small buildings, masonry construction, plumbing work and model making.

1. Chain Surveying - Study of chain and accessories, Plotting one side of a building/Five or six points in the field using chain and cross-staff
2. Compass surveying (Study of compass, Plotting one side of a building/Five or six points in the field using compass
3. Levelling - Study of levelling instruments, Determination of reduced levels of five or six points in the field.
4. Theodolite - Study of Theodolite, Measuring horizontal angles
5. Setting out practice
6. Brick Masonry
7. Plumbing - Demonstration of plumbing fixtures-Exercise in joints
8. Model making of simple solids

Internal Continuous Assessment (Maximum Marks-50)
50% - Laboratory practical and record
40% - Test
10% - Regularity in the class
SYLLABUS & CURRICULUM

of

B.Tech.

BIOTECHNOLOGY

(3rd to 8th semesters)

UNIVERSITY OF CALICUT

(2014 admission)
### SCHEME OF III SEMESTER B. Tech. COURSE

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**Note:** For EN 14 302 Computer Programming in C, the end semester examination will be held by the University as a theory paper.

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**Total Credits =210**

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**Total Credits =210**
Elective I
BT14 704 (A) Transport Phenomena in Bioprocess Systems
BT14 704 (B) Computer Based Numerical Methods
BT14 704 (C) Biopolymers
BT14 704 (D) Hazardous Waste Management
BT14 704 (E) Process Modeling and Simulation (G)
BT14 704 (F) Cancer Biology

Elective II
BT14 705 (A) Developmental Biology
BT14 705 (B) Molecular Medicine
BT14 705 (C) Gene and Stem Cell Therapy
BT14 705 (D) Modeling and Scale up of Bioreactors
BT14 705 (E) Molecular Modeling and Drug Design (G)
BT14 705 (F) Genomics and Proteomics

Elective III
BT14 804 (A) Bioethics and Intellectual Property Rights (G)
BT14 804 (B) Biomaterials
BT14 804 (C) Nanobiotecnology
BT14 804(D) Immunology and Immunotechnology
BT14 804 (E) Recombinant DNA Technology
BT14 804 (F) Basics of Plant and Animal Biotechnology

Elective IV
BT14 805 (A) Project Engineering
BT14 805 (B) Entrepreneurship Development (G)
BT14 805 (C) Energy Engineering
BT14 805 (D) Total Quality Management
BT14 805 (E) Membrane Separation Technology
BT14 805 (F) Protein Engineering
THIRD SEMESTER

EN14 301: ENGINEERING MATHEMATICS III

(Common for all branches)

Teaching scheme

Credits: 4
3 Hrs lecture and 1 hour tutorial per week

Objective

- To provide a quick overview of the concepts and results in complex analysis that may be useful in engineering.
- To introduce the concepts of linear algebra and Fourier transform which results with wide area of application.

Module I: Functions of a Complex Variable (15 hours)

Functions of a Complex Variable – Limit – Continuity – Derivative of a Complex function – Analytic functions – Cauchy-Riemann Equations – Laplace equation – Harmonic Functions – Conformal Mapping – Examples: $e^z$, $\sin z$, $\cosh z$, $(z^1/z)$ – Mobius Transformation.

Module II: Functions of a Complex Variable (15 hours)


Module III: Linear Algebra (15 hours) – (Proofs not required)


Module IV: Fourier Transforms (15 hours)


Text Books

Module I:
University of Calicut

**Module II:**

**Module III:**
Sections: 6.1, 6.2, 6.3, 6.4, 6.8, Appendix.B.1

**Module IV:**

**Reference**


**Internal Continuous Assessment (Maximum Marks-50)**

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

**University Examination Pattern**

**PART A:** Analytical/problem solving SHORT questions 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EN14 302 COMPUTER PROGRAMMING IN C

(Common for all branches)

Teaching scheme

Credits: 4

2 Hrs lectures and 2hour lab per week

Objectives

- To impart the basic concepts of computer and information technology
- To develop skill in problem solving concepts through learning C programming in practical approach.

Module I (15 hours)


Module II (15 hours)


Module III (15 hours)


Module IV (15 hours)


Text Books

University of Calicut


**Internal Continuous Assessment** *(Maximum Marks-50)*

50% - Lab Practical Tests

20% - Assignments

20% - Main Record

10% - Regularity in the class

**University Examination Pattern**

**PART A: Analytical/problem solving SHORT questions** 8 x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions** 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

**BT14 303 FLUID FLOW OPERATIONS**

**Teaching Scheme:**
3 hrs lecture and 1 hour tutorial per week

**Credits: 4**

**Objectives:**
- To impart the basic concepts of fluid statics and dynamics
- To study the basic equations of flow
- To study about the metering and pumping of fluids
University of Calicut

- To study about the flow of fluids through packed beds and fluidized beds

Module 1 [15 hrs]

Module II [15 hrs]
Basic equation of fluid flow. Equation of continuity, equation of motion, Euler equation, Bernoulli equation, momentum equation. Kinetic energy and fluid friction correction factors. Laminar flow of incompressible fluids in pipes and conduits. Shear stress and velocity distribution in circular channels. The friction factor, Hagen-Poiseuille equation. Darcy and Weisbach equation. Concept of equivalent diameter. Friction factor chart, Friction losses from change in velocity and direction and loss due to pipe fittings. Turbulent flow, universal velocity distribution equations, friction factor- Reynolds number relationship, Nikuradse- Carman Equation, average velocity, Blassius equation (derivation not required), Prandtl’s law.

Module III [15 hrs]
Transportation and metering of fluids. Pipes and pipe standards, tubings, pipe joints, flange, expansion joints, valves, automatic control valves. Different types of pumps. Description and comparison of rotary pumps, reciprocating pumps, jet pumps, air lift, and diaphragm pumps. Detailed study of centrifugal pumps - velocity diagrams, developed head, volumetric flow rate relation, various losses, characteristic curves, NPSH, cavitation, pump priming. Flow measuring devices - venturiometer, orifice meter, pitot tube, rotameter, weirs and notches.

Module IV [15 hrs]

BT14 304 MICROBIOLOGY

Teaching Scheme:
3 Hrs lecture and 1 hr tutorial per week Credits: 4

Objectives:
- To develop knowledge of the nature and characteristics of microorganisms
- To evaluate the role of microbes in public health and various industries

Module 1 [15 hrs]
History and development of microbiology. Microbial diversity. Principles of microbial taxonomy.

Module II [15 hrs]
Nutritional requirements of microorganisms, Nutritional types of bacteria – Formulation of growth medium and different types of media- Synthetic media, complex media Selective media, differential media, enrichment media, enriched media. Pure culture techniques- Spread plate, Pour plate and streak plate, preservation and maintenance of cultures.

Module III [15 hrs]
Microbial growth – growth curve, generation time. Batch culture, Fed batch culture and continuous culture, Synchronous culture- techniques adopted to generate synchronous culture, Measurement of microbial growth. Enumeration techniques- cell numbers and cell mass. Influence of environmental factors on growth

Module IV [15 hrs]
Microbiological analysis of water- Test for coliforms, Microbial flora of soil. Interactions among soil microorganisms - Mutualism, commensalisms, predation, parasitism, amensalism, competition, symbiosis. Use of micro organisms as biofertilizer and bioinsecticide. Microbial spoilage of foods and preservation of foods-Physical and chemical methods, Food borne diseases and intoxications.

Text books:
1. M.J.Pelczar Et Al, Microbiology, Tata Mcgraw Hill
2. Prescott Et Al:Microbiology, Mcgraw Hill, USA
3. Dubey and Maheswari, A textbook of Microbiology , S Chand Publications
4. Tauro, Kapoor &Yadav; An introduction to microbiology,Wiley Eastern Ltd.

Reference Books:
3. Introduction to Microbiology: Ross
4. General Microbiology: Stainier, Adelberq and Ingraham.

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

Note: One of the assignments shall be simulation of systems using any technical

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions  4 x 15 marks=60 marks**

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

**BT14 305 BIOCHEMISTRY – I**

**Teaching Scheme:**
3 Hrs lecture and 1 hr tutorial

**Credits: 4**

**Objectives :**
- To understand the fundamental aspects of life
- To impart the knowledge of the elemental composition of biomolecules

**Module 1 [15 hrs]**

**Module II [15 hrs]**

**Module III [15 hrs]**

**Module IV [15 hrs]**

**Text books:**

1. Vasudevan and Sreekumar – A Text book of Biochemistry for Medical Students , Jaypee Publications
Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

**Note:** One of the assignments shall be simulation of continuous systems using any technical computing software

**University Examination Pattern**

**PART A:** Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

**BT14 306: BIO PROCESS CALCULATIONS**

**Teaching Scheme:**
3 Hrs lecture and 1 hr tutorial

**Credits:** 4

**Objectives**

- To study the laws regarding gas, liquid and vapour
- To develop understanding about material balance and energy balances
- To study the stoichiometry and thermodynamics of microbial growth and product formation

**Module 1 [15 hrs]**

*Introduction to bioprocesses:* Historical development of bioprocess technology, an overview of traditional and modern applications of biotechnological processes, role of bioprocess engineer in the biotechnology industry, outline of an integrated bioprocess and the various (upstream and downstream)
Fermentation processes: General requirements of fermentation processes, Basic design and construction of fermentor and ancillaries, Main parameters to be monitored and controlled in fermentation processes, An overview of aerobic and anaerobic fermentation processes and their application in the biotechnology industry, solid-substrate fermentation and its applications.

Module II [15 hrs]

Module III [15 hrs]

Module IV [15 hrs]

TEXT BOOKS

REFERENCES
3. Harvey W. Blanch, Douglas S. Clark, —Biochemical Engineering, Marcel Dekker, Inc.
5. Gavhane K. A., Introduction to Process Calculations Stoichiometry, Nirali Prakashan
6. David M Himmelblau— Basic principles and calculations in Chemical Engg – Prentice Hall
**Internal Continuous Assessment (Maximum Marks-50)**

- 60% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- 10% - Regularity in the class

**Note:** One of the assignments shall be solution using any technical computing software

**University Examination Pattern**

*PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

*PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

**BT14 307 (P) MICROBIOLOGY LABORATORY**

**Teaching Scheme:**
3 hours practical per week

**Credit:** 2

**Objectives**
- To attain knowledge about the morphology and in vitro cultivation of microorganisms
- To study about the microbial analysis of food water and soil

**Experiments:**

1. Sterilization techniques; Wet heat, dry heat, filtration, disinfection
2. Preparation of culture media, cotton plugging and sterilization
3. Culturing of microorganisms: broth, agar, pure culture, streak Plate, pour plate, Spread plate isolation and preservation of bacterial culture.
4. Identification of microorganisms: Staining techniques, Simple staining, Gram staining, spore, capsule, fungal staining, and biochemical test- Carbohydrate Fermentation, IMViC, TSI, Urease Test.
5. Quantification of microorganisms: counting microscopy, nephelometry /turbidometry, total N or dry weight.
6. Growth curve of bacteria
7. Microbiological analysis of water,
8. Food microbiology: milk, fermented food. Salmonella in poultry
9. Factors affecting the bacterial growth: effect of temperature and pH
11. Microbial population in soil
12. Isolation of nitrogen fixing organisms.

REFERENCE
1. Micro Biology: Laboratory Theory and applications, M.J. Heboffee aw BE Pierce

Sessional work assessments

Lab Practical and Record = 60%
Two tests (2 x 10) = 30%
Regularity = 10%
Total marks = 50

Semester end examination

Fair record = 10%
Viva voce = 20%
Procedure and tabulation form, Conducting experiments and results = 70%
Total marks = 100

BT14 308 (P) BIOCHEMISTRY LABORATORY

Teaching Scheme:
3 hours practical per week Credits: 2

Objective:
- To study about the qualitative and quantitative analysis of biomolecules
- To analyze the biomolecules in a living tissue

Experiments:

1. Units, Volume and weight measurements, concentration units, pH measurement,
2. Preparation of buffers.
3. Qualitative tests for (a) carbohydrates and (b) amino acids
4. Estimation of reducing sugars by the Benedicts’ method.
5. Quantitative estimation for amino acids-Ninhydrin method.
6. Protein estimation by Biuret/Folins’/Bradford method.
7. Extraction, Identification and quantification of biomolecules from living tissues (Plant & Animal).
8. Extraction of lipids
9. Saponification of fats
10. Estimation of cholesterol
11. Estimation of nucleic acids: (a) Estimation of DNA (b) Estimation of RNA
12. Trypsin digestion of proteins

REFERENCES
SESSIONAL WORK ASSESSMENTS

Lab Practical and Record = 60%
Tests = 30%
Regularity = 10%
Total marks = 50

SEMESTER END EXAMINATION

Fair record = 10%
Viva voce = 20%
Procedure and tabulation form,
Conducting experiments and results = 70%
Total marks = 100

FOURTH SEMESTER

EN14 401A: Engineering Mathematics IV
(Common for ME, CE, PE, CH, BT, PT, AM, and AN)

Teaching scheme
3 hour lecture and 1 hour tutorial

Objective

- To provide a comprehensive introduction to those models and methods most likely to be encountered and used by students in their careers in engineering.
- To provide an introduction to some important partial differential equations

Module I: Probability Distributions (15 hours)

Module II: Theory of Inference (15 hours)
Module III: Series Solutions of Differential Equations (15 hours)

Module IV: Partial Differential Equations (15 hours)
Introduction – Formation of PDE – Complete Solution – Equations solvable by direct integration – Linear
PDE of First order, Lagrange's Equation: $Pp + Qq = R$ – Non-Linear PDE of First Order, $F(p,q) = 0$, Clairaut's Form: $z = px + qv + F(p,q)$, $F(z,p,q) = 0$, $F_1(x,q) = F_2(y,q)$ – Classification of Linear PDE's – Derivation of one dimensional wave equation and one dimensional heat equation – Solution of these equation by the method of separation of variables.

Text Books

Module I:
Richard A Johnson, CB Gupta, Miller and Freund's Probability and statistics for Engineers, 7e, Pearson Education- Sections: 4.1, 4.2, 4.3, 4.4, 4.6, 4.8, 5.1, 5.2, 5.5, 5.7

Module II:
Richard A Johnson, CB Gupta, Miller and Freund’s Probability and statistics for Engineers, 7e, Pearson Education- Sections: 6.1, 6.2, 6.3, 6.4, 7.2, 7.4, 7.5, 7.8, 8.1, 8.2, 8.3, 9.5

Module III:
Erwin Kreysig, Advanced Engineering Mathematics, 8e, John Wiley and Sons, Inc.-Sections: 4.1, 4.4, 4.5

Module IV:

Reference books

**Internal Continuous Assessment (Maximum Marks-50)**

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

**University Examination Pattern**

**PART A: Analytical/problem solving SHORT questions**

8 x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**

4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

**EN14 402: ENVIRONMENTAL SCIENCE**

(Common for all branches)

**Teaching scheme**

3 hours lecture and 1 hour tutorial per week

**Credits: 4**

**Objectives**

- To understand the problems of pollution, loss of forest, solid waste disposal, degradation of environment, loss of biodiversity and other environmental issues
- To create awareness among the students to address these issues and conserve the environment in a better way.

**Module I (15 hours)**
The Multidisciplinary nature of environmental science. Definition-scope and importance-need for public awareness. Natural resources. Renewable and non-renewable resources: Natural resources and associated problems-forest resources: Use and over exploitation, deforestation, case studies. Timber extraction,
University of Calicut

mining, dams and their defects on forests and tribal people- water resources: Use and over utilization of surface and ground water, floods, drought , conflicts over water, dams-benefits and problems.- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.- Food resources: World food problems, changes caused by agriculture over grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.-Energy resources: Growing energy needs, renewable and non-renewable energy resources, use of alternate energy resources, Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Module II (15 hours)

Ecosystems-Concept of an ecosystem-structure and function of an ecosystem – producers, consumers, decomposers-energy flow in the ecosystem-Ecological succession- Food chains, food webs and Ecological pyramids-Introduction, types, characteristics features, structure and function of the following ecosystem-Forest ecosystem- Grassland ecosystem –Desert ecosystem-Aquatic ecosystem(ponds, streams, lakes, rivers, oceans , estuaries)


Module III (15 hours)

Environmental pollution Definition-Causes, effects and control measures of Air pollution- Water pollution –soil pollution-Marine pollution-Noise pollution-Thermal pollution-Nuclear hazards-Solid waste management: Causes, effects and control measures of urban and industrial wastes-Role of an individual in prevention of pollution. Pollution case studies-Disaster management: floods , earth quake, cyclone and landslides-Environmental impact assessment

Module IV (15 hours)

Environment and sustainable development-Sustainable use of natural resources-Conversion of renewable energy resources into other forms-case studies-Problems related to energy and Energy auditing-Water conservation, rain water harvesting, water shed management-case studies-Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust-Waste land reclamation Consumerism and waste products-Reduce, reuse and recycling of products-Value education.

Text Books:
1. Daniels & Krishnaswamy, Environmental studies, Wiley India Pvt Ltd, 2009

References:
2. S.P Misra, S.N Pandey, Essential Environmental studies, Ane books, Pvt Ltd, 2009
Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

Note: Field work can be Visit to a local area to document environmental assets - river/forest/ground/mountain or Visit to local polluted site-urban/rural/industrial/agricultural etc. or Study of common plants, insects, birds etc. or Study of simple ecosystems-pond, river, hill slopes etc. or mini project work on renewable energy and other natural resources , management of wastes etc.

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

BT14 403 CELL BIOLOGY

Teaching Scheme:
3 Hrs lecture and 1 hr tutorial per week Credit: 4

Objectives:

- To understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
- To understand the cellular components underlying mitotic cell division.

Module I [15 hrs]
Introduction to cell theory - prokaryotic cells - eukaryotic cells - cell number - plant and animal cells - cell as a polyphasic colloidal system – ultra-structure and chemical composition of plasma membrane - membrane asymmetry - fluidity in plasma membrane - pores - glycocalyx - functions of plasma
membrane - permeability and transport - structure of plant cell wall and bacterial cell wall.

**Module II [15 hrs]**


**Module III [15 hrs]**


**Module IV [15 hrs]**

Cell division - mitosis - karyokinesis – cytokines is - cytoplasmic events - process and significance of meiosis - spermatogenesis and cogeneration


**Text Books:**


**Reference Books**

1. Darnell, Lodish and Baltimore : *Molecular Cell Biology*, W.H. Freeman
3. The Cell by Cooper. ASM Press

**Internal Continuous Assessment (Maximum Marks-50)**

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

**University Examination Pattern**

**PART A: Analytical/problem solving SHORT questions** 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions** 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

BT14 404 BIOCHEMISTRY II

Teaching Scheme:
3 Hrs lecture and 1 hr tutorial

Credits: 4

Objectives

- To impart complete understanding of biochemical processes associated with the living cell
- To enable the students to see how metabolic pathways communicate with each other

Module I [15 hrs]

Module II [15 hrs]
Metabolism of proteins - essential and non-essential amino acids - degradation and biosynthesis of amino acids - urea cycle : reactions, regulation and its linkage with the citric acid cycle - metabolism of aromatic amino acids, cysteine, histidine and serine.

Module III [15 hrs]
Metabolism of lipids - fatty acid oxidation - ketone bodies - ketosis - biosynthesis of fatty acids and triglycerides - metabolism of phospholipids - cholesterol metabolism. Metabolism of nucleic acids - Denovo biosynthesis of purine and pyrimidine nucleotides - regulation of purine and pyrimidine nucleotide biosynthesis - salvage pathways of purines and pyrimidines - formation of deoxyribonucleotides - catabolism of purines and pyrimidines.

Module IV [15 hrs]

Text books:
1. Vasudevan and Sreekumar – A Text book of Biochemistry for Medical Students , Jaypee Publications
3. Jain and Jain , Fundamentals of Biochemistry, S Chand Publications

References:
Internal Continuous Assessment  (Maximum Marks-50)

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

BT14 405 ANALYTICAL TECHNIQUES IN BIOTECHNOLOGY

Teaching Scheme:
3 Hrs lecture and 1 hr tutorial

Credits: 4

Objectives:

- Provide an understanding of the principles and practical applications of the major analytical techniques used in Biotechnological Applications
- To understand the advantages and disadvantages of different analytical techniques and their use in the identification and characterization of bio-molecules

Module I [15 hrs]
Photometry and spectro-photometry : The Beer-Lambert Law, percentage transmittance and absorbance; photoelectric colorimeters; spectrophotometers - types, UV visible, IR, atomic absorption, NMR and mass spectro-photometers.

Module II [15 hrs]
Chromatography : Partition chromatography - mobile and stationary phases paper chromatography - solvent systems - development of Rf value- ascending and descending techniques - two dimensional chromatography - thin layer chromatography.

Column chromatography - preparation of columns - gradient elution - analysis of fraction and elution profiles - ion exchange chromatography - preparation and activation of ion exchange materials - affinity chromatography - separation of macromolecules - gas chromatography and high performance liquid
University of Calicut
chromatograph (HPLC).

Module III [15 hrs]

Differential centrifugation - preparation of cellular organelle and other materials ; disintegration of cells , density gradient centrifugation; analytical ultracentrifuge - determination of molecular weight.

Module IV [15 hrs]

Text Books
1. T.G. Cooper : Tools of Biochemistry, Wiley Interscience

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

Note: One of the assignments shall be simulation of continuous systems using any technical computing software

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
BT14 406 MECHANICAL OPERATIONS

Teaching Scheme:
3 Hrs lecture and 1 hr tutorial per week

Credits: 4

Objectives:
- To impart the basic concepts of size reduction and the knowledge about the size reduction equipments
- To study about the various mechanical separation operations

Module I [15 hours]

Module II [15 hours]

Module III [15 hours]

Module IV [15 hours]

Text
1. Mc Cabe & Smith: "Unit operations in Chemical Engg" McGraw Hill
3. Badger and Benciero, "Introduction to Chemical Engineering", Mc Graw Hill

References
University of Calicut
2. Foust A.S. et al, Principles of Unit Operations, John Wiley
4. George Granger Brown, Unit Operations, Wiley

**Internal Continuous Assessment** *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

**University Examination Pattern**

*PART A: Analytical/problem solving SHORT questions* 
8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. 
There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

*PART B: Analytical/Problem solving DESCRIPTIVE questions* 
4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

**BT14 407 (P) FLUID MECHANICS & MECHANICAL OPERATIONS LAB**

**Teaching Scheme:**
3 hours practical per week

**Credits 2**

**Objective:**
- *To study about various fluid flow operations, particle analysis and mechanical separation*

**Experiments**
1. Characteristic curves of a centrifugal pump and determination of maximum efficiency.
2. Determination of coefficient of discharge of orifice meter and venturi meter.
3. Drag coefficient of a falling sphere in fluid.
4. Pressure drop of liquid passing through a packed bed.
5. Pressure drop characteristics of a fluidized bed.
8. Sieve analysis-determination of particle size.
9. Effectiveness of a screen
10. Pipette analysis
11. Determination of the mean specific cake resistance and compressibility factor using a
13. batch leaf filter.
14. Batch sedimentation in a slurry
15. Flocculation screening
17. Study of Jaw crusher

Sessional work assessments
Lab Practical and Record = 60%
Tests = 30%
Regularity = 10%
Total marks = 50

Semester End examination
Fair record = 10%
Viva voce = 20%
Procedure and tabulation form,
Conducting experiments and results = 70 %
Total marks = 100

BT14 408(P) BIOANALYTICAL TECHNIQUES LAB

Teaching Scheme:
3 hours practical per week Credits 2

Objective:
• To provide experience in various bioanalytical techniques in biotechnology

Experiments
1. Precision, accuracy and validity of an experiment. Analysis and presentation of data.
2. Colorimetry and spectrophotometry
3. Verification of Beer-Lambert’s law-using UV-Vis spectrophotometer.
   a. Change in absorbance with concentration of potassium permanganate.
   b. Absorption maxima– change in absorbance in potassium permanganate with wavelength.
   c. Concentration of two components in a binary mixture. Absorption of light by potassium dichromate and potassium permanganate.
   d. Change in absorbance of albumin and DNA solution with wave length.
4. Absorption spectra of nucleotides
5. Separation of amino acids by paper chromatography Determination of Rf value.
6. Extraction of lipids and separation using thin layer chromatography
7. Column chromatography
8. Determination of molecular weight of an enzyme by gel filtration.
10. Separation of nucleic acids by agarose gel electrophoresis

Sessional work assessments
Lab Practical and Record = 60%
Tests = 30%
Regularity = 10%
Total marks = 50
Semester End examination
Fair record = 10%
Viva voce = 20%
Procedure and tabulation form,
Conducting experiments and results = 70%
Total marks = 100

FIFTH SEMESTER

BT14 501: MASS TRANSFER OPERATIONS

Teaching Scheme:
3 Hrs lecture and 1 hr tutorial per week

Credits: 4

Objectives:
- To impart the basic concepts of mass transfer
- To develop an understanding of different separation processes like Distillation, extraction, drying and crystallization

Module I [15 hrs]
Classification of mass transfer operations Diffusional mass transfer Fick’s law. One component transferring to non-diffusing component and equimolar counter diffusion diffusivity estimation. The mass transfer coefficient. Dimensionless groups in mass transfer. Theories of mass transfer. Film theory, Penetration theory, surface – renewal theory, the boundary layer theory. Momentum, heat and mass transfer analogies. Interphase mass transfer. The two-film theory, the overall mass transfer coefficient. General features of equipment for mass transfer – Tray tower, packed tower, bubble column, and spray tower.

Module II [15 hrs]
Basic concepts of distillation – vapor – liquid equilibrium, the Raoult’s law, Relative volatility, Deviations from ideality. Flash vaporization of a binary mixture, simple distillation, continuous fractionation, McCabe-Thiele method, Ponchon, - Savarit method, minimum reflux ratio. Total reflux, optimum reflux ratio. Design of packed towers.

Module III [15 hrs]
Liquid – liquid extraction applications, Liquid – liquid equilibrium. Solvent selection, Design calculations for stage wise extraction, single stage and multi stage operation, crosscurrent and countercurrent operations, liquid – liquid extraction equipment. Super critical fluid extraction. Leaching-Applications, Heap and insitu leaching, single stage and multistage leaching. Leaching equipments.

Module IV [15 hrs]
Text book:
2. McCabe-Smith — *Unit operations of Chemical Engg* McGraw Hill International

References:

2. Seader J. D. & Henley E. J., *Separation Process Principles*

Internal Continuous Assessment (*Maximum Marks* 50)

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

**Note:** One of the assignments shall be problem solution using any technical computing software

University Examination Pattern

**PART A:** Analytical/problem solving SHORT questions 8 x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

**Note:** Use of Heat and Mass Transfer data book, Steam Tables and attested copies of relevant charts are permitted for examination.

**BT14 502 CHEMICAL REACTION ENGINEERING**

Teaching Scheme:
3 Hrs lecture and 1 hr tutorial  
**Credits:** 4

Objectives:

- To impart the basic concepts of reaction kinetics
University of Calicut

- To develop knowledge for design of ideal reactors
- To study about non-isothermal reactor design
- To study about the fundamentals of non-ideal reactors and heterogeneous catalytic reactors.

Module I [15 hrs]

Module II [15 hrs]

Module III [15 hrs]

Module IV [15 hrs]

Commercially significant types of heterogeneous catalytic reactors (description only) like fixed bed reactor, trickle bed reactor, moving bed reactor, fluidized bed reactor and slurry reactor.

Text book/References

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

Note: One of the assignments shall be problem solving using any technical computing software

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO
PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

BT14 503 ENZYME SCIENCE AND ENGINEERING

Teaching Scheme:
3 Hrs lecture and 1 hr tutorial per week

Credit: 4

Objective:
- To impart the basic concepts of enzymes and the reactors involved in free and immobilized enzyme system
- To understand the kinetics and physicochemical characteristics of enzymes

Module I [15 hrs]
Classification of enzymes. Production and purification of crude enzymes. Extracts from plant, animal and microbial sources. Mechanism of Enzyme action, Concept of active site, enzyme-substrate complex and enzyme action, Role of co factors. Specificity of enzymes, Activity of enzymes, Commercial application of enzymes in food, pharmaceutical and other industries. Enzymes for analytical and diagnostic applications.

Module II [15 hrs]

Module III [15 hrs]

Module IV [15 hrs]
Batch Operation of a stirred reactor Time course for batch enzyme reaction. Continuous operation in a stirred tank reactor. Immobilized enzyme reaction in a CSTR and plug flow reactor. Design of immobilized enzyme reactors – packed bed, fluidized bed and membrane reactors. Enzyme biosensors, clinical application of enzymes, design of enzyme electrodes and their application in industry, health care and environment.

Text books
1. Harvey W. Blanch, Douglas S. Clark, —Biochemical Engineeringl, Marcel Dekker, Inc.
2. James M. Lee, —Biochemical Engineeringl, PHI, USA.
3. Lehninger , Principles of Biochemistry CBS Publications
References

4. Tailer, R.F. *—Protein Immobilization – Fundamentals and applications*.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

Note: One of the assignments shall be simulation of continuous systems using any technical computing software

University Examination Pattern

*PART A: Analytical/problem solving SHORT questions*  
8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

*PART B: Analytical/Problem solving DESCRIPTIVE questions*  
4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

BT14 504 THERMODYNAMICS AND HEAT TRANSFER

Teaching Scheme:

3 Hrs lecture and 1 hr tutorial per week  
Credit: 4

Objective:

- To impart the basic concepts of thermodynamics and heat transfer
- To study the design of various types of heat exchangers

Module – I [15 hrs]


Module – II [15 hrs]

Module – III [15 hrs]

Module – IV [15 hrs]


Reference Books

5. Y.V.C. Rao, Chemical Engineering Thermodynamics, Universities Press

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

**Note:** One of the assignments shall be simulation of systems using any technical computing software
PART A: Analytical/problem solving SHORT questions 8x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

Note: Use of Heat and Mass Transfer data book, Steam Tables and attested copies of relevant charts are permitted for examination.

BT14 505 BIOINFORMATICS

Teaching Scheme:
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objective:
- To understand the fundamental principles of bioinformatics and using the knowledge to tackle various research problems in molecular biology

Module I [15 hrs]

Module II [15 hrs]
Introduction of databases, Biological databases and their use, Databanks – nucleotide databanks – Genebank, NCBI, EMBI, DDBJ – Protein databanks – sequence databanks – PIR, SWISSPROT, TrEMBL – structural databases – PDB, SCOP, CATH, SSEP, CADB, Pfam and GDB. Data base search, sequence submission, Sequin, Bankit, Sakura, Database search – FASTA-BLAST.

Module III [15 hrs]

Module IV [15 hrs]
University of Calicut

**Special topics in bioinformatics**


**Text Books:**
1. Introduction to Bioinformatics: T K Attwood & D J Parry Smith
2. Dan E Krane, Michael L Raymer. Fundamental concepts of Bioinformatics, Benjamin Cummings

**References:**
5. Rastogi, Mendiratta, & Rastogi, Bioinformatics Methods & Applications, PHI Learning Pvt Ltd

**Internal Continuous Assessment (Maximum Marks 50)**

- 60% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- 10% - Regularity in the class

**Note:** One of the assignments shall be simulation of continuous systems using any technical computing software

**University Examination Pattern**

**PART A: Analytical/problem solving SHORT questions**

8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**

4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

**BT14 506 MOLECULAR BIOLOGY**

**Teaching Scheme:**
3 Hrs lecture and 1 hr tutorial

Credits: 4

**Objectives:**
To get a proper understanding about the central dogma of the molecular mechanism
To study the analytical techniques used in molecular biology

Module – I [15 hrs]

Module – II [15 hrs]

Module – III [15 hrs]

Module – IV [15 hrs]

Text Books:
2. R C Dubey Text book of Molecular Biology S Chand Publishers

References:
2. Bruce Albert and James, DWatson: —Molecular Biology of the cell. Garland publishing.
3. Essentials of molecular Biology, Malacinski and Freifelder Jones and Bartlet Publishers.
4. Genomes, T. A. Brown, John Wiley and Sons PTE Ltd.
5. The Cell - A molecular approach, Gm Cooper Asm Press.

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions** 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

**BT14 507(P) MOLECULAR BIOLOGY LAB**

**Teaching Scheme:**
3 hours practical per week  
Credits: 2

**Objectives:**
- To understand the fundamental techniques of molecular biology and genetic Engineering

**Experiments:**
1. Isolation and quantification of genomic DNA from prokaryotic and eukaryotic cells.
2. Gel electrophoretic separation of DNA and molecular weight determination
3. Isolation, separation and quantification of RNA from eukaryotic and prokaryotic cells
4. Gel extraction of DNA
5. Restriction analysis of DNA
6. Transformation in E.coli
7. Isolation of plasmid DNA from prokaryotic cells
8. Cloning of DNA into plasmid vector.
9. Transblot analysis of DNA
10. PCR amplification of DNA
11. Conjugation in E.coli
12. Isolation of proteins from prokaryotic and eukaryotic cells
13. Gel electrophoretic separation of proteins
15. ELISA

**Sessional work assessments**
- Lab Practical and Record = 60%
- Test/s = 30%
- Regularity = 10%
- Total marks = 50

**Semester End examination**
- Fair record = 10%
- Viva voce = 20%
- Procedure and tabulation form, Conducting experiments and results = 70%
- Total marks = 100
BT14 508 (P) BIOINFORMATICS LAB

Teaching Scheme:
Three hours practical per week \hspace{1cm} \textbf{Credits: 2}

Objectives:
- To understand the fundamental principles of bioinformatics and using the knowledge to tackle various research problems

Experiments:
1. Unix commands
2. PERL programming
3. Biological databases i. Nucleotide sequence databases ii. Protein sequence databases iii. Protein structure databases.
4. Sequence Analysis – blastn, blastp, blast2, fasta
5. Multiple sequence alignment and phylogenetic interpretation – Clustal, Phylip, Phylodraw.
6. Gene prediction-Genscan, ORF finder, Genmark
7. Protein prediction-Conserved domain databases, Protparam, Signalp, Motif
8. Molecular visualization – Rasmol, Cn3D, Swiss PDB Viewer
9. Structure prediction – GOR, npredict, Swissmodel server
10. Structure alignment and docking – Calpha match, VAST, SAT, Hex
11. Primer design-Primer3.
12. Drawing tool - Chemisketch

 Sessional work assessments
- Lab Practical and Record = 60%
- Tests = 30%
- Regularity = 10%
- Total marks = 50

 Semester End examination
- Fair record = 10%
- Viva voce = 20%
- Procedure and tabulation form,
- Conducting experiments and results = 70 %
- Total marks = 100

SIXTH SEMESTER

BT14 601 BIOPROCESS ENGINEERING

Teaching Scheme:
3 Hrs lecture and 1 hour tutorial \hspace{1cm} \textbf{Credits: 4}
Objectives:

- To impart knowledge on the design analysis, monitoring, modelling and simulation aspects of a bioreactor
- To strengthen the knowledge of the design, operation and stability analysis of a bioreactor

Module – I [15 hrs]

Module – II [15 hrs]

Module – III [15 hrs]
The oxygen requirements of industrial fermentation. Oxygen supply. The determination of KLa values . The sulphite oxidation method. Gassing out method. Factors affecting oxygen transfer rate in fermenters like bubble size, gas hold-up, gas velocity, temperature, pressure etc. Power required for sparged and agitated vessels. The relationship between power consumption and operating variables. Role of shear in stirred fermenters. The structural components of the fermenter involved in aeration and agitation.

Module – IV [15 hrs]

Text Books:


Reference Books

2. Principal of Microbe & Cell Cultivation (1975), SJ Prit, Blackwell Scientific co.).
3. Bioprocess Computations in Biotechnology (Vol. 1) TK Ghose, Ellis howard Ltd.

Internal Continuous Assessment (Maximum Marks-50)
University of Calicut

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

Note: One of the assignments shall be simulation of continuous systems using any technical computing software

University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**
8x5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**
4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

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**BT14 602 FOOD BIOTECHNOLOGY AND ENGINEERING**

**Teaching Scheme:**
3 hours lecture and 1 hour tutorial per week

**Credits:** 4

**Objectives:**
- *To impart the basic concepts of food biotechnology*
- *To impart knowledge on food processing and preservation techniques and packaging techniques*

**Module – I [15 hrs]**
Role of micro organisms in manufacture and spoilage of fermented products, Cereals, Pulses, Nuts and Oil seeds, Fruits and Fruit products, Vegetables and Vegetable Products, Fish and Meat products. Adulteration in foods – milk, pulses and others, Rules and regulations

**Module – II [15 hrs]**
Microbiological role in food process operation and production: new protein foods: SCP; mushroom; food yeasts, algal proteins. Fermentation as a, method of preparing and preserving foods. Food additives like colouring, flavors and vitamins. Organisms and their use in pickling, alcoholic beverages and other products.

**Module – III [15 hrs]**
Mechanism of enzyme functions and reactions in process techniques: starch and sugar conversion process or baking by amylases; de-oxygenation and desugaring by glucose oxidase; beer mashing and chill-
proofing or cheese making by proteases and various other enzymes, catalytic actions in food processing. Process wastes: whey; molasses; starch substances and other food wastes for bioconversion to useful products.

Module – IV [15 hrs]
Introduction to Food Packaging, interaction of food material with packaging material, preservation of food products. Genetically modified and transgenic food development processing- nutritional and economic aspects.

Reference Books
2. Food Science and Food Biotechnology by G.F.G. Lopez & G.V.B. Canovas (2003), CRC Press, Florida, USA.
3. Lindsay, Willis, Biotechnology, Challenges for the flavour and food industries, Elsvier Applied Science.
5. Fundamentals of Food Engineering , D G Rao, PHI Learning

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

BT14 603 FINANCIAL MANAGEMENT AND COST ESTIMATION OF PROCESS INDUSTRIES

Teaching Scheme:
3 Hrs lecture and one hour tutorial per week  Credits: 4

Objectives:
• To impart the basic concepts of financial management of process industries
• To impart knowledge on the cost estimation based on plant and products

Module – I [15hrs]

Module – II [15 hrs]

Module – III [15 hrs]

Module – IV [15 hrs]

Text Books/Reference books.

3. F.C Jellen — Cost and Optimization Engineeringl.
Internal Continuous Assessment (Maximum Marks-50)

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<th>Percentage</th>
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<td>60%</td>
<td>Tests (minimum 2)</td>
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<td>30%</td>
<td>Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.</td>
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<tr>
<td>10%</td>
<td>Regularity in the class</td>
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University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

BT 14 604 PROCESS DYNAMICS AND CONTROL

Teaching scheme:

3 hours lecture and 1 hour tutorial

Credits :4

Objectives:

- To impart the basic ideas of chemical process control
- To study the methods of analysis of process systems

Module-1 (15 hours)


Qualitative analysis of the response of a system. Dynamic behavior of first order systems. Study of different first order systems, problems. Dynamic behavior of higher order systems. Different examples.

**Module II (15 hours)**

Concept of feedback control. Types of feedback control. Types of feedback controllers.


**Module III (15 hours)**


**Module IV (15 hours)**

A general introduction to advanced control systems. Dead time compensation, inverse response, cascade control, selective control systems, split-range control, feedback control, ratio control, adaptive control, inferential control. Introduction to direct digital control systems. Supervisory control. Distributed control system.


**Text and references**

1. Stephanopoulos, Introduction to Chemical Process Control
2. Coughanower& Koppel, Process System Analysis and Control

**Internal Continuous Assessment** (Maximum Marks-50)

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

**University Examination Pattern**

**PART A:** Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.
BT14 605 GENETIC ENGINEERING

Teaching Scheme:
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives:
- To impart the basic concepts of genetic engineering
- To impart the knowledge of various techniques involved in genetic engineering

Module- I [15 hrs]

Module – II [15 hrs]

Module – III [15 hrs]

Module – IV [15 hrs]

Text Books:

Reference Books:
1. From Genes to Clones by Winnacker. PANIMA
4. Principles of Gene Cloning by Old and Primrose
**Internal Continuous Assessment (Maximum Marks 50)**

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

**University Examination Pattern**

**PART A: Analytical/problem solving SHORT questions**  
8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**  
4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

**BT14 606 METABOLIC ENGINEERING**

**Teaching Scheme:**
3 hours lecture and 1 hour tutorials per week  
Credits: 4

**Objectives:**

- To understand how to regulate the metabolic pathways of bioconversion
- To understand the catabolite regulation pathways and also the primary metabolite synthesis pathways

**Module I [15 hrs]**
Review of cellular metabolism (Transport processes, fuelling reactions, biosynthesis, growth energetic)  
Review of cellular stoichiometry. Regulation of metabolic pathways: Levels of regulation of enzymatic activity (overview of kinetics, reversible and irreversible inhibitions, allosteric enzymes and co-operativity) – regulation of enzymes concentration (Control of transcription and translation – example with respect of lacoperon and catabolite repression)- Global control- regulation of metabolic networks (Branch point classification, coupled reactions and global currency metabolities and energy regulation)

**Module II [15 hrs]**
Metabolic engineering in practice: Concept of directed cellular energy utilization – analytical and synthetic elements of metabolic engineering – targets of metabolic engineering. Metabolic Pathway analysis (Typical case study: Lysine Biosynthesis) Strategies for redirecting branched and linear pathways: (Alteration of feedback regulation; limiting accumulation of end product feedback resistant mutants, alteration of permeability).

**Module III [15 hrs]**
University of Calicut

Metabolic Flux Analysis: Concept and utility of MFA – Theory – case studies – over determined systems – experimental determination of MFA by isotope labeling – applications of MFA: Case studies- concept & fundamentals of metabolic control analysis (Basic concept only).

Module IV [15 hrs]

Text Books/References
1. G Stephanopoulos et al; Metabolic Engineering principles & Methodologies
2. T. Scheper R Faurie, J. Thommel Advances in Biochemical engineering Biotechnology: Microbial production of L – Aminoacid
3. 3 Jens Hoiriis Nielsen, Sabine Arnold: Biotechnology for the future.

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions  4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

BT14 607 (P) HEAT AND MASS TRANSFER LAB

Teaching Scheme:
3 hours practical per week  Credits: 2

Objective:
- To study about the experiments in heat and mass transfer
University of Calicut

Experiments:

1. Conduction - Determination of thermal conductivity
2. Heat transfer through composite wall
3. Heat transfer in natural convection.
4. Heat transfer in forced convection
5. Double pipe heat exchanger
6. Shell and tube heat exchanger
7. Simple distillation
8. Steam distillation
9. Sieve plate distillation column
10. Solid-liquid extraction – Bonnotto type
11. Solid-liquid extraction - packed bed type
12. Ternary liquid equilibrium
14. Rotary dryer
15. Adsorption isotherms
16. Batch crystallizer

Sessional work assessments

Lab Practical and Record = 60%
Tests = 30%
Regularity = 10%
Total marks = 50

Semester End Examination
Fair record = 10%
Viva voce = 20%
Procedure and tabulation form,
Conducting experiments and results = 70%
Total marks = 100

BT14 608 (P) BIOPROCESS ENGINEERING LAB

Teaching Scheme:
3 hours practical per week

Credits: 2

Objectives:
- To do experiments based on enzymes and microbial cells
- To study about bioreactors and mass transfer effects

Experiments: (has to do a minimum of 15 experiments)
1. Culturing of different types of microorganisms (Bacteria, Yeast, fungi) used in the production of commercially imported products.
2. Formulation of simple and complex culture media
3. Estimation of biomass, substrate and product analysis
4. Growth of microorganisms-estimation of Monod parameters
5. Study of growth, substrate utilization and citric acid formation kinetics in shake flask cultures
University of Calicut

7. Estimation of Michaelis – Menten parameter
   (a) Effect of substrate concentration
   (b) Determination of Km value
8. Effect of pH on enzyme activity.
10. Techniques of enzyme immobilization
11. Bio-conversion studies with immobilized cells or enzymes
12. Isolation of secondary metabolites (eg. Antibiotic producing microorganisms) producing organisms
14. Production and estimation of Ethanol using bioreactors
16. Oxygen transfer rate in diffused air system (aeration unit)
17. Screening of process variable-Single dimensions research, Plackett –Burman design
18. Study of rheology of fermentation broth and power determination

Sessional work assessments

Lab Practical and Record = 60%
Tests = 30%
Regularity = 10%
Total marks = 50

Semester End examination

Fair record = 10%
Viva voce = 20%
Procedure and tabulation form,
Conducting experiments and results = 70 %
Total marks = 100

SEVENTH SEMESTER

BT14 701 BIOPROCESS EQUIPMENT DESIGN

Teaching Scheme:
2 hours lecture and 1 hour tutorial and 1 hour drawing per week Credits: 4

Objectives:

- To impart the basic concepts of mechanical and process design of process plants
- To impart design principles for bioreactor

Module I [30 hrs]

Mechanical design of process equipment - Design of cylindrical and spherical vessels for internal and external pressures, Design of heads, closures and supports. Design of supports- skirt support, saddle support.
Detailed process design and drawing of double pipe heat exchanger and shell and tube heat exchangers. Design and drawing of single effect evaporators employed in bioprocess operations.

Materials of construction for process and bioprocess plants. A brief idea (no detailed design; design approach only) about the design of flanges and nozzles – Classification of flanges- Flange thickness calculation- Gasket and Bolt selection and design.

Module II [30 hrs]
Design of distillation columns: Detailed process design and drawing of perforated plate, bubble cap columns and packed towers.

Design of fermenters: Design considerations for maintaining sterility of process streams and process equipments; Process design of mechanically agitated fermenters (STR or CSTR) and non-mechanically agitated (bubble column and air lift) fermenters.

Design principles of fluidized bed bioreactor, photo bioreactor, packed column bioreactor, plug flow reactor.

Note: Use of Perry’s Chemical Engineers Handbook, IS Codes, Steam Tables and attested copies of relevant charts, data tables and empirical correlations are permitted for examination.

Text Books
1. Perry & Chilton (Ed) Chemical Engineers Handbook (7th and 8th edn.)
2. Peters and Timmerhaus: Plant design and Economics for Chemical Engineers
   Hill Companies.
5. Michael L Schuler & Fikret Kargi —Bioprocess Engineeringl Prentice Hall of India Pvt
   Ltd.
7. Brownell and Young, Process Equipment Design-Vessel Design, John Wiley
8. Ludwig E E, Applied Process Design for Chemical and Petrochemical Plants, (Vol. 1,2 and 3)
   ,3rd Ed., Gulf Publishing Company, Houston

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz,
   literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

Note: One of the assignments shall be design using any software

University Examination Pattern
One question from module I involving design of equipments 50 marks

Candidates have to answer ONE questions out of TWO.

One question from module II involving design of equipments 50 marks
Candidates have to answer ONE questions out of TWO.

**BT14 702 DOWN STREAM PROCESSING**

**Teaching Scheme:**
3 hours lecture and 1 hour tutorial per week  
**Credits:** 4

**Objectives:**
- Define the fundamentals of downstream processing for biochemical product recovery.
- Address centrifugation, cell disruption, chromatography, crystallization, filtration, liquid-liquid extraction, membrane processes, process economics, process synthesis and simulation, protein refolding, and regulatory issues and validation

**Module I [15 hrs]**
Role of downstream processing in biotechnology - role and importance of downstream processing in biotechnological processes - problems and requirements of bio-product purification. Economics of downstream processing in biotechnology - post cutting-strategies - characteristics of biotechnological mixtures – process design criteria for various classes of bio-products (high volume, low-value products and low volume, high value products - physiochemical basis of bio-separation processes.

**Module II [15 hrs]**

**Module III [15 hrs]**
*Enrichment operations:* Membrane based separations - classification and range of membrane systems - molecular weight cut off- types, of membranes and manufacture (isotropic and anisotropic) module types and their advantages (flat plate/hollow tube/spiral wound etc) modes of operation (cross flow and dead end)micro and ultra filtration theory - membrane characteristics (rejection factor, concentration polarization) gel concentration model - fouling and its prevention- basic design and configuration of membrane systems (batch and multi state) - industrial applications of membrane systems- Precipitation methods (with salts, organic- solvents and polymers, extractive separations, aqueous two phase extraction, super critical extraction) - in situ product removal - integrated bioprocessing.

**Module IV [15 hrs]**
Classification of chromatographic separations. Typical liquid chromatographic set up - principles and working of ion exchange chromatography / adsorption chromatography / partition chromatography and affinity chromatography, chromatographic theory retention time and factor-selectivity factor plate model and rate theory. Van Deemter equation and band broadening. Electrophoretic separations (isoelectric focusing /gel electrophoresis /native and SDS page/southern and western blot techniques/capillary electrophoresis) -

Hybrid separation technologies (membrane chromatography and electro chromatography) Product polishing gel permeation chromatography, dialysis and crystallization.

**Text Books:**
1. Protein: Biochemistry and Biotechnology by Gary Walsh (2002 John Wiley & Sons Ltd.)
University of Calicut
Limited.

3. N. Krishna Prasad. Down Stream Processing Technology – A New Horizon in Biotechnology, PHI

Reference books:
2. Product Recovery in Bioprocess Technology, BIOTOL series VCH.
3. Asenjo J. M. Separation process in Biotechnology, Marcel Dekker Inc.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

Note: One of the assignments shall be simulation of systems using any technical computing software

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

BT14 703 ENVIRONMENTAL ENGINEERING

Teaching Scheme:
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives:
- To impart basic concepts of air pollution, water pollution and pollution due to solid waste
- To impart knowledge about the design of equipment for controlling air and water pollution and pollution due to solid waste
- To study the waste treatment of major industries

Module – I [15 hrs]

Module – II [15 hrs]

Module – III [15 hrs]

Module IV [15 hrs]
Wastewater treatment for industrial waste. Treatment methods for effluents from pulp and paper mill, dairy, distillery, tannery, food and allied industries, Edible oil refinery, soap and detergent industry, textile mill, cane sugar industry, rubber industry, drugs and pharmaceutical industry, slaughter house and meat processing industry. Common Effluent treatment Plants. Biomedical waste management. Hazardous waste management. Use of Genetically engineered organisms and emerging biotechnological processes in waste management.

Text Books/References

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

**Note:** One of the assignments shall be simulation of systems using any technical computing software

University Examination Pattern

**PART A:** Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum
of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions  4 x 15 marks=60 marks**
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

**ELECTIVE I**

**BT14 704 (A) TRANSPORT PHENOMENA IN BIOPROCESS SYSTEMS**

**Teaching Scheme:**
3 hours lecture and 1 hour tutorial per week  
Credits: 4

**Objectives:**
- To impart the basic concepts of transport phenomena in process systems
- To develop a better understanding about momentum transfer, heat transfer and mass transfer

**Module – I [15 hrs]**
Momentum transfer: Momentum transfer in bioprocess, comparison with other transport processes, effect of flow properties in momentum transfer and oxygen mass transfer. Oxygen transport: Oxygen transport to microbial cultures-Gas liquid mass transfer fundamentals, oxygen requirement of microbial cultures. Oxygen requirements of microbial cultures; oxygen mass transfer fundamentals. Oxygen transfer and oxygen demand.

**Module-II [15 hrs]**
Oxygen transport: Oxygen transfer by aeration and agitation Determination of oxygen mass transfer coefficient by various methods including dynamic gassing out and oxygen balance methods. Momentum transport by agitation: Power requirements and mixing characteristics of ungassed and gassed systems. Concept of power number, use of monographs. Defining impeller Reynolds number for Newtonian and non-Newtonian fluids. Concept of aeration rate to calculate impeller power requirement of gassed systems.

**Module – III [15 hrs]**
Mixing: Mixing and bioreaction interactions-flow regimes with and without baffles, various types of impellers and mixing equipment. Scale up: Scale up criteria for mixing equipment. Application of mixing in bioprocessing.

**Module _IV [15 hrs]**

Heat transfer II: Analogy between heat, mass and momentum transfer. Application of heat transfer in bioprocesses.

**Text Books/ References**
Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

Note: One of the assignments shall be simulation of continuous systems using any technical computing software

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

BT14 704 (B): COMPUTER BASED NUMERICAL METHODS

Teaching Scheme:
3 hours lecture and 1 hour tutorial per week Credits: 4

Objectives
- To impart the basic concepts of mathematical modelling of problems in science and engineering
  - To know procedures for solving different kinds of problems.
  - To understand the various numerical techniques which provide solutions to non linear equations, partial differential equations etc that describe the mathematical models of problems.

Module I [15 hrs]

ModuleII [15 hrs]
Interpolation – introduction - errors in polynomial interpolation - finite differences - decision of errors -
Newton’s formula for interpolation. Gauss, Sterling, Bessel’s, Everett’s Formula - interpolation by unevenly spaced points - Lagrange interpolation formula - divided difference - Newton’s general interpolation formula.

**Module III [15 hrs]**


**Module IV [15 hrs]**

Statistical Computations - frequency Chart - method of least square curve fitting procedures - fitting a straight line - curve fitting by sum of exponential - data fitting with cubic splines - approximation of functions. Regression Analysis - linear and nonlinear regression - multiple regression - statistical quality control methods.

**Text Books**

**Reference Books**

**Internal Continuous Assessment (Maximum Marks 50)**

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

**Note:** One of the assignments shall be simulation of continuous systems using any technical computing software

**University Examination Pattern**

**PART A: Analytical/problem solving SHORT questions** 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions** 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

BT14 704 (C) BIOPOLYMERS

Teaching scheme:
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives

- To impart the knowledge of the biopolymers
- To know about the production of important biopolymers
- To know about the mechanism of biodegradation and natural fibers

Module I [15 hrs]
Polymer, monomer, degree of polymerization, amorphous and crystalline properties, glass transition temperature, weight average and number average molecular weight, molecular weight distribution, polydispersity index. What are biopolymers? Plant and animal biopolymers-polynucleotides, polyamides-polysaccharides, polyisoprene, lignin, polyphosphate and polyhydroxyalkanoate, property improvements by blending, grafting applications

Module II [15 hrs]
Biosynthesis, Collagen, gelatin, casein, pectin, lignin-isolation, structure and applications, polysaccharide-starch, cellulose, dextran, pullulan, carrageenan, chitin, chitosan, hyaluronan, alginate, gums (guar, gum arabic, gum karaya, gum tragacanth, locust bean gum), humic acid. Superabsorbent polymers

Module III [15 hrs]
Synthesis and applications of poly hydroxy butyrate, polylactate, polyhydroxyvalerate, cutan, hydrocarbon biopolymers, production via fermentation, specific applications. Production and applications of polycaprolactone, polyhydroxy butyrate, copolymer of poly hydroxyl butyrate-poly hydroxyl valerate, polylactic acid, bionel, biopol

Module IV [15 hrs]
Natural fibers: Silk, wool, flax, jute, linen, cotton, sisal, bamboo, pineapple leaf, and oil palm fibers, kenaf, properties and applications, property improvement by biochemical treatment
Biodegradation, modes of biodegradation, enzymatic degradation of biopolymers and synthetic polymers. Microbial degradation of synthetic polymers

Textbook and references:

1. Johnson R.M, Mwaikambo,L.Y. and Tucker.n, Biopolymers, Rapra Technologies
2. Richard wool, and susan Sun, Biopolymers and composites

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

Note: One of the assignments shall be simulation of continuous systems using any technical computing software

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

BT14 704 (D) HAZARDOUS WASTE MANAGEMENT

Teaching Scheme:
3 hours lecture and 1 hour tutorial per week Credits :4

Objectives:
- To study the different types of hazardous wastes found in industries and other types of environment
To gain knowledge of the methods used for hazardous waste treatment

Module – I [15 hrs]
Preparation of a waste inventory-procedure and considerations-specific and non specific sources – hazardous waste numbers and codes.

Module – II [15 hrs]
Generator requirement-transporter requirements-treatment, storage and disposal requirements-ground water monitoring The hazard ranking system-prioritization of actions-contingency plans-liabilities

Module – III [15 hrs]
Hazardous waste minimization-benefits-elements of effective waste minimization programme waste audit-waste exchange-recycling

Module – IV [15 hrs]
Treatment technologies-Physical, Chemical and Biological Treatment-Management of specific recyclable hazardous waste like precious metals, lead acid batteries.
Land disposal-land treatment-deep well injection-the secure land fill-construction.

Text books/Reference

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

BT14 704 (E): PROCESS MODELING AND SIMULATION (Global)
Teaching Scheme: 3 hours lecture and 1 hour tutorial per week  

Credits: 4

Objectives:
- To impart the basic ideas on the modelling and simulation of process plans
- To represent processes in the form of mathematical models to simplify their design

Module I [15 hrs]

Module II [15 hrs]
Mathematical models for chemical engineering systems-continuous flow tanks-, enclosed vessel-mixing -reversible reaction-steam jacketed vessel-boiling of single component liquid-open and closed vessel-continuous boiling system-batch distillation.

Module III [15 hrs]

Module IV [15 hrs]
Digital simulation-numerical integration-Euler and fourth order Runge Kutta methods- simulation of gravity flow tank – CSTR in series-non isothermal CSTR binary distillation column-batch reactor

References
4. John Ingham et.al., *Chemical Engineering Dynamics- Modeling with PC Simulation, VCH Publishers*

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

Note: One of the assignments shall be simulation of continuous systems using any technical computing software

University Examination Pattern

*PART A: Analytical/problem solving SHORT questions*  

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum
of THREE questions from each module with total TEN
questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer
one question.

Maximum Total Marks: 100

BT14 704 (F) CANCER BIOLOGY

Teaching Scheme:
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives:
- To study the principles of carcinogenesis
- To study the various treatments of cancer

Module – I [15 hrs]
Fundamentals of Cancer Biology: Regulation of Cell cycle, mutations that cause changes in signal
molecules, effects on receptor, signal switches, tumour suppressor genes, modulation of cell cycle in
cancer. Different forms of cancers, Diet and cancer.

Module – II [15 hrs]
Principles of Carcinogenesis: Chemical Carcinogenesis, Metabolism of Carcinogenesis, Principles of
Physical Carcinogenesis, X-Ray radiation – mechanisms of radiation Carcinogenesis.

Module – III [15 hrs]
Principles of Molecular Cell Biology of Cancer: Oncogenes, Identification of Oncogenes, Retroviruses
and Oncogenes, detection of Oncogenes. Oncogenes/Proto Oncogene activity. Growth factors related to
transformation. Clinical significances of invasion, heterogeneity of metastatic phenotype. Metastatic
cascade. Basement Membrane disruption. Three step theory of Invasion, Proteinases and tumour cell
invasion.

Module – IV [15 hrs]
New Molecules for Cancer Therapy: Different forms of therapy, Chemotherapy, Radiation. Therapy,
Detection of Cancers, Prediction of aggressiveness of cancer, advances in cancer detection.

Text Books:

Reference books:
1. —An Introduction top Cellular and Molecular Biology of Cancer, Oxford Medical
University of Calicut


**Internal Continuous Assessment** *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

**University Examination Pattern**

**PART A: Analytical/problem solving SHORT questions** 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions** 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

**ELECTIVE II**

**BT14 705 (A) DEVELOPMENTAL BIOLOGY**

**Teaching Scheme:**
3 hours lecture and 1 hour tutorial per week  

**Credits: 4**

**Objectives:**
- Learn the basic principles of human embryology and development.
- Develop critical thinking skills, and will learn to visualize three-dimensionally.
- Correlate development with postnatal anatomy

**Module I [15 hrs]**

**Module II [15 hrs]**
An Introduction to Model Systems: Model vertebrate organisms: *X. laevis*, Chicken, Mouse, Zebrafish,
Model invertebrate organisms: *D. melanogaster, C. elegans*, Model plant: *A. thaliana*

Germ Cells & Sex, Genotypic & phenotypic sex-determination in mammals, *D. melanogaster* and *C. elegans*, Structure & Formation of germ cells, Fertilization


**Module III [15 hrs]**


**Module IV [15 hrs]**


Plant Development: Pattern development in early embryogenesis of angiosperms, Floral development

**Text/Reference Book:**


**Internal Continuous Assessment** *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

**University Examination Pattern**

**PART A:** Analytical/problem solving SHORT questions 8 x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

BT14 705 (B) MOLECULAR MEDICINE

Teaching Scheme:
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives:

- To impart knowledge on molecular medicine
- To know the techniques used for treatment of diseases

Module – I [15 hrs]

Module – II [15 hrs]
Gene therapy as a potential tool to cure human diseases Recombinant molecules in medicine. Transgenic and knock out animal models.

Module – III [15 hrs]
Stem cell research and its application in human health. Intellectual property right issues and ELSI (Evaluation of the Ethical, Legal and Social Implications program).

Module – IV [15 hrs]
Personalized medicine- Challenges faced- Basic concepts in systems Biology - Transcription networks, basic concepts, Auto-regulation, a network motif, The feed forward loop network motif, Network motifs in developmental, signal-transduction and neuronal networks, Robustness of protein circuits, the example of bacterial chemotaxis.

Text books/ Reference Books:

1. Encyclopedic Reference of Genomics and Proteomics in Molecular Medicine. Ganten, Dettv; Ruckpaul, Klaus
2. Bertarand Jordan ,Travelling Around the Human Genome: An in Situ investigation.,
3. J.Larry Jameson , Principles of Molecular Medicine,
4. R.J.Trent Molecular Medicine: An Introductory Text,
5. Alan David Blair Malcolm Molecular Medicine,
6. Molecular Medicine: Insight into the Cellular and Molecular Basis of Disease Published by Johns Hopkins University Press.
7. Dennis W.Ross Introduction to Molecular Medicine, Pounds.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class
University of Calicut

University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**  
8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**  
4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

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**BT14 705 (C) GENE AND STEM CELL THERAPY**

**Teaching Scheme:**
3 hours lecture and 1 hour tutorial per week  
Credits: 4

**Objectives:**
- To impart knowledge on the transfer and expression of genetic materials
- To obtain a basic knowledge of the treatment of diseases using gene and stem cell therapy

**Module I [15 hrs]**
*Stem cell: Introduction* – stem-cells-properties and importance of stem cells – sources of stem cells- adult, embryonic, cord blood stem cells-classification of stem cells-multi-potent, pluripotent, toti-potent, uni-potent stem cells, and clinical application of stem cells.

**Module – II [15 hrs]**
*Stem cell therapy*: Overview of stem cell therapy - harvesting of stem-embryonic, fetal and adult stem cell therapy- therapeutic cloning-current and potential stem cell treatments.

**Module – III [15 hrs]**

**Module – IV [15 hrs]**
*Ethics of gene and stem cell therapy*: Stem cell research-stem cell problems-concerns about stem cells-immunological challenges for stem-controversy and safety of stem cells-problems and ethics of gene therapy.

**Reference Books**

2. *Stem cells* by ariff bongso, Eng Hin Lee, Sydney (FRW) Brenner
3. *Embryonic stem cells* by Kursad Turksen

**Internal Continuous Assessment** *(Maximum Marks-50)*

60% - Tests (minimum 2)  
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.  
10% - Regularity in the class

**University Examination Pattern**

**PART A: Analytical/problem solving SHORT questions**  
8 x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**  
4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

**BT14 705 (D) MODELING AND SCALE UP OF BIOREACTORS**

**Teaching Scheme:**  
3 hours lecture and 1 hour tutorial per week  
**Credits : 4**

**Objectives:**
- *To impart knowledge on applications of modeling in bioreactor design*
- *To obtain a basic knowledge of scaling up operations*

**Module I [15 hrs]**
A brief outline of types and structure elements of bioreactors: Reactors with mechanical and compressed air energy input, membrane reactors for bubble free aeration; modes of operation of a bioreactor- Batch, fed-batch, continuous cultivation, cultivation with cell retention, repeated (cyclic batch) cultivation; aerobic, anaerobic and micro aerobic processes.

Modeling basics: Definition of a model; types of models (physical, mathematical and verbal); the need for modeling and control in biotechnical processes; steps in model building. Approach to modeling, Unstructured and structured modeling. Deterministic and stochastic models, Segregated and unsegregated models. Stochastic model for thermal sterilization of the medium

**Module II [15 hrs]**
Bioreactor Models: Stirred tank reactors- Description of physical processes in the stirred tank reactor, Modeling of gas/liquid flow in stirred tank reactors, single phase flow- transport equations; gas /liquid flow- multiphase conservation equations, interfacial forces, drag force, virtual mass force- turbulence and impeller models; Bubble column bioreactors. Recirculation and compartment models; Bubble column and Airlift tower loop reactors- description of physical processes, Flow models, Reactor models. Basic equations of motion- fundamental laws (mass conservation, momentum conservation, Navier Stoke’s
University of Calicut

Module III [15 hrs]
Sub models of bioreactor processes: Engineering components- Temperature control system, Pressure behavior, Aeration behavior, pH model, reaction model (A brief introduction is only desired).

Principles of similarity, pilot plants and models: Introduction to scale-up methods, pilot plants and models and principles of similarity. Dimensional Analysis and Scale-Up Criterion: Dimensional analysis, regime concept, similarity criterion and scale up methods used in chemical engineering. Scale up and scale down issues: Regime analysis of bioreactor processes. Correlations for oxygen transfer Effect of scale on oxygenation, mixing, sterilization, pH, temperature, inoculum development, nutrient availability and supply.

Module IV [15 hrs]
Bioreactor scale-up based on constant power consumption per volume, mixing time, impeller tip speed (shear), mass transfer coefficients. Scale-up of stirred tank bioreactors. Scale up of downstream processes: Adsorption (LUB method); Chromatography(constant resolution etc.); Filtration (constant resistance etc.); Centrifugation (equivalent times etc.); Extractors (geometry based rules). Scale-down related aspects.

Text Books/ References
3. K.Schugerl, Measuring, Modeling and Controlling Biotechnology- a multivolume comprehensive treatise (Rehm and Reed eds.) VCH, Weinheim.

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

Note: One of the assignments shall be simulation of systems using any technical computing software
PART A: Analytical/problem solving SHORT questions  8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions  4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

BT14 705 (E) MOLECULAR MODELING AND DRUG DESIGN
(Global)

Teaching Scheme:

3hours lecture and 1 hour tutorial per week  Credits: 4

Objectives:

- To impart knowledge on various molecular modeling structures
- To impart knowledge on analog and structure based drug design

Module – I [15 hrs]

Module – II [15 hrs]

Module – III [15 hrs]
Comparative protein modeling: Modelling by Homology the alignment, construction of frame work, selecting variable regions, side chain placement and refinement, validation of protein models – Ramchandran plot, threading and ab initio modelling. Analog based drug design: Introduction to QSAR, lead module linear and nonlinear modeled equations, biological activities, physicochemical parameter and
molecular descriptions, molecular modeling in drug discovery.

**Module – IV [15 hrs]**
Structure based drug design: 3D pharmacophores, molecular docking, De Novo Ligand design, free energies and solvation, electrostatic and non electrostatic contribution to free energies.
Further applications on the design of new molecules: 3D data base searching and virtual screening.
Source of data, molecular similarity and similarity searching, combinatorial libraries – generation and utility.

**Text Books**
1. *Principles and applications of modeling* by Leach
2. *Molecular modeling* by the Hans Peter Heltie & Gerd Falkens, VCH.

**References**
1. *Chemical Applications of Molecular Modelling* by Jonathan Goodman.
2. *Computational Chemistry* by Guy H, Grant &W Graham Richards, Oxford University.

**Internal Continuous Assessment** *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

**Note:** One of the assignments shall be simulation of systems using any technical computing software

**University Examination Pattern**

**PART A:** Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

**BT14 705 (F) GENOMICS AND PROTEOMICS**

**Teaching Scheme:**
3 hours lecture and 1 hour tutorial per week  

**Credits: 4**
Objectives:

- To provide an advanced knowledge of gene expression and gene therapy
- To understand the various technologies of gene mapping, proteomic techniques and new target identification for drug discovery

Module I [15 hrs]
Structure and organization of prokaryotic and eukaryotic genomes nuclear, mitochondrial and chloroplast genomes; Computational analysis of sequences- finding genes and regulatory regions; Gene annotation; Similarity searches; Pairwise and multiple alignments; Alignment statistics; Prediction of gene function using homology, context, structures, networks; Genetic variation-polymorphism, deleterious mutation; Phylogenetics; Tools for genome analysis–PCR, RFLP, DNA fingerprinting, RAPD, Automated DNA sequencing; Linkage and pedigree analysis; Construction of genetic maps; Physical maps, FISH to identify chromosome landmarks.

Module II [15 hrs]
Human genome project-landmarks on chromosomes generated by various mapping methods; BAC libraries and shotgun libraries preparation; Physical map-cytogenetic map, restriction map, DNA sequence; DNA sequencing and sequence assembly; Model organisms and other genome projects; Comparative genomics of relevant organisms such as pathogens and non-pathogens; Evolution of a pathogen e.g. Hepatitis C virus or a bacterial pathogen; Taxonomic classification of organisms using molecular markers- 16S rRNA typing/sequencing;

Module III [15 hrs]
Overview of protein structure-primary, secondary, tertiary and quarternary structure; Relationship between protein structure and function; Outline of a typical proteomics experiment; Identification and analysis of proteins by 2D analysis; Spot visualization and picking; Tryptic digestion of protein and peptide fingerprinting; Mass spectrometry : ion source (MALDI, spray sources); analyzer (ToF, quadrupole, quadrupole ion trap) and detector; clinical proteomics and disease biomarkers; Prions; proteins in disease; Protein-protein interactions: Solid phase ELISA, pull-down assays (using GST-tagged protein), far western analysis, by surface plasmon resonance technique, Yeast two hybrid system, Phage display; Protein interaction maps; Protein arrays-definition, applications- diagnostics, expression profiling.

Module IV [15 hrs]
Human disease genes; DNA polymorphism including those involved in disease; Hemoglobin and the anemias; Phenylketonuria (monogenic) and diabetes (multigenic) genetic disorders; ‘disease’ gene vs. ‘susceptibility’ gene; SNP detection: hybridization based assays (allele specific probes); Polymerization based assays (allele specific nucleotide incorporation, allele-specific PCR); Ligation based assays (allele specific oligonucleotide ligation); Polymorphism detection without sequence information: SSCP; Proteomics and drug discovery; High throughput screening for drug discovery; Identification of drug targets; Pharmacogenomics and pharmacobiosgenetics and drug development; Toxicogenomics; Metagenomics.

Text Books:

Reference Books:
5. Various research and review journals like Nature Biotechnology, Current Opinion,

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz,
literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern
PART A: Analytical/problem solving SHORT questions 8 x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of
TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer
one question.

Maximum Total Marks: 100

BT14 706 (P) DOWNSTREAM PROCESSING LAB

Teaching Scheme:
3hours practical per week  Credits: 2

Objectives:
- To conduct experiments in downstream processing operations

Experiments:
1. Cell disruption techniques
2. Filtration
3. Centrifugation
4. Sedimentation
5. Leaching
6. Membrane based filtration – Ultra Filtration and Micro Filtration
7. Protein precipitation methods and its recovery
8. Two-phase aqueous extraction
University of Calicut

9. Liquid chromatographic techniques
10. Electrophoretic separation techniques
11. Dialysis
12. Crystallization
13. Drying

Sessional work assessments

Lab Practical and Record = 60%
Tests = 30%
Regularity = 10%
Total marks = 50

Semester End examination

Fair record = 10%
Viva voce = 20%
Procedure and tabulation form,
Conducting experiments and results = 70 %
Total marks = 100

BT14 707 (P) REACTION ENGINEERING AND PROCESS CONTROL LAB

Teaching Scheme:
3 Hrs practical per week

Credits: 2

Objectives:
- To conduct experiments in reaction engineering and process control

Experiments: [Minimum 12 experiments needs to be conducted]

1. Kinetics of hydrolysis of esters
2. Determination of activation energy
3. Batch reactor
4. Stirred tank reactor
5. Plug flow reactor
6. Fixed bed reactor
7. Fluidized bed reactor
8. Recycle bed reactor
9. UV photo reactor
10. RTD in CSTR
11. Time constant of manometer
12. Calibration of thermo couple
13. Dynamics of liquid level systems-interacting and non-interacting
14. Measurement of level by capacitance method
15. Characteristics of P.I.D controller
16. Control valve characteristics

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Sessional work assessments
Lab Practical and Record = 60%
Tests = 30%
Regularity = 10%
Total marks = 50

Semester End examination
Fair record = 10%
Viva voce = 20%
Procedure and tabulation form,
Conducting experiments and results = 70 %
Total marks = 100

BT14 708 (P) PROJECT

Teaching Scheme:
4 hours per week

Credit: 4

Objectives:

- To judge the capacity of the students in converting the theoretical knowledge into practical systems/ investigative analysis.

Project work is for duration of two semesters and is expected to begin in the seventh semester and completed in the eighth semester. Each student group consisting of not more than five members is expected to design and develop a complete system or make an investigative analysis of a technical problem in the relevant area. Project evaluation committee consisting of the guide and three/four faculty members will perform the screening and evaluation of the projects. Each project group should submit project synopsis within three weeks from the start of the seventh semester. Project evaluation committee shall study the feasibility of each project work before giving consent. Literature survey and 40 % of the work has to be completed in the seventh semester.

Students should execute the project work using the facilities of the institute. However, external projects can be taken up in reputed industries, if that work solves a technical problem of the external firm. Prior sanction should be obtained from the head of the department before taking up external project work and there must be an internal guide for such projects. The objective of the project is to test the ability of the student to coordinate the entire knowledge of biotechnology engineering and to judge the student’s capacity in the design of plant/ process system. The project can be experimental or design based. The students are required to prepare the project report on a complete process showing the selection of alternatives, preparation of flow sheet, bioprocess calculations and detailed design calculations of the major items of equipments. The project should include mechanical design, capital cost; product cost estimation, profitability, breakeven analysis, plant location and lay out. The project selected should be an industrial problem. Any laboratory experimental data generated may be used for the design of the industrial plant. The assessment shall be based on individual and group performance.

Each student has to submit an interim report of the project at the end of the 7th semester. Members of the group will present the project details and progress of the project before the committee at the end of the 7th semester. 50% of the marks is to be awarded by the guide and 50% by the evaluation committee.

Internal Continuous Assessment
University of Calicut

20%- Technical relevance of the project
40%- Literature survey and data collection
20%- Progress of the project and presentation
10%- Report
10%- Regularity in the class
Total Marks: 100

EIGHTH SEMESTER

BT 14 801 BIOPROCESS INSTRUMENTATION

Teaching Scheme:

3 hours lecture and 1 hour tutorial per week. Credits : 4

Objectives:

- To impart the basic ideas about instruments
- To evaluate the operating principles of different instruments
- To study about biosensors and instrumentation of bioprocesses

Module I [15 hrs]
Sensing elements—various types, sensors for temperature, pressure and fluid flow, transducers— their principles and working, transmission methods, indicating and recording means. Temperature measurements, temperature scales, basic principles and working of thermometers, mercury in glass thermometers, thermocouples, ranges of different types of temperature measuring instruments. Sources of errors and precautions to be taken in temperature measurements.

Module II [15 hrs]
Pressure measurement. McLeod gauge, Knudsen gauge, Bourden gauge, bellow, diaphragm. Transducers of electrical and mechanical types. Piezo-electric manometers, thermal conductivity gauges, ionization gauge, liquid level measurements, gas density detector.
Moisture content determination by thermal drying. Instruments for measuring humidity. Composition analysis using spectroscopic methods like absorption, emission and mass spectrometers. Gas analysis by thermal conductivity, polarography and chromatography.

Module III [15 hrs]
Biosensors, types and features, various components of biosensors, Transducers, calorimetric, optical, potentiometric/ amperometric, conductometric/ resistometric biosensors, Biosensors for glucose, alcohol, carbon dioxide, cell population, BOD

Module IV [15 hrs]
Instrumentation for bioprocesses, schematic summary of biochemical reactor instrumentation, Physical and chemical sensors for the medium and gases. On-line sensors for cell properties. Off-line analytical
methods. Foam sensing and control unit, measurement and control of dissolved oxygen, pH measurement and control. Components of a computer linked system, logging of process data, data analysis, and process control

**Textbooks/References**

1. Eckmann D.P., Industrial Instrumentation, Wiley Eastern
2. Fribance, Industrial Instrumentation Fundamentals, TMH edition
4. Bailley and Ollis, Biochemical engineering Fundamentals, McGraw Hill
6. Stansbury, Whitaker, Hall, Principles of Fermentation Technology, Elsevier

**Internal Continuous Assessment (Maximum Marks - 50)**

- 60% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- 10% - Regularity in the class

**Note:** One of the assignments shall be simulation of systems using any technical computing software

**University Examination Pattern**

**PART A: Analytical/problem solving SHORT questions**

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

**BT14 802 SAFETY AND BIOSAFETY IN PROCESS PLANTS**

**Teaching Scheme:**

3 Hrs lecture and 1 hour tutorial

**Credits: 4**

**Objectives:**

- *To impart the basic concepts of safety procedures carried out in chemical process plants and bioprocess plants*
- *To impart knowledge on safety and biosafety guidelines*

**Module – I [15 hrs]**

Operational Parameters in a process plant, duties and responsibilities of operator, supervisor and process engineer and manager in a process plant. Raw materials scheduling, start-up, shut down. Common operational problems in process plants, Trouble shooting methods. The role of preventive maintenance and break-down maintenance. Plant utilities – water, power, steam, air and fuels. Elementary aspects of
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Module – II [15 hrs]


Module – III [15 hrs]


Module –IV [15 hrs]


References:

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

BT14 803 INDUSTRIAL BIOTECHNOLOGY AND BIOPHARMACEUTICALS

Teaching Scheme:
3 Hrs lecture and 1 hour tutorial per week

Credits: 4

Objectives:

- To describe the various technologies involved in manufacture of industrial products in biotechnology
- To give knowledge about the manufacture of major biopharmaceuticals

Module I [15 hrs]
A review of industrial fermentation and enzymatic processes and products. Role of a bioprocess engineer in bioprocess industry. Outline of the various unit operations involved in the upstream and downstream operation of a bioprocess plant. Process flow sheeting, Strain development. General fermentation process.

Development of Drug and Pharmaceutical Industry, Economics of drug industry, pharmaecoaomics, Good manufacturing practice.

Module II [15 hrs]
Production of citric acid, gluconic acid, lactic acid, acetic acid, ethanol, acetone/butanol, glutamic acid, lysine, pencillins, cephalosporin, baker's yeast, alcoholic beverages, high-fructose corn syrup.

Module III [15 hrs]
Vitamins B12, riboflavin, protease, amylase, glucose isomerase, SCP. Insulin, Interferon, erythropoietin, streptokinase, interleukin, blood factor VIII, monoclonal antibodies, vaccines

Module IV [15 hrs]
Biopharmaceutics- Drug absorption, distribution, chemical principles affecting all the above plasma models, Pharmacogenomics, and metabolism, Pharmacokinetics &. Physico drug concentration - time profile – Pharmacokinetic Models, Pharmacogenomics

Text Books/references
1. Gary Walsh —Biopharmaceuticals: Biochemistry and biotechnologyl John Willey & Sons Ltd
2. L.E Casida —Industrial Microbiologyl New Age International Publishers

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz,
University Examination Pattern

**PART A:** Analytical/problem solving SHORT questions  8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions  4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

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**ELECTIVE III**

**BT14 804 (A) BIOETHICS AND INTELLECTUAL PROPERTY RIGHTS** *(Global)*

**Teaching Scheme:**
3 Hrs lecture and 1 hour tutorial per week  

**Credits: 4**

**Objectives:**
- To impart knowledge on bioethics and intellectual property rights
- To study the various ethical issues occurring in biotechnology

**Module – I [15 hrs]**

**Module – II [15 hrs]**
Intellectual Property Rights – Development and need for IPR in knowledge based industries. Various types of intellectual Property Rights with examples (Trademarks, Copyrights, Industrial Designs, Patents, Geographical Indicators etc) – Objectives of the patent system – Basic principles and general requirements of Patents (Novelty, Utility Non obviousness. Etc) and tenets of patent law – Product and Process Patents)

**Module – III [15 hrs]**
Module – IV [15 hrs]

Text Books/ Reference books
3. Legal Economic and Ethical Dimensions, VCHPublishers.

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

Note: One of the assignments shall be simulation of continuous systems using any technical computing software

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

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BT14 804 (B) BIOMATERIALS

Teaching Scheme:
3 Hrs lecture and 1 hour tutorial per week

Credits: 4

Objectives:
- To study the structure and characteristics of different types of biomaterials of natural and synthetic origin
- To give an idea on the effective uses of these materials

Module I [15 hrs]

Module II [15 hrs]
Hard tissue replacement implant: orthopaedic implants (hip, knee), dental implants, adhesives and sealants. Soft tissue replacement implant. Skin implant, burn (wound), dressings/ synthetic skin, dialysis membranes, scaffolds, vascular implants, heart valve implants. Artificial kidneys and livers. Sutures, biomaterials for gene delivery. Hydrogel as stimuli-sensitive biomaterials, ophthalmologic implants, biomaterials for drug delivery

Module III [15 hrs]

Module IV [15 hrs]
Biopolymers, definition, plant and animal biopolymers- polynucleotide, polyamides, polysaccharides, polysisoprene, lignin, polyphosphate and poly hydroxyl alkanoates. Application and chemical synthesis of super absorbent polymers, polyethylene glycol, polypropylene glycol, poly tetra methylene glycol, polyglycerine. Bioplastics and environment, commercial bioplastics. Natural fibers like silk, wool, flax, jute, linen, cotton, sisal, bamboo. Biocomposite- properties and applications

Text books/ references
1. Ratner, Hoffman, Schoen Biomaterial science- an introduction to materials in medicine Academic press
2. Park J.B. Biomaterials- science and engineering, Plenum press
Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

Note: One of the assignments shall be simulation of continuous systems using any technical computing software

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

BT14 804 (C) NANOBIOTECHNOLOGY

Teaching Scheme:
3 Hrs lecture and 1 hour tutorial per week

Credits: 4

Objective:

- To impart basic ideas on nanoparticles
- To impart knowledge on the use of bionanoparticles and their applications in biotechnology

Module – I [15 hrs]

Module – II [15 hrs]
Quantum Dots, Gold Nanoparticles, Lipoparticles, Assembly of Nanoparticles into Micelles, Biomedical applications of self-assembly of nanoparticles, Paramagnetic and superparamagnetic nanoparticles, Fluorescent nanoparticles.

Module – III [15 hrs]
Bacterial structure relevant to nanobiotechnology, Cubosomes, Dendrimers, DNA Nanoparticle Conjugates, DNA Octahedron, Fullerenes, Nanoshells, Carbon Nanotubes, Nanopores, Nano structured Silicon.
Module – IV [15 hrs]
Molecular motors, Nanoparticles for molecular diagnostics, Nanobiosensors, Nanopharmaceuticals, Nanoparticle – Based Drug Delivery, Nanostructures for Tissue Engineering/Regenerative Medicine, Ethical safety, and regulatory issues of nanomedicine.

References
2. Nanomaterials and Nanosystems for Biomedical Applications: M.Reza Mozafari.
3. The Handbook of Nanomedicine, Kewal K.Jain
4. Bio Nanotechnology, Elisabeth S.Pappazoglou, Aravind Parthasarathy
5. Biomedical Nanostructures, Kenneth E.Goonsalves, Craig R.Halberstadt, Cate T. Laurecin, Lakshmi S.Nair.

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

BT14 804 (D) IMMUNOLOGY AND IMMUNOTECHNOLOGY

Teaching Scheme:
3 Hrs lecture and 1 hour tutorial per week Credits: 4

Objectives:
- To impart knowledge on the immune system
- To impart knowledge on immunity to infection and molecular immunology

Module – I [15 hrs]
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Module – II [15 hrs]

Module – III [15 hrs]

Module – IV [15 hrs]

Text Books:
2. Roitt I.M., Brostoff J and Male D.K *Immunology* Mosby Publication

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
BT14 804(E) RECOMBINANT DNA TECHNOLOGY

Teaching Scheme:
3 Hrs lecture and 1 hour tutorial per week

Credits: 4

Objectives:
- To impart the basic concepts of recombinant DNA technology
- To study the application of recombinant DNA technology

Module – I [15 hrs]
Introduction of recombinant DNA into a host (Bacteria, plants & animals by various methods)

Module – II [15 hrs]

Module – III [15 hrs]

Module – IV [15 hrs]

Text Books / Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern
PART A: Analytical/problem solving SHORT questions 8x 5 marks = 40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.
PART B: Analytical/Problem solving DESCRIPTIVE questions  4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

BT14 804 (F) BASICS OF PLANT AND ANIMAL BIOTECHNOLOGY

Teaching Scheme:
3 hours lecture and 1 hour tutorial per week Credits: 4

Objectives:
- To understand the basic and important aspects of biotechnology in plant and animal science
- To make the students understand the concepts of transgenics
- To help in the understanding of cell culture and related techniques

Module I [15 hrs]

Module II [15 hrs]
Molecular aspects of diseases susceptibility and resistance: Transposable elements, factors influencing disease resistances and susceptibility. Transgenics- herbicide tolerance, insect resistance, viral resistance stress tolerance

Module III [15 hrs]

Module IV [15 hrs]

Text Books:
1. P.R Yadav, rajiv Tyagi, Biotechnology of Animals tissues, Discovery Publishing House

Reference Books:
1. Dodd’s J.H Plant Genetic Engineering, Cambridge University Press
Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)  
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.  
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN.  
There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ELECTIVE IV

BT14 805 (A) PROJECT ENGINEERING

Teaching scheme:  
3 Hrs lecture & 1 hour tutorial per week  
Credits: 4

Objectives

- To impart the basic concepts of project management

Module I [15 hrs]
Scope of project engineering - the role of project engineer - R & D - TEFR - plant location and site selection - preliminary data for construction projects - process engineering - flow diagrams - plot plans - engineering design and drafting

Module II [15 hrs]
Planning and scheduling of projects - bar chart and network techniques - procurement operations- office procedures - contracts and contractors - project financing - statutory sanctions

Module III [15 hrs]
Details of engineering design and equipment selection I - design calculations excluded - vessels -heat exchangers - process pumps - compressors and vacuum pumps - motors and turbines – other process equipment

Module IV [15 hrs]
Details of engineering design and equipment selection II - design calculations excluded – piping design - thermal insulation and buildings - safety in plant design - plant constructions, start up and commissioning
Text books:
1. Rase & Barrow, Project Engineering of Process Plants, John Wiley

References:
5. Frederick B. Plummer. Project Engineering, BH

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

BT14 805 (B) ENTREPRENEURSHIP DEVELOPMENT (Global)

Teaching scheme:
3 Hrs lecture & 1 hour tutorial per week Credits: 4

Objectives
- To give an idea on entrepreneurial perspectives

Module I [15 hrs]
Entrepreneurial perspectives- understanding of entrepreneurship process- entrepreneurial decision process- entrepreneurship and economic development- characteristics of entrepreneurial competencies- managerial functions for enterprise.

Module II [15 hrs]
Process of business opportunity identification and evaluation- industrial policy- environment market
Module III [15 hrs]
Process and strategies for starting venture- stages of small business growth- entrepreneurship in international environment- entrepreneurship- achievement motivation- time management, creativity and innovation structure of the enterprise- planning, implementation and growth

Module IV [15 hrs]
Technology acquisition for small units- formalities to be completed for setting up a small scale unit-forms of organizations for small scale units-financing of project and working capital-venture capital and other equity assistance available- break even analysis and economic ratios technology transfer and business incubation

Text Books/References
5. Dr. Patel V.G., Seven Business Crisis, Tata McGraw hill
8. Rao C.R., Finance for small scale Industries

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)  
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.  
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions  8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions  4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
BT14 805 (C) ENERGY ENGINEERING

Teaching Scheme:
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives:
- To impart the knowledge of energy sources and their harnessing technologies.
- To understand about energy audit and conservation in industries

Module I [15 hrs]
Energy-units of energy-conservation factors-general classification of energy-world
ergy resources and energy consumption-Indian energy resources and energy consumption, energy crisis-energy alternatives-electrical energy from conventional energy resources-internal combustion engines-steam turbines-gas turbines-hydro turbines (thermodynamic cycles not included)-nuclear reactors-thermal, hydel and nuclear power plants(process outlines only)- efficiency, merits and demerits of the above power plants, combined cycle power plants-fluidized bed combustion-small hydropower.

Module II [15 hrs]
Solar energy-solar thermal systems-flat plate collectors-focussing collectors-solar water heating solar cooling-solar distillation-solar refrigeration-solar dryers-solar pond-solar thermal power generation-solar photovoltaic systems-solar cells-solar photovoltaic power generation-solar energy application in India-energy plantations. Wind energy-types of wind mills-types of wind rotors-darrieus rotor and gravian rotor-wind electric power generation-wind power in India economics of wind farm-ocean wave energy conversion-ocean thermal energy conversion-tidal energy conversion-geothermal energy conversion.

Module III [15 hrs]

Module IV [15 hrs]
Energy conservation in chemical process plants.- energy audit- energy saving in heat exchangers, distillation columns, dryers, ovens, furnaces and boilers- steam economy in chemical plants energy conservation in petroleum, fertilizer and steel industries-cogeneration, pinch technology recycling for energy saving- electrical energy conservation in chemical plants, energy conservation in bioprocess plants- environmental aspects of energy use.

Reference Books
3. Rao, S, & Parulekar B.B, Energy Technology, Khanna publishers
4. Rai G.D., Non-conventional energy sources, Khanna publishers
5. Nagpal G.R., Power plant Engineering, Khanna publishers
University of Calicut

**Internal Continuous Assessment (Maximum Marks-50)**

- 60% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- 10% - Regularity in the class

**University Examination Pattern**

**PART A: Analytical/problem solving SHORT questions**

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**

Two questions from each module with choice to answer one question. 

*Maximum Total Marks: 100*

**BT14 805 (D) TOTAL QUALITY MANAGEMENT**

**Teaching scheme:**

3 Hrs lecture and 1 hour tutorial per week                               **Credits: 4**

**Objectives**

- *To impart knowledge on the concept of quality tools for analyzing quality statistical tools in quality acceptance sampling life tests*

**Module I [15 hrs]**


**Module II [15 hrs]**

SWOT analysis-strategic planning-customer focus-quality function deployment-customer satisfaction measurement-seven new management tools-Deming wheel-zero defect concept-bench marking-six sigma concepts-failure mode and effect analysis-poke yoke

**Module III [15 hrs]**

Five S for quality assurance-quality circle philosophy-failure rate analysis-mean failure rate-mean time to failure (MTTF)-Mean time between failure (MTBF)-hazard models-system reliability availability-maintenance

**Module IV [15 hrs]**

Text Books
1. L Suganthi, Anand A Samuel, Total Quality Management, PHI

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8 x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

BT14 805 (E) MEMBRANE SEPARATION TECHNOLOGY

Teaching Scheme:
3 Hrs lecture and 1 hour tutorial per week  Credits: 4

Objectives:
- To impart knowledge on the uses of different membranes for separation procedures
- To study membrane separation techniques

Module – I [15 hrs]

Module – II [15 hrs]
Characterization of membranes: introduction, membrane characterization. Characterization of porous membranes, characterization of non-porous membranes. Transport in membranes: introduction, driving forces, non equilibrium thermodynamics, transport through porous, non-porous and ion exchange membranes.
Module-III [15 hrs]

Module – IV [15 hrs]
Polarization phenomenon and fouling: introduction to concentration polarization, turbulence promoters, pressure drop, gel layer model, osmotic pressure model, boundary layer resistance model, concentration polarization in diffusive membrane separators and electro dialysis, membrane fouling, method to reduce fouling, compaction. Module and process design: Introduction, plate and frame module spiral wound module, tabular module, capillary module, hollow fiber module, comparison of module configurations.

Text books/ Reference books:
1. S.P.Nunes , K.V, Peinemann, Membrane Technology in the chemical industry Wiley-VCH
4. C.J. Geankoplis. Transport processes and Unit Operations

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
BT14 805 (F) PROTEIN ENGINEERING

Teaching Scheme:
3 hours lecture and 1 hour tutorials per week

Credits: 4

Objectives:
- To impart advance knowledge on how to engineer proteins through a detailed study of protein structure, its characteristic properties and its significance in biological systems

Module – I [15 hrs]
Protein – Bond interactions in protein structure; primary structure and its determination; secondary structure and its prediction methods; tertiary structure and domain in proteins; proteins folding pathways; quaternary structures; methods to determine 3D structures; X-ray crystallography and NMR method; post translational modifications.

Module II [15 hrs]
Structure function relationship of Proteins: DNA-binding proteins: prokaryotic transcription factors, Helix-turn-Helix motif in DNA binding, Trp repressor, Eucaryotic transcription factors, Zn fingers, helix-turn helix motifs in homeodomain, Leucine zippers, Membrane proteins: General characteristics, Transmembrane segments, prediction, bacteriorhodopsin and Photosynthetic reaction center, and Enzymes: Serine proteases, understanding catalytic design by engineering tryspin, chymotrypsin and elastase, substrate-assisted catalysis other commercial applications.

Module III [15 hrs]
Protein phosphorylation – Immunoglobulins: IgG Light chain and heavy chain architecture, abzymes – ribonuclease – lysozyme. Epidermal growth factor. Insulin and PDGF receptors and their interactions with effectors, immunoglobulins; classes and its biological functions;

Module IV [15 hrs]
Protein engineering and Protein Design: Protein data base analysis – methods to alter primary structure of proteins – Examples of engineered proteins – Protein design, principles and examples. Methods in Proteins engineering; Immunotoxins; mechanism and its applications; Drug designing; structure based approach, receptor based approach.

Text Books:

Reference:

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class
University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**  
8 x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**  
4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

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**BT14 806 (P) SEMINAR**

**Teaching scheme:**
3 Hrs per week  
Credits: 2

**Objective:**

- To assess the ability of the student to study and present a seminar on a topic of current relevance in biotechnology engineering and allied areas.

It enables the students to gain knowledge in any of the technically relevant current topics and acquire the confidence in presenting the topic. The student will undertake a detailed study on the chosen topic under the supervision of a faculty member, by referring papers published in reputed journals and conferences. Each student has to submit a seminar report, based on these papers; the report must not be reproduction of any original paper. A committee consisting of three/four faculty members will evaluate the seminar.

**Internal continuous assessment**

40% - Design and development  
30% - Presentation and demonstration of results  
20% - Report  
10% - Regularity in the class

Total Marks: 100

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**BT14 807 (P) PROJECT**

**Teaching scheme**
7 Hrs practical per week  
Total Credits: 7

This project work is the continuation of the project initiated in seventh semester. The performance of the students in the project work shall be assessed on a continuous basis by the project evaluation committee through progress seminars and demonstrations conducted during the semester. Each project group should maintain a log book of activities of the project. It should have entries related to the work done, problems
There shall be at least an interim evaluation and a final evaluation of the project in the 8th semester. Each project group has to submit an interim report in the prescribed format for the interim evaluation. Each project group should complete the project work in the 8th semester. Each student is expected to prepare a report in the prescribed format, based on the project work. Members of the group will present the relevance, design, implementation, and results of the project before the project evaluation committee comprising of the guide and three/four faculty members specialized in biotechnology engineering and allied areas 50% of the marks is to be awarded by the guide and 50% by the evaluation committee.

Internal continuous assessment

- 40% - Design and development
- 30% - Presentation and demonstration of results
- 20% - Report
- 10% - Regularity in the class

Total Marks : 100

**BT14 808 (P) VIVA – VOCE**

**Objective:**

- To examine the knowledge acquired by the student during the B. Tech. course, through an oral examination

The students shall prepare for the oral examination based on the theory and laboratory subjects studied in the B. Tech. course, seminar, and project. There is only university examination for viva-voce. University will appoint two external examiners and an internal examiner for viva-voce. These examiners shall be senior faculty members having minimum five years teaching experience at engineering degree level. For final viva-voce, candidates should produce certified reports of, seminar, and project (two interim reports and main report). If he/she has undergone industrial training/industrial visit/educational tour or presented a paper in any conference, the certified report/technical paper shall also be brought for the viva-voce. Allotment of marks for viva-voce shall be as given below.

**Assessment in viva-voce**

- 40% - Subject
- 30% - Project
- 20% - Seminar
- 10% - Industrial training/ Industrial visit/ Papers presented at national level

Maximum marks: 100