KUMARAGURU COLLEGE OF TECHNOLOGY, COIMBATORE – 641 049
(An Autonomous Institution Affiliated to Anna University, Chennai)

REGULATIONS - 2014
CURRICULUM AND SYLLABI FOR I & II SEMESTERS
KUMARAGURU COLLEGE OF TECHNOLOGY, COIMBATORE - 641049  
(An Autonomous Institution Affiliated to Anna University, Chennai)

**SEMESTER – I**  
(COMMON TO ALL BRANCHES OF ENGINEERING & TECHNOLOGY)

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**TOTAL – 34 HOURS**  
**TOTAL CREDITS – 24**

*Physics Lab is offered for 50% of the classes and Chemistry lab for remaining 50% of the classes in the first semester. In the second semester the labs are interchanged.

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## B.E - AERONAUTICAL ENGINEERING

### SEMESTER – II

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**TOTAL – 33 HOURS**

**TOTAL CREDIT – 25**
## B.E – AUTOMOBILE ENGINEERING

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**TOTAL – 32 HOURS**

**TOTAL CREDITS – 24**
# B.Tech – BIOTECHNOLOGY

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**TOTAL – 31 HOURS**

**TOTAL CREDITS – 23**
### B.E CIVIL ENGINEERING

#### SEMESTER – II

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**TOTAL – 32 HOURS**  
**TOTAL CREDITS – 24**
### B.E - COMPUTER SCIENCE AND ENGINEERING

**SEMESTER – II**

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**TOTAL – 33 HOURS**

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## B.E - ELECTRONICS AND COMMUNICATION ENGINEERING

### SEMESTER - II

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**TOTAL CREDITS – 24**
## B.E - ELECTRICAL AND ELECTRONICS ENGINEERING

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**PRACTICAL**

**TOTAL – 32 HOURS**

**TOTAL CREDITS – 24**
## B.Tech - TEXTILE TECHNOLOGY (FASHION TECHNOLOGY)

### SEMESTER – II

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**TOTAL – 31 HOURS**

**TOTAL CREDIT – 23**
## B.Tech - INFORMATION TECHNOLOGY

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**TOTAL – 32 HOURS**

**TOTAL CREDIT – 24**
## B.E - MECHANICAL ENGINEERING

### SEMESTER – II

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**TOTAL – 32 HOURS**

**TOTAL CREDITS – 24**
### B.E - MECHATRONICS ENGINEERING

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**TOTAL – 32 HOURS**

**TOTAL CREDIT – 24**
### B.Tech - TEXTILE TECHNOLOGY

#### SEMESTER – II

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**TOTAL – 32 HOURS**

**TOTAL CREDITS – 24**
OBJECTIVES

- Discover an understanding of the process of oral communication
- Originate knowledgeable audience-centered speaking
- Formulate a significant training ground for the development of student’s abilities in public speaking
- Create multiple opportunities for students to practice and share their reading skill development
- Improve critical thinking and analytical skills
- Develop a milestone for leadership and group participation through communication skills

READING: FUNDAMENTALS OF ENGLISH 15 Hours


WRITING: BASIC STRATEGIES OF WRITING 15 Hours

Agreeing and disagreeing – Practice of frequency - Article Writing (Critical writing - Creative writing) - Anecdote Formation - Greeting friends and strangers - Short prepared compositions on current affairs - Writing a proposal for conducting science exhibition - Factual business letters and E-mail etiquette

LISTENING: LANGUAGE ACQUISITION 15 Hours

Descriptive words and regular - irregular verbs - Conversation between old friends; introducing others - Tense and voice - Establishing relationships and negotiating - Discussion on Practical business tasks - Ordering or answering enquiries - Short telephone conversations - Outline a problem and present a solution - Fluency Drills - British and American equivalents.

SPEAKING: ADEPTNESS OF ARTICULATION 15 Hours

Practice of phonetic transcription (Vowel and Consonant symbols) - Presenting information - General business discussions and factual discussions - Giving and getting product information - Describing organizations - Practicing of conversation starters and closers with friends and strangers - Asking about possibility/preference - Offering help - Seeking permission – Persuading - Talking about people and places - Explaining ideas and visual information

L: 30 Hr, T: 30 Hr, TOTAL: 60 HOURS
REFERENCES

COURSE OUTCOMES
➢ Formulate and practice effective reading strategy to enhance technical communication
➢ Assess strengths in writing skills and set goals for future growth
➢ Practice and perceive the full repertoire of listening strategies by using authentic listening tasks
➢ Create learning situations to develop speaking skills based on sound educational and communication theories.
OBJECTIVES:

On completion of the course the students are expected

- To know eigen values and eigen vectors and diagonalization of a matrix.
- To know about the geometrical aspects of curvature, evolute and envelope.
- To solve ordinary differential equations of certain types and its application.
- To understand the concepts of partial differentiation, maxima and minima.

MATRICES


GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS


FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS

Leibnitz’s equation – Bernoulli’s equation – Equations of first order and higher degree - Clairaut’s form – Applications: Orthogonal trajectories and simple Electric circuit problems.

HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS

Linear equations of second and higher order with constant coefficients – Euler’s and Legendre’s linear equations – Method of variation of parameters – First order Simultaneous linear equations with constant coefficients - Application - Oscillatory electrical circuit. (Differential equations and associated conditions need to be given).
FUNCTIONS OF SEVERAL VARIABLES


L: 45 + T: 15 = 60 Hours

REFERENCES


Course Outcome

After pursuing the above mentioned course, the students will be able to:

- Know eigen values and eigen vectors and its role in the system of equations.
- Discover the radius, centre and circle of curvature of any curves.
- Solve the ordinary differential equations of certain types and its applications.
- Identify the maximum and minimum values of surfaces
OBJECTIVES
At the end of the course the students would be exposed to fundamental knowledge in

- Various engineering subjects and applications.
- Structure identification of engineering materials.
- Non-destructive techniques.
- Interferometric techniques in metrology and electrical phenomena.
- Application of lasers in engineering and technology.
- Atomic and Nuclear related theories.

CRYSTAL PHYSICS
9 Hours

APPLIED OPTICS
9 Hours

QUANTUM PHYSICS
9 Hours
Plancks quantum theory of black body radiation (derivation) – Photo electric effect – Compton effect (derivation) and experimental verification of Compton effect – De-broglies concept - Schrodinger wave equation – time independent and time dependent equations (derivations) – physical significance of wave function – particle in a box ( one dimensional case) – Electron microscope – Scanning electron microscope – Transmission electron microscope.

ULTRASONICS AND NDT
9 Hours
ATOMIC AND NUCLEAR PHYSICS  
9 Hours
Introduction – Atomic spectra – Molecular spectra – Applications – Raman effect – Stokes lines and anti stokes lines – Applications – Nuclear models – Liquid drop model – The Shell model- Nuclear fission – Theory – Energy released per fission – Chain reaction – Controlled chain reaction – Nuclear reactors – Condition for sustained chain reaction – Types of Nuclear reactors – Nuclear fusion – Thermo nuclear reactions – Differences between fission and fusion

TOTAL: 45 HOURS

REFERENCES

COURSE OUTCOMES
➢ Analyze and identify the crystal structure in materials
➢ Categorize and illustrate the optical materials and its application to engineering
➢ Examine and compare samples at nano level
➢ Apply the NDT techniques and modern engineering tools necessary for engineering practice.
➢ Discuss the role of nuclear physics in energy production
OBJECTIVES

- To inculcate an understanding of the importance of chemistry by providing an overall perspective of theoretical and modern technological aspects of applied chemistry before beginning their more specialized courses.
- To embellish the usage of chemistry to exhibit engineering and technical concepts

ELECTROCHEMISTRY

Introduction - Electrode potential – Nernst equation and problems - Electrochemical series - Application of EMF measurements & problems - Kohlrausch law of independent migration of ions & its application - Conductometric titrations (acid-base & precipitation titration)

Electrodes: Standard and reference electrode (Hydrogen & Calomel) – Types of electrodes (Metal – Metal ion; Metal – Metal insoluble salt, Redox electrode) – Ion selective (glass electrode) – determination of pH using glass electrode

Cells: Galvanic cell – Types of concentration cells

ENERGY STORING DEVICES

Batteries: Primary Battery (Lechlanche & Alkaline battery) - Secondary Battery (Lead acid storage battery, Nickel - Cadmium battery & Lithium – Polymer battery) – Flow battery (Hydrogen and Oxygen Fuel Cell)

Solar Cells: Hybrid Solar cells

Nuclear Reactors: Light water nuclear power plant (nuclear fission) - ICF (nuclear fusion)

THERMODYNAMICS

Introduction - Thermodynamic process (isothermic, isobaric, isochoric and adiabatic processes) - Internal energy – first law of thermodynamics (Mathematical derivation & limitation) - Enthalpy - Second law of thermodynamics - Entropy - Entropy change of an ideal gas & problems - Free energy - work function - Gibbs Helmholtz equation (derivation, applications & problems) - Van’t Hoff isotherm (derivation & problems) - Van’t Hoff isochore - (derivation & problems) - Third law and zeroeth law (Only statements)

SURFACE CHEMISTRY

Introduction of adsorption - Types of Adsorption - Adsorption isotherm (Freundlich isotherm, Langmuir adsorption isotherm, BET isotherm) - Applications of adsorption: Role of adsorption in catalytic reactions, Ion exchange adsorption, adsorption chromatography (Column chromatography)
SPECTROSCOPY 9 Hours
Introduction to spectroscopy - Beer Lambert’s Law - Colorimetric analysis (principle, instrumentation (block diagram only) & application (Estimation of concentration of Ferrous and copper ions a solution by colorimetry) - UV – visible spectroscopy (principles, instrumentation (block diagram only) & simple Applications) - IR spectroscopy (principles, instrumentation (block diagram only) & simple applications) - Flame photometry (Principle, instrumentation (block diagram only) & simple Applications)

TOTAL: 45 HOURS

REFERENCE

COURSE OUTCOMES
➤ Assemble a battery and illustrate the phenomenon of production of electric current
➤ Discuss the thermodynamic concepts and predict the feasibility of chemical reaction
➤ Apply the theory of adsorption in real life situations
➤ Outline the principles and instrumentation of spectroscopic techniques
OBJECTIVES
- To enable students to learn about the basics of computers and problem solving methods
- To learn the various features of C
- To learn how to program using C language

INTRODUCTION
9 Hours

C LANGUAGE BASICS
9 Hours

ARRAYS AND STRINGS
9 Hours

FUNCTIONS, STORAGE CLASSES AND POINTERS
9 Hours
Storage classes – auto, static, extern, register- scope rules.
Pointers: Definition – Initialization – Pointers arithmetic – Pointers and arrays - Dynamic memory allocation - Example Problems

STRUCTURES, UNIONS AND FILES
9 Hours

L: 45 Hr, T: 15 Hr, TOTAL: 60 Hours
REFERENCES

COURSE OUTCOMES
- Explain the basics of programs and programming
- Select appropriate data types and control structures for solving a given problem.
- Illustrate the representation of arrays, strings and usage of string operations.
- Illustrate the importance of pointers and dynamic memory allocation.
- Explain the basics of file handling mechanism.
OBJECTIVES
- To understand the principle of orthographic projection of points, lines, surfaces and solids.
- To understand the principle of section and development of solids.
- To understand the principle of Isometric and Perspective projections.
- To study the principle of free-hand sketching techniques.

PLANE CURVES, PROJECTION OF POINTS AND LINES 15 Hours
Importance of graphics in design process, visualization, communication, documentation and drafting tools. Construction of curves - ellipse, parabola, and hyperbola by eccentricity method only. Orthographic projection of points. Projections of straight lines located in first quadrant - determination of true length and true inclinations.

PROJECTIONS OF SURFACES AND SOLIDS 15 Hours
Projections of plane surfaces - polygonal lamina and circular lamina, located in first quadrant and inclined to one reference plane. Projection of simple solids - prism, pyramid, cylinder and cone. Drawing views when the axis of the solid is inclined to one reference plane.

SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 15 Hours
Sectioning of simple solids - prisms, pyramids, cylinder and cone. Obtaining sectional views and true shape when the axis of the solid is vertical and cutting plane inclined to one reference plane. Development of lateral surfaces of truncated prisms, pyramids, cylinders and cones.

PICTORIAL PROJECTIONS 15 Hours
Isometric projection, Isometric scale, Isometric views of simple solids, truncated prisms, pyramids, cylinders and cones. Perspective projection of prisms and pyramids when its base resting on the ground by vanishing point method.

FREE-HAND SKETCHING 15 Hours
Free hand sketching techniques, sketching of orthographic views from given pictorial views of objects, including free-hand dimensioning. Sketching pictorial views from given orthographic views.

L: 30 Hr, P: 45 Hr, TOTAL: 75 Hours
REFERENCES

COURSE OUTCOMES
- Construct various plane curves and projection of lines and surfaces.
- Develop projection of solids, sections of solids and surfaces.
- Apply the concepts of isometric, perspective and free hand sketching in engineering practice.
OBJECTIVES

- To apply the theoretical principles and perform experiments
- Experience the importance of theory by using analytical equipments and quantitative and qualitative procedures.

LIST OF EXPERIMENTS

PREPARATION OF SOLUTIONS (STANDARD)
1. Preparation of normal solutions of the following substances - oxalic acid, sodium carbonate, hydrochloric acid.
2. Preparation of phosphate buffer using Henderson equation.

WATER TESTING
3. Determination of total, temporary and permanent hardness by EDTA method.
4. Estimation of DO by Winkler’s method.
5. Estimation of alkalinity by Indicator method.

ELECTRO CHEMICAL ANALYSIS
7. Estimation of hydrochloric acid by pH metry.
8. Conductometric titration of mixture of acids and strong base
9. Conductometric precipitation titration using BaCl₂ and Na₂SO₄.
10. Estimation of Iron by Potentiometry

PHOTOMETRY
11. Estimation of the Ferrous ions (Thiocyanate method) by Spectrophotometry.
12. Estimation of sodium and potassium by Flame photometry.

TOTAL: 45 HOURS

REFERENCES

COURSE OUTCOMES

- Prepare normal solutions
- Analyse the properties of water by applying the chemical concepts
- Estimate the concentration of solutions by electrochemical methods and apply it in real life situations like blood testing etc
OBJECTIVES

- The experiments are designed to illustrate phenomena in different areas of Physics and to expose you to measuring instruments.
- The laboratory provides a unique opportunity to validate physical theories in a quantitative manner.
- Laboratory experience demonstrates the limitations in the application of physical theories to real physical situations.
- In general, the purpose of these laboratory exercises is both to demonstrate some physical principle and to teach techniques of careful measurement.

LIST OF EXPERIMENTS

Any Ten Experiments
1. Lee’s disc - determination of thermal conductivity of a bad conductor
2. Air wedge - determination of thickness of a given specimen.
3. Spectrometer - determination of wavelength of mercury source using grating
4. Compound pendulum - determination of acceleration due to gravity.
5. Carey foster bridge – determination of specific resistance of a given coil of wire.
7. Non-uniform bending – determination of Young’s modulus
8. Ultrasonic interferometer – determination of velocity of sound and compressibility of liquid.
9. Band gap determination of a semiconductor using post office box
10. Semiconductor laser:
    a. Determination of wavelength of laser using grating
    b. Particle size determination
    c. Acceptance angle of optical fibre
11. Torsional pendulum - determination of Rigidity modulus of the wire
12. Field along the axis of a coil – Determination of magnetic moment.

Demonstration experiments:
1. Determination of solar cell parameters
2. Hall effect
3. Four probe apparatus
4. Animations – (Laser, Fiber optics and hysteresis curve)

TOTAL: 45 HOURS

COURSE OUTCOMES

- Determine different physical properties of a material like the thermal conductivity thickness of the material, etc.
- Perform experiments involving the physical phenomena like interference and diffraction.
- Apply physical theories in real life situations by also taking into account its limitations.
OBJECTIVES
- To enable students to solve problems using C
- To apply the various features of C

LIST OF EXPERIMENTS

1. Simple programs
   - To find whether the given number is prime or not
   - Factorial of the given number
2. Programs involving Control and Looping Structures
   - Arithmetic Progression
   - Trigonometric series evaluation
3. Programs using Arrays
   - Sorting
   - Matrix addition and Multiplication
4. Calculation of median of a frequency distribution.
5. Evaluation of integrals
   - Trapezoidal Rule
6. String Processing
7. Program using Recursive function
8. Using pointers in C
9. Program using Functions, Structures and Files
   - Students Mark Analysis
10. Iterative method for finding Roots of the polynomials
    - Lagrange interpolation method

TOTAL: 45 HOURS

COURSE OUTCOMES
- Develop algorithms, flowcharts and programs to solve a given problem.
- Demonstrate code reusability using recursive and non-recursive functions.
- Implement pointers, memory allocation techniques and files in ‘C’ language.
- Apply and practice logical ability to solve simple problems.
- Demonstrate ‘C’ programs for statistical and scientific problem solving.
LIST OF EXPERIMENTS

GROUP – I 21 Hours

A. CIVIL ENGINEERING
1. Carpentry
   • Study of carpentry tools
   • Preparation of T joint
   • Preparation of dovetail joint

2. Plumbing
   • Study of pipeline joints

B. MECHANICAL ENGINEERING
1. Fitting
   • Study of fitting tools
   • Preparation of L joint
   • Preparation of square joint

2. Sheet Metal Working
   • Study of sheet metal working tools
   • Preparation of cone and tray

3. Welding
   • Study of arc welding tools and equipment
   • Preparation of butt joint

GROUP - II (ELECTRICAL & ELECTRONICS ENGINEERING) 12 Hours

C. ELECTRICAL ENGINEERING PRACTICE
   • Basic household wiring using switches, fuse, indicator-lamp, etc.,
   • Preparation of wiring diagrams.
   • Stair case light wiring.
   • Tube light wiring
   • Study of iron-box, fan with regulator, emergency lamp and microwave oven.
D. ELECTRONIC ENGINEERING PRACTICE

1. Assembling simple electronic component on a small PCB and Testing.
2. Soldering simple electronic circuits and checking continuity.
   - DC and AC voltage measurement
   - DC and AC current measurements.
   - Resistance Measurement.
   - Continuity measurement.
4. Testing of Electronic components
   - Resistors
   - Inductors and capacitors
   - Diodes (resistance in forward bias and reverse bias)
   - Transistors
5. Study of CRO and Function generator
   - Study of Panel Controls
   - Measurement of Amplitude, Frequency, phase difference

TOTAL: 45 HOURS

COURSE OUTCOMES

- Select the various tools and equipments used in the fabrication workshop.
- Develop various models in carpentry, fitting, sheet metal work and welding.
- Demonstrate and evaluate the parameters of basic electronic components (wires, resistors, capacitors, diodes etc.) and test the components.
- Estimate DC and AC Voltage and currents using appropriate measuring instruments.
OBJECTIVE
- To inspire students to become best Humans.
- To know about self.
- To overcome evil temperaments.
- To live with sound health.
- To reach Intuition.

HUMAN LIFE & EXCELLENCE 4 Hours
Body, Soul, Mind & Their Functional Relationship: Panchboothas and it’s association – Form of the body: physical body, astral body, causal body - Effect: Pain, Disease, Death; Soul – Life force – Bio magnetism – Genetic Centre – Mind: Origin & it’s ten stages.

INTROSPECTION & THOUGHT ANALYSIS 4 Hours
Introduction – Importance – Blemishes – Six evil temperaments & their maneuvering.
Thought analysis: Introduction - process of thought – Mind & Thought relationship – causes for origin of thoughts
Exercise: Training & Practice of Thought analysis

MORALIZATION OF DESIRE 2 Hours
Training: Moralization of Desire.

NEUTRALIZATION OF ANGER 2 Hours
Introduction – Origin of Anger – Alternative forms of Anger – A chain action – Consequence of anger on self & others – Neutralization of anger – the point where anger is won.
Training: Neutralizing anger.

ERADICATION OF WORRIES 2 Hours
Training – Eradication of Worries.

REALIZATION OF SELF 2 Hours
Training: Realization of self.
THEORY & PRACTICAL SESSION ON PHYSICAL EXERCISE: 9 Hours

MEDITATION 5 Hours
Meditation: Agna Meditation – Shanthi Meditation.

Total: 30 Hours

COURSE OUTCOMES
- Acquire knowledge on the individual in relation to Nature and Society.
- Analysis purity of Thoughts, Moralization of Desire
- Learn about Neutralization of Anger.
- Develop skills in Sky yoga and Kaya kalpa.
### B.E - AERONAUTICAL ENGINEERING

#### SEMESTER – II

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<td>Elements of Aeronautics</td>
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| **PRACTICAL** |                              |   |   |   |   |
|               | Chemistry Laboratory         | 0 | 0 | 3 | 1 |
| U14CS211      | Computing Laboratory         | 0 | 0 | 3 | 1 |
| U14AEP201     | CAD Laboratory - I           | 0 | 0 | 3 | 1 |
| U14GHP201     | Human Excellence – Family Values | 1 | 0 | 1 | 1 |

**TOTAL – 33 HOURS**

**TOTAL CREDIT – 25**
OBJECTIVES
- To develop reading accuracy and English fluency
- To Employ appropriate formats in writing and effective
- To compare and relate words/sounds and listen for specific information.
- To maximize the elements of spoken ability

INTERPRETATIONAL DEXTERITY  15 Hours
Homophones and homonyms - Encoding and decoding advertisements - Transcoding
Graphical Representations – Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree
diagram - Reading brochures, leaflets, instruction manual - Cloze test - Reading
Comprehension- Note Making – Linear and non-linear - Book review, Article review

STYLES OF SCRIPTING  15 Hours
Types of sentences - Concord - Framing Questions – “Wh” questions, Yes/No questions and
Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a
passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative,
Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting
information, explaining a situation, letter of acceptance, declining letter, letter of application
and resume - Essay Writing

AUDITORY PROFICIENCY  15 Hours
Listening to monologues, Listening for general content - Listening to dialogues - Listening to
a telephonic conversation - Listening for specific information, numbers, time, duration -
Listening to conversations between three or more people- Listening to a group discussion and
providing factual information, Intensive listening

ORATORICAL EFFICIENCY  15 Hours
Discussing studies/interests/friends/families-Describe an object or event - Describing a
working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a
public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS

REFERENCES
1. Mark Ibbotson, Cambridge English for Engineering Published by Cambridge University
3. Jeremy Comfort, Pamela Rogerson, Trish Stott and Derek Utley, Speaking Effectively,
   Cambridge University Press, .1994
5. Dorothy Adams, Everyday English: A Course on Communicative English, Cengage
   learning, 2009
COURSE OUTCOMES

- Distinguish the application of technical diction for the data interpretation while reading
- Construct technical sentences and compose corporate letters
- Improve listening for inferring technical information
- Develop spoken communication needed for presentations and discussions
OBJECTIVES
On completion of the course, the students are expected

- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS
9 Hours
Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application : Area as double integral – Volume as triple integral.

VECTOR CALCULUS
9 Hours
Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green’s theorem in a plane, Gauss divergence theorem and Stoke’s theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION
9 Hours
Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : \( w = z + c, cz, 1/z \) and bilinear transformation.

COMPLEX INTEGRATION
9 Hours
Statement and applications of Cauchy’s integral theorem and Cauchy’s integral formula (excluding proofs) – Taylor’s and Laurent’s series expansions – Singularities – Residues – Cauchy’s residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).
LAPLACE TRANSFORM  

**9 Hours**


L: 45 + T: 15 = 60

REFERENCES


Course Outcomes

**After pursuing the above mentioned course, the students will be able to:**

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.
OBJECTIVES
At the end of the course students would be exposed to
- Types of defects in engineering materials and mechanisms of strengthening
- Properties of conducting, super conducting, magnetic and dielectric materials.
- Properties of Semi conducting, optical and new engineering materials.

CONDUCTING AND SUPERCONDUCTING MATERIALS

Superconducting Materials: Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I & Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS
Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS


NANOTECHNOLOGY AND NEW ENGINEERING MATERIALS
New Engineering Materials: Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications advantages and disadvantages of SMA.

Nano Materials: synthesis - plasma arcing – Chemical vapour deposition – sol-gel - Electro deposition – ball milling – properties of nanoparticles and applications. – Carbon nano tubes –
fabrication - arc method – pulsed laser deposition - Chemical vapour deposition - structure, properties & applications.

**STRENGTHENING OF MATERIALS**

9 Hours

Strengthening mechanisms for the improvement of mechanical properties - cold working precipitation hardening, solute hardening and diffusion hardening - Fracture-Mechanism of brittle fracture (Griffith’s theory) and Ductile fracture - difference between brittle and ductile fracture - fatigue failure and its prevention - creep different stages in creep curve-Factors affecting mechanical properties Grain size and heat treatment - Mechanical test Tensile, compression, hardness, impact creep, fatigue and stress.

**TOTAL: 45 HOURS**

**REFERENCE BOOKS**

2. Avadhanalu M.N. and Kshirsagar P.G., A textbook of Engineering Physics, S. Chand & Company Ltd, New Delhi, 2005

**COURSE OUTCOMES**

- Apply core concepts in Materials Science to solve engineering problems
- Determine the position of the acceptor or donor levels and the brand gap of an extrinsic semiconductor
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the techniques to manufacturing of modern materials and nano materials for engineering applications
- Recognize the basic concepts of strengthening of materials in technological applications
OBJECTIVES

- To inculcate essential knowledge on theoretical and modern technological aspects of fuels and combustion, specialty materials, water technology, corrosion studies and powder metallurgy.

FUELS AND COMBUSTION

Classification of fuels - coal varieties - analysis of coal (proximate and ultimate analysis) - coke manufacture (Otto-Hoffman byproduct coke oven method) - characteristics of metallurgical coke - cracking (thermal and catalytic cracking definition only) – manufacturing of synthetic petrol (Fischer Tropsch method, Bergius process) – knocking (octane number, cetane number) - gaseous fuels (production, composition and uses of producer gas, water gas and natural gas).

Combustion: gross and net calorific value - determination of calorific value by bomb calorimeter - explosive range - spontaneous ignition temperature - flue gas analysis (Orsat apparatus).

MECHANICAL ENGINEERING MATERIALS

Abrasives: Moh’s scale of hardness - natural abrasives (diamond, corundum, emery, garnets and quartz) - artificial abrasives (silicon carbide, boron carbide).

Refractories: Characteristics - classification (acid, basic and natural refractories) - properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) - General manufacturing methods of refractories - preparation, properties and uses of high alumina bricks, magnesite and zirconia bricks.

Lubricants: Classification - Functions - properties (viscosity index, flash and fire point, oiliness, carbon residue, aniline point, cloud and pour point) - greases (calcium based, sodium based, lithium based) - solid lubricants (graphite, molybdenum disulphide).

CORROSION SCIENCE

Corrosion - Principles of electrochemical corrosion - difference between chemical and electrochemical corrosion - factors influencing corrosion.

Types of corrosion: galvanic corrosion - differential aeration corrosion (soil (microbial) corrosion, pitting corrosion, water line corrosion) - stress corrosion.

Corrosion control: cathodic protection (sacrificial anode) - Protective Coatings (Paint, Electroplating of Copper).

WATER TECHNOLOGY

9 Hours
Boiler feed water: requirements - disadvantages of hard water (formation of deposits in steam boilers, priming, foaming, caustic embrittlement & boiler corrosion).

Prevention of scale formation: external treatment (ion exchange method) - internal treatment (phosphate, calgon, carbonate, colloidal) - desalination by reverse osmosis - Treatment of Domestic water

PHASE RULE AND POWDER METALLURGY

Phase rule - condensed phase rule - construction of phase diagram (thermal analysis) – Applications of phase rule: Simple eutectic system (Ag - Pb, Fe - C system).

POWDER METALLURGY : Preparation of metal powders (mechanical pulverization, atomization, chemical reduction, electrolytic process, decomposition) - mixing and blending - compacting - sintering - advantages and limitations of powder metallurgy.

TOTAL: 45 HOURS

REFERENCES

COURSE OUTCOMES
- Classify the different types of fuels and their properties
- Categorize the engineering materials and their uses
- Defend the Corrosion problems
- Design a water purifier
- Identify the techniques of preparing metal powder
OBJECTIVES

- To understand the concept of equilibrium of particles and rigid bodies.
- To understand the concept of first and second moment of area.
- To understand the concept of various types of frictions.
- To understand the principle of work energy method, Newton’s law and impact of elastic bodies.

BASICS & STATICS OF PARTICLES

9 Hours

EQUILIBRIUM OF RIGID BODIES

9 Hours
Moment of a force about point – Varignon s theorem- Moment of a couple-Resolution of force in to force couple system-Resultant of coplanar non concurrent system - Types of supports and their reactions- Requirements of stable equilibrium - Equilibrium of Rigid bodies in two dimensions.

PROPERTIES OF SURFACES AND SOLIDS

9 Hours
First moment of area and the Centroid of sections Rectangle, circle, triangle, T section, I section Angle section and Hollow section. Second and product moments of plane area Rectangle, triangle, circle. T Section, I section, Angle section and Hollow section, Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia.

FRICTION

9 Hours
Frictional force-Law of coloumb friction , simple contact friction, Rolling resistance and Belt friction, Ladder friction, Wedge friction.

DYNAMICS OF PARTICLES

9 Hours
Kinematics: Rectilinear & Curvilinear motion of particles, Displacements Velocity and acceleration.

L: 45 Hr, T: 15 Hr, TOTAL: 60 HOURS

REFERENCES


**COURSE OUTCOMES**
- Explain the concept of equilibrium of particles and rigid bodies.
- Apply the concepts of equilibrium and moment of inertia for various shapes sections.
- Make use of various concepts of friction.
- Solve problems using the concepts in kinematics and kinetics.
OBJECTIVES

- To promote an understanding of the aeronautical field and a higher level of motivation among students by providing an overall perspective before they begin their more specialized courses. A broad base is developed into which subsequent courses can be integrated in depth.

INTRODUCTION TO AIRPLANES 9 Hours

AIRPLANE STRUCTURES AND MATERIALS 9 Hours
Introduction to structural design of Aircraft and spacecraft, flight loads, general types of construction, Monocoque, Semi-monocoque and composite structure construction, Typical wing and fuselage structure, Metallic and Non metallic materials, Use of aluminium alloy, titanium, stainless steel and composite materials in aerospace.

AIRCRAFT ENGINES 9 Hours
Selection of power plants: piston, turbo-propeller, turbofan, and jet engines with after burner / thrust augmentation thrust vector control, FADEC. Use of propeller and jets for thrust production, Comparative merits. Theory of Propellers.

SPACE SYSTEM DESIGN 9 Hours
Overview on space environment, introduction to space debris, Launch site selection, Brief introduction to rockets, ramjet, and SCRAMJET, Thrust vector control mechanisms, staging of rockets, space mission, re-entry vehicles, life support systems for manned space missions, Fuel cells, Introduction to space mechanics: Kepler’s laws of planetary motion, introduction to satellites, Interplanetary missions, Space exploration.

ROTORCRAFT, UAVs, AND AIRCRAFT SYSTEMS 9 Hours
Introduction to Helicopters and Micro-lights. Introduction to UAVs and MAVs. Types and applications, Maintenance, safety and operations. Basic principles and lay out of various aircraft systems: Hydraulic system, Aircraft Fuel system, Engine fuel system, Air conditioning and Pressurization system Flight control system, Navigation and Weapon control system, Under carriage and Brake system, High lift devices.

L: 45 Hr, T: 15 Hr, TOTAL: 60 HOURS
REFERENCES

COURSE OUTCOMES
➢ To provide students with an introduction to the aerospace field.
➢ To teach students about the fundamentals of vehicle flight in the atmosphere
➢ To teach students about the fundamentals of vehicle flight in space
➢ To provide students with an understanding of performance
➢ To provide students with engineering background suitable for subsequent course work in aerospace engineering.
OBJECTIVES
- To apply the theoretical principles and perform experiments
- Experience the importance of theory by using analytical equipments and quantitative and qualitative procedures.

LIST OF EXPERIMENTS

PREPARATION OF SOLUTIONS (STANDARD)
1. Preparation of normal solutions of the following substances - oxalic acid, sodium carbonate, hydrochloric acid.
2. Preparation of phosphate buffer using Henderson equation.

WATER TESTING
3. Determination of total, temporary and permanent hardness by EDTA method.
4. Estimation of DO by Winkler’s method.
5. Estimation of alkalinity by Indicator method.

ELECTRO CHEMICAL ANALYSIS
7. Estimation of hydrochloric acid by pH metry.
8. Conductometric titration of mixture of acids and strong base
10. Estimation of Iron by Potentiometry

PHOTOMETRY
11. Estimation of the Ferrous ions (Thiocyanate method) by Spectrophotometry.
12. Estimation of sodium and potassium by Flame photometry.

TOTAL: 45 HOURS

REFERENCES

COURSE OUTCOMES
- Prepare normal solutions
- Analyse the properties of water by applying the chemical concepts
- Estimate the concentration of solutions by electrochemical methods and apply it in real life situations like blood testing etc
OBJECTIVES

- To analyze webpage and identify its elements and attributes
- Learn the basic language of the web: HTML.
- Be able to embed social media content into web pages.
- Implement and understand how to get used with MATLAB

List of Experiments

1. Study of HTML tags
2. Design a web page using basic html tags
3. Design a webpage using table tags
4. Design a webpage using forms and frames
5. Design a webpage using list tags
6. Develop a website of your interest (include a minimum of 3 web pages)
7. Study of MATLAB functions
8. Working with matrix operations
9. Working with image arithmetic
   a. Addition of two images
   b. Subtraction of two images
10. Write a Matlab program for the following
    a. Read an image and crop
    b. Read an image and resize
11. Working with Integration and Differentiation
12. Working with graphs

COURSE OUTCOMES

On successful completion of this course the student should be able to

1. Develop static web pages using HTML. [S]
2. Perform basic MATLAB operations. [S]
3. Make use of MATLAB to work with images and graphs. [S]
4. Perform integration and differentiation using MATLAB. [S]
5. Develop team spirit and professional attitude towards the development of simple web applications [A]
OBJECTIVES

- To introduce the concept of 2-D drafting using CAD packages.

LIST OF EXERCISES

1. Study of drafting software.
3. Development of Isometric drawing for Simple components.
5. Development of Assembled drawing for Landing Gear.
8. Development of three view diagram of a typical Helicopter.

TOTAL: 45 HOURS

List of Tools required

- Drafting & modeling software (Like AUTOCAD)

COURSE OUTCOMES

- Use the AutoCAD software program to create drawings from scratch and to modify, manipulate, copy, delete, save, and plot drawings.
- Use the full range of AutoCAD commands and options and employ shortcuts and time-saving strategies to operate the program at a level of efficiency acceptable for employment as a CAD Engineer.
- Create, render, and manipulate 3D AutoCAD drawings and convert 2D drawings to 3D drawings.
- Identify or roughly define the terms, concepts, and standards associated with the topics of the course.
- Report to a workplace regularly and punctually, engage effectively and congenially with peers and supervisors, work from written as well as oral instructions, use assigned time efficiently for productive work, and meet production deadlines.
- Demonstrate graphical and computational problem-solving skills appropriate to the level of the coursework.
OBJECTIVES
- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C’s & 5E’s.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY 4 Hours

Greatness of womanhood: Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY 2 Hours
Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.
Training: Method of blessings.

FOOD IS MEDICINE 2 Hours
Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C’S & 5E’S 4 Hours
Personality Concepts: Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality-5 C’s and 5 E’s.
Time Management: Importance –Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT 4 Hours
Leadership Traits – Carrying oneself - Factors of leadership – Principles of leadership.


Training: Method of Self-Control.

SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA 4 Hours
Spiritual development: Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.
KayaKalpa yoga: Aim - kayakalpa philosophy - Importance of kayakalpa training.
Training: Kaya Kalpa Yoga.

EXERCISE & MEDITATION
Simplified Physical Exercise & Meditation Practice.

L: 16 Hr, P: 14, Total: 30 Hours

REFERENCES BOOKS:

COURSE OUTCOMES:
- Behaves as a responsible family member.
- Develop skills for personality improvement.
- Acquire practical knowledge on self-control technique for teenagers.
- Identify the significant of Genetic Centre for the Soul functional base operation.
### B.E – AUTOMOBILE ENGINEERING

#### SEMESTER – II

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**TOTAL – 32 HOURS**

**TOTAL CREDITS – 24**
OBJECTIVES
- To develop reading accuracy and English fluency
- To Employ appropriate formats in writing and effective
- To compare and relate words/sounds and listen for specific information.
- To maximize the elements of spoken ability

INTERPRETATIONAL DEXTERITY 15 Hours
Homophones and homonyms - Encoding and decoding advertisements - Transcoding
Graphical Representations – Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree
diagram - Reading brochures, leaflets, instruction manual - Cloze test - Reading
Comprehension- Note Making – Linear and non-linear - Book review, Article review

STYLES OF SCRIPTING 15 Hours
Types of sentences - Concord - Framing Questions – “Wh” questions, Yes/No questions and
Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a
passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative,
Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting
information, explaining a situation, letter of acceptance, declining letter, letter of application
and resume - Essay Writing

AUDITORY PROFICIENCY 15 Hours
Listening to monologues, Listening for general content - Listening to dialogues - Listening to
a telephonic conversation - Listening for specific information, numbers, time, duration -
Listening to conversations between three or more people- Listening to a group discussion and
providing factual information, Intensive listening

ORATORICAL EFFICIENCY 15 Hours
Discussing studies/interests/friends/families-Describe an object or event - Describing a
working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a
public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS

REFERENCES
1. Mark Ibbotson, Cambridge English for Engineering Published by Cambridge University
3. Jeremy Comfort, Pamela Rogerson, Trish Stott and Derek Utley, Speaking Effectively,
Cambridge University Press, .1994
5. Dorothy Adams, Everyday English: A Course on Communicative English, Cengage
learning, 2009
COURSE OUTCOMES
- Distinguish the application of technical diction for the data interpretation while reading
- Construct technical sentences and compose corporate letters
- Improve listening for inferring technical information
- Develop spoken communication needed for presentations and discussions
OBJECTIVES

On completion of the course, the students are expected

- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS

9 Hours
Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application : Area as double integral – Volume as triple integral.

VECTOR CALCULUS

9 Hours
Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green’s theorem in a plane, Gauss divergence theorem and Stoke’s theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION

9 Hours
Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : $w = z + c$, $cz$, $1/z$ and bilinear transformation.

COMPLEX INTEGRATION

9 Hours
Statement and applications of Cauchy’s integral theorem and Cauchy’s integral formula (excluding proofs) – Taylor’s and Laurent’s series expansions – Singularities – Residues – Cauchy’s residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).
LAPLACE TRANSFORM  
9 Hours

L: 45 + T: 15 = 60

REFERENCES


Course Outcomes

After pursuing the above mentioned course, the students will be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.
OBJECTIVES
At the end of the course students would be exposed to
- Types of defects in engineering materials and mechanisms of strengthening
- Properties of conducting, super conducting, magnetic and dielectric materials.
- Properties of Semi conducting, optical and new engineering materials.

CONDUCTING AND SUPERCONDUCTING MATERIALS 9 Hours
Conducting Materials : Classical free electron theory of metals-Electrical conductivity –
Thermal conductivity - expression – Wiedemann Franz law(derivation) – Lorentz number –
drawbacks of classical theory – Fermi distribution function – density of energy states – effect
of temperature on Fermi energy.

Superconducting Materials : Superconducting phenomena – properties of superconductors
– Meissner effect, Isotope effect, Type I &Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS 9 Hours
Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of
an electron and hole – carrier concentration in an intrinsic semi conductor (derivation) –
Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap
semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) –
Variation of Fermi level with temperature and impurity concentration – Hall effect –
Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS 9 Hours
Magnetic Materials : Properties of dia, para, ferro, anti ferro and ferri magnetic materials -
Langevin’s theory of paramagnetism – Weiss theory of Ferromagnetism – Domain theory
of ferromagnetism - hysteresis – soft and hard magnetic materials – Ferrites – Applications -
magnetic recording and readout - Storage of magnetic data, Tapes, floppy, magnetic disc
drives – Bubble memory.

Dielectric Materials : Electronic, ionic, orientation and space charge polarization -
Frequency and temperature dependence of polarization – Dielectric loss – Dielectric breakdown – different types of break down mechanism - Ferro electric materials - properties
and applications.

NANOTECHNOLOGY AND NEW ENGINEERING MATERIALS 9 Hours
New Engineering Materials : Metallic glasses – preparation, properties and applications –
shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications
advantages and disadvantages of SMA.

Nano Materials : synthesis - plasma arcing – Chemical vapour deposition – sol-gel - Electro
deposition – ball milling – properties of nanoparticles and applications. – Carbon nano tubes –
fabrication - arc method – pulsed laser deposition - Chemical vapour deposition - structure, properties & applications.

STRENGTHENING OF MATERIALS
9 Hours
Strengthening mechanisms for the improvement of mechanical properties - cold working precipitation hardening, solute hardening and diffusion hardening - Fracture-Mechanism of brittle fracture (Griffith’s theory) and Ductile fracture - difference between brittle and ductile fracture - fatigue failure and its prevention - creep different stages in creep curve-Factors affecting mechanical properties Grain size and heat treatment - Mechanical test Tensile, compression, hardness, impact creep, fatigue and stress.

TOTAL: 45 HOURS

REFERENCE BOOKS
2. Avadhanalu M.N. and Kshirsagar P.G., A textbook of Engineering Physics, S. Chand & Company Ltd, New Delhi, 2005

COURSE OUTCOMES
- Apply core concepts in Materials Science to solve engineering problems
- Determine the position of the acceptor or donor levels and the brand gap of an extrinsic semiconductor
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the techniques to manufacturing of modern materials and nano materials for engineering applications
- Recognize the basic concepts of strengthening of materials in technological applications
OBJECTIVES

- To inculcate essential knowledge on theoretical and modern technological aspects of fuels and combustion, specialty materials, water technology, corrosion studies and powder metallurgy.

FUELS AND COMBUSTION 9 Hours
Classification of fuels - coal varieties - analysis of coal (proximate and ultimate analysis) - coke manufacture (Otto-Hoffman byproduct coke oven method) - characteristics of metallurgical coke - cracking (thermal and catalytic cracking definition only) – manufacturing of synthetic petrol (Fischer Tropsch method, Bergius process) – knocking (octane number, cetane number) - gaseous fuels (production, composition and uses of producer gas, water gas and natural gas).

Combustion: gross and net caloric value - determination of calorific value by bomb calorimeter - explosive range - spontaneous ignition temperature - flue gas analysis (Orsat apparatus).

MECHANICAL ENGINEERING MATERIALS 9 Hours

Abrasives: Moh’s scale of hardness - natural abrasives (diamond, corundum, emery, garnets and quartz) - artificial abrasives (silicon carbide, boron carbide).

Refractories: Characteristics - classification (acid, basic and natural refractories) - properties (refractoriness, refactoriness under load, dimensional stability, porosity, thermal spalling) - General manufacturing methods of refractories - preparation, properties and uses of high alumina bricks, magnesite and zirconia bricks.

Lubricants: Classification - Functions - properties (viscosity index, flash and fire point, oiliness, carbon residue, aniline point, cloud and pour point) - greases (calcium based, sodium based, lithium based) - solid lubricants (graphite, molybdenum disulphide).

CORROSION SCIENCE 9 Hours

Corrosion - Principles of electrochemical corrosion - difference between chemical and electrochemical corrosion - factors influencing corrosion.

Types of corrosion: galvanic corrosion - differential aeration corrosion (soil (microbial) corrosion, pitting corrosion, water line corrosion) - stress corrosion.

Corrosion control: cathodic protection (sacrificial anode) - Protective Coatings (Paint, Electroplating of Copper).

WATER TECHNOLOGY 9 Hours
Boiler feed water: requirements - disadvantages of hard water (formation of deposits in steam boilers, priming, foaming, caustic embrittlement & boiler corrosion).

Prevention of scale formation: external treatment (ion exchange method) - internal treatment (phosphate, calgon, carbonate, colloidal) - desalination by reverse osmosis - Treatment of Domestic water

PHASE RULE AND POWDER METALLURGY 9 Hours
Phase rule - condensed phase rule - construction of phase diagram (thermal analysis) – Applications of phase rule: Simple eutectic system (Ag - Pb, Fe - C system).

POWDER METALLURGY : Preparation of metal powders (mechanical pulverization, atomization, chemical reduction, electrolytic process, decomposition) - mixing and blending - compacting - sintering - advantages and limitations of powder metallurgy.

TOTAL: 45 HOURS

REFERENCES

COURSE OUTCOMES
- Classify the different types of fuels and their properties
- Categorize the engineering materials and their uses
- Defend the Corrosion problems
- Design a water purifier
- Identify the techniques of preparing metal powder
OBJECTIVES

- To understand the concept of equilibrium of particles and rigid bodies.
- To understand the concept of first and second moment of area.
- To understand the concept of various types of frictions.
- To understand the principle of work energy method, Newton’s law and impact of elastic bodies.

BASICS & STATICS OF PARTICLES


EQUILIBRIUM OF RIGID BODIES

Moment of a force about point – Varignon s theorem- Moment of a couple-Resolution of force in to force couple system-Resultant of coplanar non concurrent system - Types of supports and their reactions- Requirements of stable equilibrium - Equilibrium of Rigid bodies in two dimensions.

PROPERTIES OF SURFACES AND SOLIDS

First moment of area and the Centroid of sections Rectangle, circle, triangle, T section, I section Angle section and Hollow section. Second and product moments of plane area Rectangle, triangle, circle. T Section, I section, Angle section and Hollow section, Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia.

FRICTION

Frictional force-Law of coloumb friction , simple contact friction, Rolling resistance and Belt friction, Ladder friction, Wedge friction.

DYNAMICS OF PARTICLES

Kinematics: Rectilinear & Curvilinear motion of particles, Displacements Velocity and acceleration.

L: 45 Hr, T: 15 Hr, TOTAL: 60 HOURS
REFERENCES

COURSE OUTCOMES
- Explain the concept of equilibrium of particles and rigid bodies.
- Apply the concepts of equilibrium and moment of inertia for various shapes sections.
- Make use of various concepts of friction.
Solve problems using the concepts in kinematics and kinetics
OBJECTIVES

- To study the characteristics of circuit elements
- To understand relationships among current, voltage and power in DC and AC circuits
- To study the construction, characteristics and applications of amplifiers and oscillators circuitry

ELECTRIC CIRCUITS FUNDAMENTALS 9 Hours

ELECTROMAGNETISM 9 Hours

AC-CIRCuits 9 Hours

ELECTRICAL MACHINES (Qualitative Treatment Only) 9 Hours

ELECTRONIC CIRCUITS 9 Hours
Semiconductor diode – Half wave and Full wave rectifier – Bipolar Junction transistors – circuit configurations – static characteristics – load line and biasing – simple introduction to amplifiers – Introduction to Binary logic gates – AND, OR, NOT, NAND, NOR, EX-OR & EX-NOR.

TOTAL: 45 HOURS
REFERENCES

COURSE OUTCOMES
- Acquire the knowledge of fundamental laws of electrical and electronics engineering.
- State the definition of magnetic circuits.
- Choose suitable motor for desired application.
- The students have the ability to apply the fundamental laws of magnetic circuits to electrical machines.
- The learners can verify the truth table of digital logic gates.
OBJECTIVES

- The experiments are designed to illustrate phenomena in different areas of Physics and to expose you to measuring instruments.
- The laboratory provides a unique opportunity to validate physical theories in a quantitative manner.
- Laboratory experience demonstrates the limitations in the application of physical theories to real physical situations.
- In general, the purpose of these laboratory exercises is both to demonstrate some physical principle and to teach techniques of careful measurement.

LIST OF EXPERIMENTS

Any Ten Experiments
1. Lee’s disc - determination of thermal conductivity of a bad conductor
2. Air wedge - determination of thickness of a given specimen.
3. Spectrometer - determination of wavelength of mercury source using grating
4. Compound pendulum - determination of acceleration due to gravity.
5. Carey foster bridge – determination of specific resistance of a given coil of wire.
7. Non-uniform bending – determination of Young’s modulus
8. Ultrasonic interferometer – determination of velocity of sound and compressibility of liquid.
9. Band gap determination of a semiconductor using post office box
10. Semiconductor laser:
   a. Determination of wavelength of laser using grating
   b. Particle size determination
   c. Acceptance angle of optical fibre
11. Torsional pendulum - determination of Rigidity modulus of the wire
12. Field along the axis of a coil – Determination of magnetic moment.

Demonstration experiments:
1. Determination of solar cell parameters
2. Hall effect
3. Four probe apparatus
4. Animations – (Laser, Fiber optics and hysteresis curve)

TOTAL: 45 HOURS

COURSE OUTCOMES

- Determine different physical properties of a material like the thermal conductivity, thickness of the material, etc.
- Perform experiments involving the physical phenomena like interference and diffraction.
- Apply physical theories in real life situations by also taking into account its limitations.
### LIST OF EXPERIMENTS

1. Introduction to CAD Commands  
2. Creation of simple objects  
3. Special curves  
4. Projection & Section of simple solids  
5. Orthographic views of solids  
6. Isometric views of objects  
7. Simple trusses  
8. 3D modeling of simple solids  
9. 2D multiple views from 3D model  

**TOTAL: 45 HOURS**

### COURSE OUTCOMES

- Draw 2D and 3D drawings using drafting software  
- Convert orthographic view into isometric view  
- Become familiar to draw Special curves
AIM
To provide experimental skill in the operation of DC, AC machines and Hands on experience in the development of electronic circuits.

OBJECTIVES
- To experimentally verify the principle of operation, performance characteristics of DC Motors and AC Motors.
- To obtain the characteristics of electronic devices and its applications

LIST OF EXPERIMENTS
1. Load Test on DC Shunt Motor
2. Load Test on DC Series Motor
3. Speed Control of DC Shunt Motor
4. Load Test on three phase Induction Motor
5. Load Test on single phase Induction Motor
6. Load test on single phase transformer
7. Half wave and full wave rectifier
8. Characteristics of CE transistor configuration
9. Characteristics of PN diode
10. Verification of truth table of logic gates

TOTAL: 45 HOURS

COURSE OUTCOMES
- The Students will gain the basic knowledge and understanding the concept of AC and DC machines.
- Students will know the working principle, performance characteristics, (Torque, Speed, Efficiency) control and applications of Electrical Machines.
- Students will be able to design and conduct performance experiments in machines and Rectifiers.
- To familiarize the starting methods of all rotating machines.
- Students will be exposed to the practical applications of identify and solve machines related problems.
OBJECTIVES
- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C’s & 5E’s.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY 4 Hours

Greatness of womanhood: Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY 2 Hours
Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.
Training: Method of blessings.

FOOD IS MEDICINE 2 Hours
Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C’S & 5E’S 4 Hours
Personality Concepts: Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality-5 C’s and 5 E’s.
Time Management: Importance –Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT 4 Hours
Leadership Traits – Carrying oneself - Factors of leadership – Principles of leadership.

Training: Method of Self-Control.

SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA 4 Hours
Spiritual development: Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.
KayaKalpa yoga: Aim - kayakalpa philosophy - Importance of kayakalpa training.
Training: Kaya Kalpa Yoga.
EXERCISE & MEDITATION

Simplified Physical Exercise & Meditation Practice.

10 Hours

L: 16 Hr, P: 14, Total: 30 Hours

REFERENCES BOOKS:

1. Dr. A. Chandra Mohan, “Leadership and Management”, Himalaya Publication House,

COURSE OUTCOMES:

- Behaves as a responsible family member.
- Develop skills for personality improvement.
- Acquire practical knowledge on self-control technique for teenagers.
- Identify the significant of Genetic Centre for the Soul functional base operation.
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**TOTAL – 31 HOURS**  **TOTAL CREDITS – 23**
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Discussing studies/interests/friends/families-Describe an object or event - Describing a
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- Improve listening for inferring technical information
- Develop spoken communication needed for presentations and discussions
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- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

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Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : \( w = z + c, cz, 1/z \) and bilinear transformation.

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Statement and applications of Cauchy’s integral theorem and Cauchy’s integral formula (excluding proofs) – Taylor’s and Laurent’s series expansions – Singularities – Residues – Cauchy’s residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).
LAPLACE TRANSFORM

9 Hours


L: 45 + T: 15 = 60

REFERENCES


Course Outcomes

After pursuing the above mentioned course, the students will be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.
OBJECTIVES
At the end of the course the students would be exposed to

- Properties of conducting, super conducting, magnetic and dielectric materials.
- Properties of Semi conducting, optical and new engineering materials.
- Application of ultrasonic and nuclear physics in medicine.

CONDUCTING AND SUPERCONDUCTING MATERIALS 9 Hours

Superconducting Materials: Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I &Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS 9 Hours
Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS 9 Hours


NANOTECHNOLOGY AND NEW ENGINEERING MATERIALS 9 Hours
New Engineering Materials: Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications advantages and disadvantages of SMA.

Nano Materials: synthesis - plasma arcing – Chemical vapour deposition – sol-gel - Electro deposition – ball milling – properties of nanoparticles and applications. – Carbon nano tubes –
fabrication - arc method – pulsed laser deposition - Chemical vapour deposition - structure, properties & applications.

MEDICAL PHYSICS  
9 Hours
Ultrasound picture of human body – Block diagram of basic pulse Echo system – A Scan – B scan & M Scan Psychological effect - ultrasound therapy – Phonocardiograph (PCG) source of radioactivity for nuclear medicine - statistical aspects – Basic instrumentation (Geiger Muller counter, Photo multiplier Tube & Scintillation detector (Renogram) and its clinical applications (Thyroid and Kidney function) – Nuclear medicine imaging devices - Gamma Camera - Positron camera.

TOTAL: 45 HOURS

REFERENCE BOOKS
5. Avadhanalu M.N. and Kshirsagar P.G., A textbook of Engineering Physics, S. Chand & Company Ltd, New Delhi, 2005 (Units: 1,2,3,4).
6. Arumugam M., Physics-II (For Civil, Chemical, Textile, Biotechnology, Polymer and Fashion technology), Anuradha agencies, Kumbakonam, 2005 (Units: 5).

COURSE OUTCOMES
- Apply core concepts in Materials Science to solve engineering problems
- Determine the position of the acceptor or donor levels and the band gap of an extrinsic semiconductor
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the techniques to manufacturing of modern materials and nano materials for engineering applications
- Sketch the skills and techniques for biotechnological and medical applications
OBJECTIVES

- To correlate theoretical principles with application oriented studies
- To inculcate a basic foundation in stereochemistry of Biomolecules
- To embellish the usage of chemistry to exhibit engineering and technical concepts by presenting a overview on theoretical and modern technological aspects in polymers, water technology and biomolecular analysis as required for the Bio technology students.

CHEMICAL BONDING IN BIOMOLECULES

Ionic, covalent and co-ordinate covalent bonds (overview only), hybridization (sp, sp², sp³, sp³d, sp³d² in simple molecules), hydrogen bonding and its consequences, Van der Waal’s forces (dipole – dipole, dipole – induced dipole, induced dipole – induced dipole interactions) - dipole moment (applications).

INTRODUCTION TO STEREOCHEMISTRY

Isomerism : Introduction and classification of isomerism.
Structural isomerism : Definition, chain, position, functional, mesomerism, tautomerism, Conformational isomerism in simple organic molecules
Notation : d and l; R and S ; E and Z notation of simple organic molecules
Configurational isomerism or geometrical isomerism: definition – in alkenes and cyclopropanes
Optical isomerism : Definition and conditions of optical isomerism - Optical activity – Chirality – Optical isomerism in tartaric and lactic acids - optical activity without asymmetric carbon (allelenes, Biphenyl derivatives) – definition of Enantiomers, diastereomers, Mesocompounds, racemic mixture, asymmetric synthesis – Walden inversion

WATER TECHNOLOGY


CHEMISTRY OF POLYMERS

Introduction - classification based on source, application, thermal properties (thermosetting and thermoplastics) - effect of polymer structure on properties – types of polymerization (addition, condensation, co-polymerization and Ring polymerisation) - mechanism of polymerization (free radical mechanism and coordination mechanism - monometallic)
Bio Polymers and its applications : Cellulose, Starch, Collagen, Lignins and Chitosins
Determination of the amount of calcium in milk powder by EDTA Complexometry - Estimation of iodine in iodized common salt by Iodometry - Estimation of phosphoric acid in soft drinks (coca cola) by molybdenum blue method - Synthesis of fluorescein, and its use in angiogram techniques - Super absorbent polymers: preparation, properties and uses

TOTAL: 45 HOURS

REFERENCES
1. Finar I.L., Organic chemistry, Publishing house, UK.
6. Amarika Singh, Vairam S., and Suba Ramesh, Chemistry for Engineers, Wiley India ltd., New Delhi

COURSE OUTCOMES
- Outline basic concepts of stereochemistry
- Discuss the mechanism of polymer formation
- Paraphrase an experiment in required sequence
- Design a waste water purifier
OBJECTIVES
- To study the characteristics of circuit elements
- To understand relationships among current, voltage and power in DC and AC circuits
- To study the construction, characteristics and applications of amplifiers and oscillators circuitry

ELECTRIC CIRCUITS FUNDAMENTALS 9 Hours

ELECTROMAGNETISM 9 Hours

AC-CIRCUITS 9 Hours

ELECTRICAL MACHINES (Qualitative Treatment Only) 9 Hours

ELECTRONIC CIRCUITS 9 Hours
Semiconductor diode – Half wave and Full wave rectifier – Bipolar Junction transistors – circuit configurations – static characteristics – load line and biasing – simple introduction to amplifiers – Introduction to Binary logic gates – AND, OR, NOT, NAND, NOR, EX-OR & EX-NOR.

TOTAL: 45 HOURS
REFERENCES

COURSE OUTCOMES
➢ Acquire the knowledge of fundamental laws of electrical and electronics engineering.
➢ State the definition of magnetic circuits.
➢ Choose suitable motor for desired application.
➢ The students have the ability to apply the fundamental laws of magnetic circuits to electrical machines.
➢ The learners can verify the truth table of digital logic gates.
OBJECTIVES

- To expose the students to the area of biochemistry/cell biology and basic genetics. This knowledge is required to understand Biochemistry, molecular biology and genetic engineering.

CARBOHYDRATES 9 Hours
Definition; Carbohydrates--; Classification- Monosaccharides - Structure, and function, Disaccharides- Structure and function- Sucrose, Lactose, Polysaccharides- Starch, cellulose, heparin, hyaluronic acid.

LIPIDS 9 Hours
Definition: Classification of lipids- Simple lipids -Physical and chemical properties of fats. Saponification number; Compound lipids-Structure and function of phospholipids and Glycolipids. Fatty acids (C16, C18) - Saturated and unsaturated fatty acids; Essential fatty acids. Steroids : Cholesterol Structure and functions.

AMINO ACIDS, PEPTIDES, VITAMINS AND MINERALS 9 Hours
Amino acid- Definition, Structure and classification; Essential amino acids; Peptides-Definition, Structure and properties. Vitamins- Definition, Structure; Physiological functions of fat and water soluble vitamins. Minerals - Essential macro and micro minerals, sources and functions.

CLASSICAL GENETICS 9 Hours
Mendelian genetics- Introduction, Principles; Monohybrid, Dihybrid and Trihybrid crosses; Backcross and testcross; Linkage, Crossing over, Genetic mapping, recombination; Multiple alleles- Blood group antigens.

CHROMOSOME STRUCTURE AND ORGANIZATION 9 Hours
Nucleic acids: structure of DNA, RNA; Chromosome organization of eukaryotes. Ploidy-polyploidy and Aneuploidy; Human karyotypes; Human sex Chromosome-linked disorders - Hemophilia, Fragile X; Special chromosomes - Polytene chromosomes and Lamp Brush chromosome.

TOTAL: 45 HOURS
REFERENCES

COURSE OUTCOMES
- Draw the structure and explain the classification and functions of carbohydrates
- Describe the structure and functions of lipids, and cholesterol
- Classify and discuss the properties and functions of amino acids, vitamins and minerals
- Recall the concepts of mendelian genetics and multiple allelism
- Understand and explain the structure of chromosomes and related disorders
OBJECTIVES

- The experiments are designed to illustrate phenomena in different areas of Physics and to expose you to measuring instruments.
- The laboratory provides a unique opportunity to validate physical theories in a quantitative manner.
- Laboratory experience demonstrates the limitations in the application of physical theories to real physical situations.
- In general, the purpose of these laboratory exercises is both to demonstrate some physical principle and to teach techniques of careful measurement.

LIST OF EXPERIMENTS

Any Ten Experiments
1. Lee’s disc - determination of thermal conductivity of a bad conductor
2. Air wedge - determination of thickness of a given specimen.
3. Spectrometer - determination of wavelength of mercury source using grating
4. Compound pendulum - determination of acceleration due to gravity.
5. Carey foster bridge – determination of specific resistance of given coil of wire.
7. Non-uniform bending – determination of Young’s modulus
8. Ultrasonic interferometer – determination of velocity of sound and compressibility of liquid.
9. Band gap determination of a semiconductor using post office box
10. Semiconductor laser:
    a. Determination of wavelength of laser using grating
    b. Particle size determination
    c. Acceptance angle of optical fibre
11. Torsional pendulum - determination of Rigidity modulus of the wire
12. Field along the axis of a coil – Determination of magnetic moment.

Demonstration experiments:
1. Determination of solar cell parameters
2. Hall effect
3. Four probe apparatus
4. Animations – (Laser, Fiber optics and hysteresis curve)

TOTAL: 45 HOURS

COURSE OUTCOMES

- Determine different physical properties of a material like the thermal conductivity, thickness of the material, etc.
- Perform experiments involving the physical phenomena like interference and diffraction.
- Apply physical theories in real life situations by also taking into account its limitations.
OBJECTIVES

- To analyze webpage and identify its elements and attributes
- Learn the basic language of the web: HTML.
- Be able to embed social media content into web pages.
- Implement and understand how to get used with MATLAB

List of Experiments

1. Study of HTML tags
2. Design a web page using basic html tags
3. Design a webpage using table tags
4. Design a webpage using forms and frames
5. Design a webpage using list tags
6. Develop a website of your interest (include a minimum of 3 web pages)
7. Study of MATLAB functions
8. Working with matrix operations
9. Working with image arithmetic
   a. Addition of two images
   b. Subtraction of two images
10. Write a Matlab program for the following
    a. Read an image and crop
    b. Read an image and resize
11. Working with Integration and Differentiation
12. Working with graphs

COURSE OUTCOMES

On successful completion of this course the student should be able to

1. Develop static web pages using HTML. [S]
2. Perform basic MATLAB operations. [S]
3. Make use of MATLAB to work with images and graphs. [S]
4. Perform integration and differentiation using MATLAB. [S]
5. Develop team spirit and professional attitude towards the development of simple web applications [A]
OBJECTIVES

- To teach basic skills required for analysis of biomolecules such as carbohydrates, proteins, lipids, etc.
- To enable the student to perform simple experiments in Genetics.

LIST OF EXPERIMENTS

1. Qualitative analysis of Carbohydrates (glucose, galactose, fructose, maltose, sucrose and starch)
2. Qualitative analysis of amino acids (tyrosine, tryptophan, methionine, alanine and proline)
3. Qualitative analysis of lipids (general lipids)
4. Qualitative analysis of Proteins (simple and glycoproteins)
5. Qualitative analysis of minerals.
6. Blood grouping
7. Isolation of starch from potato
8. Identification of mitotic stages in onion root tip
9. Identification of polytene chromosomes
10. Genetic Mapping (Problems to be worked out)

TOTAL 45 HOURS

REFERENCES


COURSE OUTCOMES

- Ability to perform experiments for qualitative analysis of biomolecules.
- Ability to carry out simple experiments related to Cell Biology and Genetics
OBJECTIVES

- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C’s & 5E’s.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY


Greatness of womanhood: Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY

Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.
Training: Method of blessings.

FOOD IS MEDICINE

Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C’S & 5E’S

Personality Concepts: Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality-5 C’s and 5 E’s.
Time Management: Importance –Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT

Leadership Traits – Carrying oneself - Factors of leadership – Principles of leadership.

Training: Method of Self-Control.

SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA

Spiritual development: Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.
**KayaKalpa yoga**: Aim - kayakalpa philosophy - Importance of kayakalpa training.

**Training**: Kaya Kalpa Yoga.

**EXERCISE & MEDITATION**

Simplified Physical Exercise & Meditation Practice.

<table>
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**REFERENCES BOOKS:**


**COURSE OUTCOMES:**

- Behaves as a responsible family member.
- Develop skills for personality improvement.
- Acquire practical knowledge on self-control technique for teenagers.
- Identify the significant of Genetic Centre for the Soul functional base operation.
### B.E Civil Engineering

#### Semester – II

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**Total – 32 Hours**  
**Total Credits – 24**
OBJECTIVES

- To develop reading accuracy and English fluency
- To employ appropriate formats in writing and effective
- To compare and relate words/sounds and listen for specific information.
- To maximize the elements of spoken ability

INTERPRETATIONAL DEXTERITY 15 Hours
Homophones and homonyms - Encoding and decoding advertisements - Transcoding Graphical Representations – Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree diagram - Reading brochures, leaflets, instruction manual - Cloze test - Reading Comprehension- Note Making – Linear and non-linear - Book review, Article review

STYLES OF SCRIPTING 15 Hours
Types of sentences - Concord - Framing Questions – “Wh” questions, Yes/No questions and Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative, Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting information, explaining a situation, letter of acceptance, declining letter, letter of application and resume - Essay Writing

AUDITORY PROFICIENCY 15 Hours
Listening to monologues, Listening for general content - Listening to dialogues - Listening to a telephonic conversation - Listening for specific information, numbers, time, duration - Listening to conversations between three or more people- Listening to a group discussion and providing factual information, Intensive listening

ORATORICAL EFFICIENCY 15 Hours
Discussing studies/interests/friends/families-Describe an object or event - Describing a working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS

REFERENCES
COURSE OUTCOMES

- Distinguish the application of technical diction for the data interpretation while reading
- Construct technical sentences and compose corporate letters
- Improve listening for inferring technical information
- Develop spoken communication needed for presentations and discussions
OBJECTIVES
On completion of the course, the students are expected

- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS
9 Hours
Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application : Area as double integral – Volume as triple integral .

VECTOR CALCULUS
9 Hours
Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green’s theorem in a plane, Gauss divergence theorem and Stoke’s theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION
9 Hours
Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : \( w = z + c \), \( cz \), \( 1/z \) and bilinear transformation.

COMPLEX INTEGRATION
9 Hours
Statement and applications of Cauchy’s integral theorem and Cauchy’s integral formula (excluding proofs) – Taylor’s and Laurent’s series expansions – Singularities – Residues – Cauchy’s residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).
LAPLACE TRANSFORM  9 Hours

L: 45 + T: 15 = 60

REFERENCES


Course Outcomes

After pursuing the above mentioned course, the students will be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.
OBJECTIVES
At the end of the course the students would be exposed to fundamental knowledge in

- Design of acoustically good buildings
- Properties and applications of conducting materials, Superconducting materials, magnetic and dielectric materials.
- Preparation, properties and applications of Metallic glasses, Shape memory alloys and Nano materials.

ACOUSTICS
9 Hours

CONDUCTING AND SUPERCONDUCTING MATERIALS
9 Hours
Superconducting Materials: Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I & Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS
9 Hours
Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap of a semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS
9 Hours
Dielectric Materials: Electronics, ionic, orientation and space charge polarization - Frequency and temperature dependence of polarization – Dielectric loss – Dielectric breakdown – different types of break down mechanism - Ferro electric materials - properties and applications.
NEW ENGINEERING MATERIALS AND NANOTECHNOLOGY  9 Hours

New Engineering Materials: Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications advantages and disadvantages of SMA.


TOTAL: 45 HOURS

REFERENCE BOOKS
5. Avadhanalu M.N. and Kshirsagar P.G., A textbook of Engineering Physics, S. Chand & Company Ltd., New Delhi, 2004

COURSE OUTCOMES
- Apply core concepts in Materials Science to solve engineering problems
- Describe the impact of acoustic engineering solutions in a constructional environmental, and societal context
- Determine the position of the acceptor or donor levels and the brand gap of an extrinsic semiconductor,
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the techniques to manufacturing of modern materials for engineering practice.
OBJECTIVES

- To impart a sound knowledge of theoretical and modern technological aspects of, water technology, corrosion studies and specialty engineering materials as required for the civil engineers.

WATER TECHNOLOGY  
9 Hours
Water hardness - Boiler feed water - boiler corrosion - priming and foaming - formation of deposits in steam boilers and heat exchangers – caustic embrittlement - disadvantages (wastage of fuel, decrease in efficiency, boiler explosion) - prevention of scale formation: Internal treatment (phosphate, calgon, carbonate, colloidal), external treatment (ion exchange method) - desalination by reverse osmosis - Treatment of common effluents.

CORROSION SCIENCE  
9 Hours
Corrosion: principles of electrochemical corrosion - difference between chemical and electrochemical corrosion - factors influencing corrosion.
Types of corrosion: galvanic corrosion, differential aeration corrosion (soil (microbial) corrosion, pitting corrosion, water line corrosion), stress corrosion
Corrosion control: cathodic protection (sacrificial anode) - electroplating (Copper plating).

ENGINEERING MATERIALS  
9 Hours
Abrasives: Moh’s scale of hardness - natural abrasives (diamond, corundum, emery, garnets and quartz) - artificial abrasives (silicon carbide, boron carbide).
Refractories: characteristics - classification (acid, basic and natural refractories) - properties (refractoriness, refactoriness under load, dimensional stability, porosity thermal spalling) - general manufacturing methods of refractories - preparation, properties and uses of high alumina bricks, magnesite and zirconia bricks only.
Lubricants: functions - classification with examples - properties (viscosity index, flash and fire point, oiliness, carbon residue, aniline point, cloud and pour point) – greases (calcium based, sodium based, lithium based only) - solid lubricants (graphite, molybdenum sulphide).

CHEMISTRY OF CONSTRUCTION MATERIALS  
9 Hours
Cement: Chemical composition – setting and hardening — special cements (high alumina cement, sorel cement, white Portland cement, water proof cement).
Paint: constituents – functions – special paints (fire retardant, water repellant, temperature indicating and luminous paints) - Varnishes and lacquers

COMPOSITE MATERIALS  
9 Hours
Composites: definition – characteristics – constituents – types: properties and applications of fibre reinforced plastic (FRP), metal matrix composites (MMC), ceramic matrix composites (CMC), Engineered cementitious composites (ECC), Natural fiber reinforced composite
Engineering Plastics: Preparation (mechanism not required) and applications of polyamide, polycarbonates, polyurethanes and thermocole - polymer blends and alloys
TOTAL: 45 HOURS

REFERENCES

COURSE OUTCOMES
- Design a water purifier.
- Defend the Corrosion problems
- Identify the different construction materials and their constituents
- Describe the impact of composite materials and engineering plastics in construction
- Categorize the engineering materials and their uses.
OBJECTIVES

- To understand the concept of equilibrium of particles and rigid bodies.
- To understand the concept of first and second moment of area.
- To understand the concept of various types of frictions.
- To understand the principle of work energy method, Newton’s law and impact of elastic bodies.

BASICS & STATICS OF PARTICLES 9 Hours

EQUILIBRIUM OF RIGID BODIES 9 Hours
Moment of a force about point – Varignon s theorem- Moment of a couple-Resolution of force in to force couple system-Resultant of coplanar non concurrent system - Types of supports and their reactions- Requirements of stable equilibrium - Equilibrium of Rigid bodies in two dimensions.

PROPERTIES OF SURFACES AND SOLIDS 9 Hours
First moment of area and the Centroid of sections Rectangle, circle, triangle, T section, I section Angle section and Hollow section. Second and product moments of plane area Rectangle, triangle, circle, T Section, I section, Angle section and Hollow section, Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia.

FRICTION 9 Hours
Frictional force-Law of coloumb friction , simple contact friction, Rolling resistance and Belt friction, Ladder friction, Wedge friction.

DYNAMICS OF PARTICLES 9 Hours
Kinematics: Rectilinear & Curvilinear motion of particles, Displacements Velocity and acceleration.

L: 45 Hr, T: 15 Hr, TOTAL: 60 HOURS

REFERENCES

**COURSE OUTCOMES**

- Explain the concept of equilibrium of particles and rigid bodies.
- Apply the concepts of equilibrium and moment of inertia for various shapes sections.
- Make use of various concepts of friction.
- Solve problems using the concepts in kinematics and kinetics.
OBJECTIVES
• At the end of this course the student should have learnt about the various materials, both conventional and modern, that are commonly used in Civil Engineering construction. Further he should be able to appreciate the criteria for choice of the appropriate material and the various tests for quality control in the use of these materials.

STONES-BRICKS-CONCRETE BLOCKS 9 Hours

LIME-CEMENT-AGGREGATES-MORTAR 9 Hours

CONCRETE 9 Hours

TIMBER AND OTHER MATERIALS 9 Hours

MODERN MATERIALS 9 Hours

TOTAL: 45 HOURS
REFERENCES
4. Shetty M.S., Concrete Technology (Theory and Practice), S. Chand & Co Ltd.

COURSE OUTCOMES
- Compare the properties of most common and advanced building materials.
- Understand the typical and potential applications of these materials
- Understand the quality test procedures for various materials
- Know about the structural forms of various materials
- Acquire knowledge on advanced materials used in civil engineering field.
OBJECTIVES
- To apply the theoretical principles and perform experiments
- Experience the importance of theory by using analytical equipments and quantitative and qualitative procedures.

LIST OF EXPERIMENTS

PREPARATION OF SOLUTIONS (STANDARD)
1. Preparation of normal solutions of the following substances - oxalic acid, sodium carbonate, hydrochloric acid.
2. Preparation of phosphate buffer using Henderson equation.

WATER TESTING
3. Determination of total, temporary and permanent hardness by EDTA method.
4. Estimation of DO by Winkler’s method.
5. Estimation of alkalinity by Indicator method.

ELECTRO CHEMICAL ANALYSIS
7. Estimation of hydrochloric acid by pH metry.
8. Conductometric titration of mixture of acids and strong base
9. Conductometric precipitation titration using BaCl₂ and Na₂SO₄.
10. Estimation of Iron by Potentiometry

PHOTOMETRY
11. Estimation of the Ferrous ions (Thiocyanate method) by Spectrophotometry.
12. Estimation of sodium and potassium by Flame photometry.

TOTAL: 45 HOURS

REFERENCES

COURSE OUTCOMES
- Prepare normal solutions
- Analyse the properties of water by applying the chemical concepts
- Estimate the concentration of solutions by electrochemical methods and apply it in real life situations like blood testing etc
OBJECTIVES

- To analyze webpage and identify its elements and attributes
- Learn the basic language of the web: HTML.
- Be able to embed social media content into web pages.
- Implement and understand how to get used with MATLAB

List of Experiments

1. Study of HTML tags
2. Design a web page using basic html tags
3. Design a webpage using table tags
4. Design a webpage using forms and frames
5. Design a webpage using list tags
6. Develop a website of your interest (include a minimum of 3 web pages)
7. Study of MATLAB functions
8. Working with matrix operations
9. Working with image arithmetic
   a. Addition of two images
   b. Subtraction of two images
10. Write a Matlab program for the following
    a. Read an image and crop
    b. Read an image and resize
11. Working with Integration and Differentiation
12. Working with graphs

COURSE OUTCOMES

On successful completion of this course the student should be able to

1. Develop static web pages using HTML. [S]
2. Perform basic MATLAB operations. [S]
3. Make use of MATLAB to work with images and graphs. [S]
4. Perform integration and differentiation using MATLAB. [S]
5. Develop team spirit and professional attitude towards the development of simple web applications [A]
LIST OF EXPERIMENTS

1. Tests on Aggregate
2. Moisture Content of Concrete Aggregate”
3. Specific Gravity and Absorption of Coarse Aggregate
4. Specific Gravity and Absorption of fine Aggregate”
5. Resistance to Degradation of Small-size coarse Aggregate by Abrasion in the Los Angeles Machine
6. Aggregate crushing strength test
7. Abrasion test
8. Shape Test (Flakiness Index)
9. Shape test (Elongation Index)
10. Shape Test (Angularity Number)
11. Unit Weight and Voids in Aggregate in its compacted or loose condition”
12. Sieve analysis of fine and coarse aggregate

Tests on Cement

1. Blaine’s Air Permeability test
2. Fineness of Hydraulic Cement by No.100 or No. 200 Sieve”
3. Normal Consistency of Hydraulic Cement”
4. Initial and Final Time of Setting of Cement”
5. Density and Specific Gravity of cement”
6. Compressive Strength of Hydraulic Cement Mortars"
7. Tensile Strength of Cement Mortar
8. Compressive strength of brick
9. Strength tests on Flooring tiles

TOTAL: 45 HOURS

COURSE OUTCOMES

➢ Find the physical and mechanical properties of construction materials like cement, sand and aggregates by conducting various laboratory tests.
OBJECTIVES

- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C’s & 5E’s.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY

**4 Hours**


**Greatness of womanhood:** Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY

**2 Hours**

Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.

**Training:** Method of blessings.

FOOD IS MEDICINE

**2 Hours**

Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C’S & 5E’S

**4 Hours**

**Personality Concepts:** Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality-5 C’s and 5 E’s.

**Time Management:** Importance –Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT

**4 Hours**

**Leadership Traits** – Carrying oneself - Factors of leadership – Principles of leadership.

**Self Development:** Importance – Techniques to development oneself– How to develop oneself?–Ten Commandments of self-development– Self-control technique for teenagers.

**Training:** Method of Self-Control.

SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA

**4 Hours**

**Spiritual development:** Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.

**KayaKalpa yoga:** Aim - kayakalpa philosophy - Importance of kayakalpa training.
Training: Kaya Kalpa Yoga.

EXERCISE & MEDITATION
Simplified Physical Exercise & Meditation Practice.

10 Hours

L: 16 Hr, P: 14, Total: 30 Hours

REFERENCES BOOKS:
1. Dr. A. Chandra Mohan, “Leadership and Management”, Himalaya Publication House,

COURSE OUTCOMES:
• Behaves as a responsible family member.
• Develop skills for personality improvement.
• Acquire practical knowledge on self-control technique for teenagers.
• Identify the significant of Genetic Centre for the Soul functional base operation.
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**TOTAL – 33 HOURS**  
**TOTAL CREDITS – 25**
OBJECTIVES

- To develop reading accuracy and English fluency
- To employ appropriate formats in writing and effective
- To compare and relate words/sounds and listen for specific information.
- To maximize the elements of spoken ability

INTERPRETATIONAL DEXTERITY  15 Hours
Homophones and homonyms - Encoding and decoding advertisements - Transcoding
Graphical Representations – Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree
diagram - Reading brochures, leaflets, instruction manual - Cloze test - Reading
Comprehension- Note Making – Linear and non-linear - Book review, Article review

STYLES OF SCRIPTING  15 Hours
Types of sentences - Concord - Framing Questions – “Wh” questions, Yes/No questions and
Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a
passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative,
Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting
information, explaining a situation, letter of acceptance, declining letter, letter of application
and resume - Essay Writing

AUDITORY PROFICIENCY  15 Hours
Listening to monologues, Listening for general content - Listening to dialogues - Listening to
a telephonic conversation - Listening for specific information, numbers, time, duration -
Listening to conversations between three or more people- Listening to a group discussion and
providing factual information, Intensive listening

ORATORICAL EFFICIENCY  15 Hours
Discussing studies/interests/friends/families-Describe an object or event - Describing a
working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a
public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS

REFERENCES
1. Mark Ibbotson, Cambridge English for Engineering Published by Cambridge University
3. Jeremy Comfort, Pamela Rogerson, Trish Stott and Derek Utley, Speaking Effectively,
   Cambridge University Press, .1994
5. Dorothy Adams, Everyday English: A Course on Communicative English, Cengage
   learning, 2009
COURSE OUTCOMES

➢ Distinguish the application of technical diction for the data interpretation while reading
➢ Construct technical sentences and compose corporate letters
➢ Improve listening for inferring technical information
➢ Develop spoken communication needed for presentations and discussions
OBJECTIVES
On completion of the course, the students are expected

- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS 9 Hours
Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application : Area as double integral – Volume as triple integral.

VECTOR CALCULUS 9 Hours
Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green’s theorem in a plane, Gauss divergence theorem and Stoke’s theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION 9 Hours
Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : $w = z + c$, $cz$, $1/z$ and bilinear transformation.

COMPLEX INTEGRATION 9 Hours
Statement and applications of Cauchy’s integral theorem and Cauchy’s integral formula (excluding proofs) – Taylor’s and Laurent’s series expansions – Singularities – Residues – Cauchy’s residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).
LAPLACE TRANSFORM


REFERENCES


Course Outcomes

After pursuing the above mentioned course, the students will be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.
OBJECTIVES
At end of the course students would be exposed to
- Conducting, superconducting, magnetic and dielectric materials in electrical devices.
- Semi-conducting, optical and new engineering materials in switching and display devices, data storage.

CONDUCTING AND SUPERCONDUCTING MATERIALS

Superconductors: Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I & Type II superconductors – High Tc superconductors – Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS
Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semiconductor (derivation) – Fermi level – Variation of Fermi level with temperature – Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semiconductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS


NEW ENGINEERING MATERIALS AND NANOTECHNOLOGY
New Engineering Materials: Metallic glasses – preparation, properties and applications – Shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications - advantages and disadvantages of SMA.

OPTICAL MATERIALS

9 Hours

TOTAL: 45 HOURS

REFERENCES

COURSE OUTCOMES
➢ Apply core concepts in Materials Science to solve engineering problems
➢ Determine the position of the acceptor or donor levels and the brand gap of an extrinsic semiconductor,
➢ Classify & differentiate the structure and physical properties of conducting materials
➢ Apply the techniques to manufacturing of modern materials for engineering practice.
➢ Recognize the various nanomaterials for engineering and technological applications
OBJECTIVES

- To study the characteristics of circuit elements
- To understand relationships among current, voltage and power in DC and AC circuits
- To study the construction, characteristics and applications of amplifiers and oscillators circuitry

DC CIRCUITS

9 Hours


AC CIRCUITS

9 Hours


SEMICONDUCTOR DIODE AND APPLICATIONS

9 Hours


TRANSISTORS AND APPLICATIONS

9 Hours


OSCILLATORS AND OPERATIONAL AMPLIFIERS

9 Hours


L: 45 Hr T: 15 Hr TOTAL: 60 HOURS

REFERENCES


COURSE OUTCOMES
- Define & identify the basic electrical quantities and also able to calculate approximately the voltage, current parameters in DC circuits using basic laws.
- Understand the phasor representation of various AC circuit parameters and acquire knowledge on fundamentals of three phase ac circuits.
- Differentiate the various semiconductor diodes and rectifiers
- Summarize the characteristics of different types of transistors.
- Apply the achieved basic knowledge about oscillators & op-amp to different dc applications.
OBJECTIVES

- Acquire an overview of data storage and manipulation in computers
- Understand the basic concepts of operating systems, networks, and databases
- Know the applications of Internet and Information Technology

**Computer Basics and Architecture** 11 Hours

**Computer Organization and Architecture:** Introduction-CPU-Communication among various units - Instruction Format-Instruction Cycle-Instruction Set-Data Representation in Computers.

**Computer Memory and Storage:** Memory Hierarchy-Types of Memory-CPU interaction with memory-Secondary Storage devices and its types

**Basics of Operating Systems and Databases** 10 Hours

**Operating systems:** Evolution-Types of Operating System –Functions of Operating System-Coordinating machine activities-Handling competition among processes

**Database Fundamentals:** Logical and Physical Data Concepts- Database Management System-Architecture-Database Models-Types of databases.

**Basics of Networks and Data Communication** 08 Hours

**Networks:** Network Topologies-Communication Protocol-Network devices

**Data Communication:** Introduction-Data Communication-Transmission Media-Modulation-Multiplexing-Switching

**Basics of Data abstraction and Software Engineering** 11 Hours

**Data abstraction:** Basic data structures - Implementation - Classes and objects - Object Oriented Programming

**Software Engineering:** Lifecycle-Methodologies-Modularity-Quality Assurance-Documentation-Software Ownership and Liability

**Current and Future trends in IT** 05 Hours


**REFERENCES**

1. Introduction to Information Technology, Pearson Education, ITL Education solutions Ltd., 2012
COURSE OUTCOMES

- Outline various functional components of computer system.
- Summarize the functions of operating systems.
- Define different types of network topologies and protocols.
- Explain the various internet tools and terminology.
- Explain the basic concept of data abstraction, database, software engineering.
OBJECTIVES
- To provide students in-depth theoretical base of the Digital Electronics.
- To provide the fundamental designing concepts of different types of Logic Gates, Minimization techniques etc.
- To familiarize the students regarding designing of different types of the Digital circuits.
- To provide the computational details for Digital Circuits. To introduce the basic concept of Hardware Components.

NUMBER SYSTEM AND BASIC LOGIC
10 Hours

COMBINATIONAL CIRCUITS
9 Hours
Problem formulation and design of combinational circuits, adder, subtractor, Serial adder/ Subtractor - Parallel adder/ Subtractor - Carry look ahead adder - BCD adder - Magnitude Comparator, parity checker, Encoder , decoder, Multiplexer/ Demultiplexer , code converters, Function realization using gates and multiplexers.

SEQUENTIAL CIRCUIT
8 Hours

DESIGN OF SEQUENTIAL CIRCUITS
10 Hours

DIGITAL LOGIC FAMILIES AND PLD
8 Hours
Memories – ROM, PROM, EEPROM, RAM – Programmable Logic Devices: Programmable Logic Array (PLA)- Programmable Array Logic (PAL) - Implementation of combinational logic using PROM, PLA and PAL. Introduction to FPGA. Digital logic families: TTL, ECL, CMOS.

L: 45 Hr, T: 15 Hr, TOTAL: 60 HOURS
REFERENCES

COURSE OUTCOMES
- Translate numerical values in various number systems and perform number conversions between number systems.
- Demonstrate the knowledge of logic gates, Boolean algebra and apply optimal minimization techniques to simplify the Boolean function.
- Analyze and design combinational and sequential circuits.
- Apply the knowledge to solve the real time problems related to digital circuits.
- Compare various programmable devices and digital logic families.
OBJECTIVES

- To study the characteristics of resonant circuits
- To obtain the characteristics of electronic devices
- To obtain the characteristics of amplifier circuits

LIST OF EXPERIMENTS

1. Verification of Kirchhoff’s Laws
2. Series & Parallel Resonance
4. Half wave and full wave rectifier
5. Zener diode Regulator
6. Common Emitter Transistor characteristics
7. JFET characteristics
8. Wein Bridge oscillator
9. Comparator, summing Amplifier using Op-Amp
10. Integrator and Differentiator using Op-Amp

TOTAL: 45 HOURS

COURSE OUTCOMES

- Understand and verify the breadboard connections.
- Check the working condition of a cathode ray oscilloscope.
- Understand the basic laws of electric circuits.
- Understand the working of various electronic devices.
- Understand the performance of an amplifier to carryout different operations.
OBJECTIVES

- Acquire in-depth practical knowledge of computer hardware.
- Understanding the connection of networks.
- Develop skills related to the troubleshooting PC.

LIST OF EXERCISES

1. Study the components through assembling and disassembling of PC.
2. Study of different types of network topologies and cables along with crimping.
4. Installation and configuration of Windows and Linux operating systems.
5. Troubleshooting frequently occurring problems
6. Application software installation.
7. IP configuration and connecting a small LAN including file sharing.
8. Process Handling through task manager
10. Hands on learning of the Unix /Linux commands

TOTAL: 45 HOURS

COURSE OUTCOMES

- Explain the various computer hardware components and their functionality.
- Illustrate the assembling process of a computer system.
- Explain the local area network and file sharing methods.
- Perform the installation of Windows and Linux operating system.
- Summarize the basic Unix /Linux commands.
OBJECTIVES
- To provide students in-depth practical base of the Digital Electronics.
- To familiarize the students regarding designing of different types of the Digital circuits.
- To provide the computational details for Digital Circuits.

LIST OF EXPERIMENTS
1. Verification of Boolean theorems using digital logic gates
2. Design and implementation of combinational circuits using basic gates for arbitrary functions, code converters, etc.
3. Design and implementation of 4-bit binary adder / subtractor using basic gates and MSI devices
4. Design and implementation of parity generator / checker using basic gates and MSI devices
5. Design and implementation of magnitude comparator
6. Design and implementation of application using multiplexers
7. Design and implementation of shift registers
8. Design and implementation of synchronous and asynchronous counters
9. Simulation study of any combinational and sequential circuit using VHDL.

COURSE OUTCOMES

On successful completion of this course, the student should be able to

- Construct truth table for specific digital logic functionality.
- Illustrate digital logic function using optimal minimization techniques.
- Construct and troubleshoot the digital circuits.
- Solve the problems related to digital circuits.
- Experiment with digital circuits using VHDL.

TOTAL: 45 HOURS
OBJECTIVES

- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C’s & 5E’s.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY


**Greatness of womanhood:** Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY

Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.

**Training:** Method of blessings.

FOOD IS MEDICINE

Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C’S & 5E’S

**Personality Concepts:** Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality- 5 C’s and 5 E’s.

**Time Management:** Importance –Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT

**Leadership Traits** – Carrying oneself - Factors of leadership – Principles of leadership.

**Self Development:** Importance – Techniques to development oneself– How to develop oneself?–Ten Commandments of self-development– Self-control technique for teenagers.

**Training:** Method of Self-Control.

SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA

**Spiritual development:** Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.

**Kaya Kalpa yoga:** Aim - kayakalpa philosophy - Importance of kayakalpa training.
Training: Kaya Kalpa Yoga.

EXERCISE & MEDITATION
Simplified Physical Exercise & Meditation Practice.

L: 16 Hr, P: 14, Total: 30 Hours

REFERENCES BOOKS:

COURSE OUTCOMES:
- Behaves as a responsible family member.
- Develop skills for personality improvement.
- Acquire practical knowledge on self-control technique for teenagers.
- Identify the significant of Genetic Centre for the Soul functional base operation.
## B.E - ELECTRONICS AND COMMUNICATION ENGINEERING

### SEMESTER - II

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**TOTAL – 33 HOURS**

**TOTAL CREDITS – 24**
OBJECTIVES

- To develop reading accuracy and English fluency
- To Employ appropriate formats in writing and effective
- To compare and relate words/sounds and listen for specific information.
- To maximize the elements of spoken ability

INTERPRETATIONAL DEXTERITY 15 Hours
Homophones and homonyms - Encoding and decoding advertisements - Transcoding
Graphical Representations – Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree
diagram - Reading brochures, leaflets, instruction manual - Cloze test - Reading
Comprehension- Note Making – Linear and non-linear - Book review, Article review

STYLES OF SCRIPTING 15 Hours
Types of sentences - Concord - Framing Questions – “Wh” questions, Yes/No questions and
Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a
passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative,
Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting
information, explaining a situation, letter of acceptance, declining letter, letter of application
and resume - Essay Writing

AUDITORY PROFICIENCY 15 Hours
Listening to monologues, Listening for general content - Listening to dialogues - Listening to
a telephonic conversation - Listening for specific information, numbers, time, duration -
Listening to conversations between three or more people- Listening to a group discussion and
providing factual information, Intensive listening

ORATORICAL EFFICIENCY 15 Hours
Discussing studies/interests/friends/families-Describe an object or event - Describing a
working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a
public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS

REFERENCES
1. Mark Ibbotson, Cambridge English for Engineering Published by Cambridge University
3. Jeremy Comfort, Pamela Rogerson, Trish Stott and Derek Utley, Speaking Effectively,
   Cambridge University Press, 1994
5. Dorothy Adams, Everyday English: A Course on Communicative English, Cengage
   learning, 2009
COURSE OUTCOMES

➢ Distinguish the application of technical diction for the data interpretation while reading
➢ Construct technical sentences and compose corporate letters
➢ Improve listening for inferring technical information
➢ Develop spoken communication needed for presentations and discussions
OBJECTIVES

On completion of the course, the students are expected

- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS

9 Hours
Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application: Area as double integral – Volume as triple integral.

VECTOR CALCULUS

9 Hours
Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green’s theorem in a plane, Gauss divergence theorem and Stoke’s theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION

9 Hours
Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping: \( w = z + c \), \( cz \), \( 1/z \) and bilinear transformation.

COMPLEX INTEGRATION

9 Hours
Statement and applications of Cauchy’s integral theorem and Cauchy’s integral formula (excluding proofs) – Taylor’s and Laurent’s series expansions – Singularities – Residues – Cauchy’s residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).
LAPLACE TRANSFORM  
9 Hours

L: 45 + T: 15 = 60

REFERENCES


Course Outcomes

After pursuing the above mentioned course, the students will be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.
OBJECTIVES
At end of the course students would be exposed to
- Conducting, superconducting, magnetic and dielectric materials in electrical devices.
- Semi conducting, optical and new engineering materials in switching and display devices, data storage.

CONDUCTING AND SUPERCONDUCTING MATERIALS 9 Hours

Superconductors: Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I & Type II superconductors – High Tc superconductors – Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS 9 Hours
Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semiconductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semiconductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS 9 Hours


NEW ENGINEERING MATERIALS AND NANOTECHNOLOGY 9 Hours
New Engineering Materials: Metallic glasses – preparation, properties and applications – Shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications - advantages and disadvantages of SMA.

OPTICAL MATERIALS  
9 Hours

TOTAL: 45 HOURS

REFERENCES

COURSE OUTCOMES
- Apply core concepts in Materials Science to solve engineering problems
- Determine the position of the acceptor or donor levels and the brand gap of an extrinsic semiconductor,
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the techniques to manufacturing of modern materials for engineering practice.
- Recognize the various nanomaterials for engineering and technological applications
OBJECTIVES
To impart a sound knowledge on basics of
- Theoretical and modern technological aspects of modern polymeric materials technology for micro electrical, electronics, instrumentation and communication fields.

INTRODUCTION TO CONDUCTING POLYMERIC MATERIALS  9 Hours

APPLIED CONDUCTING POLYMERS  9 Hours
Synthesis, structure, morphology, conductivity, doping theory and uses of Poly(sulfur nitride), polyacetylene, polyphenylene, poly(phenylene vinylenes), poly(phenylene sulfide), Polypyrrole and Polythiophene, Polyaniline - Polymers with transition metals in the side-group structure and their uses (includes Stacked Phthalocyanine polymers).

MANUFACTURING METHODS OF ORGANO ELECTRONICS MATERIALS 9Hours

ORGANIC ELECTRONIC MATERIALS  9 Hours
Organic thin-film transistor (OTFT) – architecture, operating mode - fabrication techniques - structure-property relationship - Methods of improving performance – structural perfection - device architecture - Electrical and environmental stability – chemical effects on stability - Gate dielectrics on electrical functionality.

ADVANCED MATERIALS FOR ORGANIC ELECTRONICS  9 Hours

TOTAL: 45 HOURS
REFERENCES

COURSE OUTCOMES
- Analyse and determine the required conducting polymers in fabrication of organic electronic devices
- Describe the mechanism of formation of conducting polymeric materials
- Design an Organic Thin film transistor
- Outline the performance of Pentacene transistors
OBJECTIVES

- Recognize and apply basic electrical units and terminology
- Identify the circuit elements and their corresponding schematic symbols - voltage and current sources (ac and dc), resistors, transformers, capacitors, inductors
- State and apply the laws, rules and theorems to analyze electrical circuit
- Analyze steady state and transient response of source free / driven RL and RC circuits.
- Design and analyze series and parallel Resonance circuits.

DC CIRCUITS ANALYSIS


NETWORK THEOREMS

Superposition Theorem, Thevenin’s Theorem and Norton’s Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem, Verification of Theorems, Introduction to PSPICE.

SINUSOIDAL STEADY STATE ANALYSIS


FIRST ORDER AND SECOND ORDER CIRCUITS

Basic RL and RC Circuits: The Source-Free RL Circuit, the Source-Free RC Circuit, The Unit-Step Function, Driven RL Circuits, Driven RC Circuits- Source free series and parallel RLC circuits.

RESONANCE AND COUPLED CIRCUITS

Frequency Response of Parallel and Series Resonance circuits-determination of Resonant Frequency, Q – Factor and Bandwidth.
Magnetically Coupled Circuits - Self Inductance, Mutual Inductance, Coefficient of Coupling, Energy in a coupled circuit, Linear Transformer, Ideal Transformer, Duality.

L: 45 Hr, T: 15 Hr  TOTAL: 60 HOURS
REFERENCES

COURSE OUTCOMES
- Able to model passive elements & sources
- Apply circuit theory concepts to compute voltage, current & resistance in DC&AC circuits.
- Use SPICE as a simulation tool to analyze electric circuits.
- Estimate the transient response of simple RL, RC & RLC circuits.
- Predict the frequency response of resonance circuits.
OBJECTIVES
- Describe the basic concepts of Electron Ballistics
- Illustrate the formation of a p-n junction diode (built-in potential, electric field, charge transport).
- Explain the construction, operation and characteristics of BJT, JFET and MOSFET
- Appraise the functioning of special semiconductor devices: Tunnel diode, SCR, DIAC, TRIAC, UJT, optoelectronic devices.
- Discuss the manufacturing methods for the production of Integrated Circuits.

ELECTRON BALLISTICS
9 Hours
Force on charge particles in electric field – Motion of charge in uniform and time varying electric fields – Force in a magnetic field – Current Density – Motion in a Magnetic Field – Electrostatic deflection in a cathode ray tube – Magnetic deflection in a cathode ray tube – Deflection sensitivity- Magnetic Focusing –Parallel Electric and Magnetic Fields – Perpendicular Electric and Magnetic Fields – Cyclotron

SEMICONDUCTOR DIODES
9 Hours

BIPOLAR JUNCTION TRANSISTORS AND FIELD EFFECT TRANSISTORS
9 Hours

SPECIAL SEMICONDUCTOR DEVICES
9 Hours
Tunnel diode, Operation and Characteristics - SCR ,TRIAC, DIAC - Applications. UJT - Operation - Characteristics – Equivalent Circuit and Applications – Opto electronic devices- LED - Photo diode –Photo transistor

FABRICATION OF SEMICONDUCTOR DEVICES
9 Hours
REFERENCES

COURSE OUTCOMES
- Recognize the concepts of Electron ballistics
- Understand the principles of Semiconductor Physics
- Illustrate the characteristics of diodes, BJT, FET, MOSFET and their applications.
- Develop skills to implement simple projects using the basic devices
OBJECTIVES

- The experiments are designed to illustrate phenomena in different areas of Physics and to expose you to measuring instruments.
- The laboratory provides a unique opportunity to validate physical theories in a quantitative manner.
- Laboratory experience demonstrates the limitations in the application of physical theories to real physical situations.
- In general, the purpose of these laboratory exercises is both to demonstrate some physical principle and to teach techniques of careful measurement.

LIST OF EXPERIMENTS

Any Ten Experiments
1. Lee’s disc - determination of thermal conductivity of a bad conductor
2. Air wedge - determination of thickness of a given specimen.
4. Compound pendulum - determination of acceleration due to gravity.
5. Carey foster bridge – determination of specific resistance of a given coil of wire.
7. Non-uniform bending – determination of Young’s modulus
8. Ultrasonic interferometer – determination of velocity of sound and compressibility of liquid.
9. Band gap determination of a semiconductor using post office box
10. Semiconductor laser:
    a. Determination of wavelength of laser using grating
    b. Particle size determination
    c. Acceptance angle of optical fibre
11. Torsional pendulum - determination of Rigidity modulus of the wire
12. Field along the axis of a coil – Determination of magnetic moment.

Demonstration experiments:
5. Determination of solar cell parameters
6. Hall effect
7. Four probe apparatus
8. Animations – (Laser, Fiber optics and hysteresis curve)

TOTAL: 45 HOURS

COURSE OUTCOMES

➢ Determine different physical properties of a material like the thermal conductivity thickness of the material, etc.
➢ Perform experiments involving the physical phenomena like interference and diffraction.
➢ Apply physical theories in real life situations by also taking into account its limitations.
OBJECTIVES
- Assemble simple electric circuits with passive elements and sources.
- Verify laws and theorems in electric circuits
- Design and analyze series and parallel resonant circuits
- Use simulation tools to analyze electric circuits.

LIST OF EXPERIMENTS
1. Measurement of current and voltage in series and parallel circuits.
2. Verification of Kirchhoff’s Laws.
3. Verification of Thevenin’s Theorem
4. Verification of Reciprocity Theorem
5. Verification of Superposition Theorem
6. Verification of Maximum Power Transfer Theorem
7. Frequency Response of Series and Parallel resonance circuits

PSPICE SIMULATION
8. Verification of Theorems
9. Analysis of Transient Response of RL & RC circuits
10. Analysis of Series and parallel resonance circuits

TOTAL: 45 HOURS

COURSE OUTCOMES
- Practice proper use of measuring instruments.
- Relate physical observations and measurements involving electrical circuits to theoretical principles.
- Experiment series and parallel resonance circuits.
- Able to use simulation tools to analyze electric circuits.
OBJECTIVES

- Sketch the characteristics of the semiconductor devices: Diode, Zener diode, Transistor, FET, MOSFET, UJT, SCR, Photo diode & Photo transistor.
- Demonstrate the application circuits: rectifier, voltage regulator and BJT amplifier.

LIST OF EXPERIMENTS

1. PN Diode VI–Characteristics
2. Half Wave and Full wave rectifier
3. Zener Diode characteristics and Voltage regulator
4. Transistor (CE) characteristics and h parameter determination
5. JFET characteristics
6. MOSFET characteristics
7. UJT characteristics
8. SCR characteristics
9. TRIAC and DIAC characteristics
10. Photo Diode and Photo Transistor characteristics
11. BJT as an amplifier and switch

TOTAL: 45 HOURS

COURSE OUTCOMES

- Analyze the characteristics and behavior of devices like diode, zener diode, BJT, FET, MOSFET, UJT, SCR and optoelectronic devices
- Verify the working of diodes, transistors and their applications
- Build a common emitter/base/collector amplifier and measure h-parameters.
OBJECTIVES

- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C’s & 5E’s.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY


**Greatness of womanhood:** Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY

Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.

**Training:** Method of blessings.

FOOD IS MEDICINE

Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C’S & 5E’S

**Personality Concepts:** Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality-5 C’s and 5 E’s.

**Time Management:** Importance – Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT

**Leadership Traits** – Carrying oneself - Factors of leadership – Principles of leadership.

**Self Development:** Importance – Techniques to development oneself– How to develop oneself?– Ten Commandments of self-development– Self-control technique for teenagers.

**Training:** Method of Self-Control.

SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA

**Spiritual development:** Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.
Kaya Kalpa yoga: Aim - kayalpa philosophy - Importance of kayakalpa training.

Training: Kaya Kalpa Yoga.

EXERCISE & MEDITATION
Simplified Physical Exercise & Meditation Practice.

10 Hours

L: 16 Hr, P: 14, Total: 30 Hours

REFERENCES BOOKS:
1. Dr. A. Chandra Mohan, “Leadership and Management”, Himalaya Publication House,

COURSE OUTCOMES:
- Behaves as a responsible family member.
- Develop skills for personality improvement.
- Acquire practical knowledge on self-control technique for teenagers.
- Identify the significant of Genetic Centre for the Soul functional base operation.
### B.E - ELECTRICAL AND ELECTRONICS ENGINEERING

#### SEMESTER – II

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**TOTAL – 33 HOURS**

**TOTAL CREDIT – 25**
OBJECTIVES

- To develop reading accuracy and English fluency
- To Employ appropriate formats in writing and effective
- To compare and relate words/sounds and listen for specific information.
- To maximize the elements of spoken ability

INTERPRETATIONAL DEXTERITY

15 Hours

Homophones and homonyms - Encoding and decoding advertisements - Transcoding
Graphical Representations – Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree
diagram - Reading brochures, leaflets, instruction manual - Cloze test - Reading
Comprehension- Note Making – Linear and non-linear - Book review, Article review

STYLES OF SCRIPTING

15 Hours

Types of sentences - Concord - Framing Questions – “Wh” questions, Yes/No questions and
Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a
passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative,
Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting
information, explaining a situation, letter of acceptance, declining letter, letter of application
and resume - Essay Writing

AUDITORY PROFICIENCY

15 Hours

Listening to monologues, Listening for general content - Listening to dialogues - Listening to
a telephonic conversation - Listening for specific information, numbers, time, duration -
Listening to conversations between three or more people- Listening to a group discussion and
providing factual information, Intensive listening

ORATORICAL EFFICIENCY

15 Hours

Discussing studies/interests/friends/families-Describe an object or event - Describing a
working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a
public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS

REFERENCES

1. Mark Ibbotson, Cambridge English for Engineering Published by Cambridge University
3. Jeremy Comfort, Pamela Rogerson, Trish Stott and Derek Utley, Speaking Effectively,
Cambridge University Press, 1994
5. Dorothy Adams, Everyday English: A Course on Communicative English, Cengage
learning, 2009
COURSE OUTCOMES

- Distinguish the application of technical diction for the data interpretation while reading
- Construct technical sentences and compose corporate letters
- Improve listening for inferring technical information
- Develop spoken communication needed for presentations and discussions
OBJECTIVES
On completion of the course, the students are expected

- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS
9 Hours
Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application : Area as double integral – Volume as triple integral.

VECTOR CALCULUS
9 Hours
Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green’s theorem in a plane, Gauss divergence theorem and Stoke’s theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION
9 Hours
Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : \( w = z + c \), \( cz \), \( 1/z \) and bilinear transformation.

COMPLEX INTEGRATION
9 Hours
Statement and applications of Cauchy’s integral theorem and Cauchy’s integral formula (excluding proofs) – Taylor’s and Laurent’s series expansions – Singularities – Residues – Cauchy’s residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).
LAPLACE TRANSFORM


L: 45 + T: 15 = 60

REFERENCES


Course Outcomes

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.
OBJECTIVES
At the end of the course the students would be exposed to fundamental knowledge in

- Design of acoustically good buildings
- Properties and applications of conducting materials, Superconducting materials, magnetic and dielectric materials.
- Preparation, properties and applications of Metallic glasses, Shape memory alloys and Nano materials.
- Plasma, types and its applications

ACOUSTICS

CONDUCTING AND SUPERCONDUCTING MATERIALS

Superconducting Materials: Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I & Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING & OPTICAL MATERIALS
Origin of band gap in solids (Qualitative treatment only) - carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration –

MAGNETIC & DIELECTRIC MATERIALS 9 Hours


**Dielectric Materials**: Electronic, ionic, orientation and space charge polarization - Frequency and temperature dependence of polarization – Dielectric loss – Dielectric breakdown – different types of break down mechanism - Ferro electric materials - properties and applications.

PLASMA AND NANOTECHNOLOGY 9 Hours

**Plasma Technology**: properties of plasma- types of plasma- thermal and non thermal plasma- Production of glow discharge plasma-Cold plasma- applications in textile and biomedical field.


**REFERENCE**

**COURSE OUTCOMES**
- Apply core concepts in Materials Science to solve engineering problems
- Describe the impact of acoustic engineering solutions in a constructional environmental, and societal context.
- Determine the position of the acceptor or donor levels and the brand gap of an extrinsic semiconductor,
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the concepts of nanomaterials and modern materials for explaining surface properties like adhesion etc. in engineering practice.
OBJECTIVES
To impart a sound knowledge on basics of

- Theoretical and modern technological aspects of modern polymeric materials technology for micro electrical, electronics, instrumentation and communication fields.

INTRODUCTION TO CONDUCTING POLYMERIC MATERIALS 9 Hours

APPLIED CONDUCTING POLYMERS 9 Hours
Synthesis, structure, morphology, conductivity, doping theory and uses of Poly(sulfur nitride), polyacetylene, polyphenylene, poly(phenylene vinylenes), poly(phenylene sulfide), Polypyrrole and Polythiophene, Polyaniline - Polymers with transition metals in the side-group structure and their uses (includes Stacked Phthalocyanine polymers).

MANUFACTURING METHODS OF ORGANO ELECTRONICS MATERIALS 9 Hours

ORGANIC ELECTRONIC MATERIALS 9 Hours
Organic thin-film transistor (OTFT) – architecture, operating mode - fabrication techniques - structure-property relationship - Methods of improving performance – structural perfection - device architecture - Electrical and environmental stability – chemical effects on stability - Gate dielectrics on electrical functionality.

ADVANCED MATERIALS FOR ORGANIC ELECTRONICS 9 Hours

TOTAL: 45 HOURS
REFERENCES

COURSE OUTCOMES
- Analyse and determine the required conducting polymers in fabrication of organic electronic devices
- Describe the mechanism of formation of conducting polymeric materials
- Design an Organic Thin film transistor
- Outline the performance of Pentacene transistors
OBJECTIVES

- To understand the concept of electrical circuits, characteristics of circuit elements and power sources.
- To analyze A.C. circuits, the concept of active, reactive and apparent powers, power factor and resonance in series and parallel circuits.
- To solve electrical network problems using mesh and nodal analysis and by applying network theorems.
- To know the basic concepts of magnetic coupled circuits.
- To know the fundamental relationships involved with three phase circuits and power measurement.

BASIC CIRCUIT CONCEPTS


AC CIRCUIT CONCEPTS


CIRCUIT ANALYSIS & NETWORK THEOREMS

Nodal analysis and Mesh analysis for D.C and A.C circuits, Superposition theorem, Thevenin’s theorem, Norton’s theorem, Reciprocity theorem, maximum power transfer theorem, Duality in networks-problems.

MAGNETIC COUPLED CIRCUITS


THREE PHASE CIRCUITS

Phase sequence-line and phase quantities-Three phase star and delta connections -analysis of three phase circuits with star and delta connected balanced and unbalanced loads- power measurement in three phase circuits using two wattmeter method-power factor of an unbalanced system.
REFERENCES

COURSE OUTCOMES
- Determine the current and voltage magnitudes by applying laws. Students can also reduce the complex circuits to simple forms using reduction techniques and source transformations. Students will be able to draw the phasor diagrams and can find the design parameters (Q factor and bandwidth) for series and parallel resonance circuits.
- Reduce the complex circuits to simple circuits and apply mesh and nodal analysis to compute the current and voltage magnitudes in different branches of the given circuit.
- Understand the concepts of magnetic circuits and can compute the effective inductance with respect to different parameters like number of turns, flux, area, direction of winding current and flux density. Students understand the 3 phase concepts and its types applicable for both balanced and unbalanced load.
OBJECTIVES
- To introduce principles of power generation utilizing various sources
- To introduce the basic concepts in various thermal applications like IC engines, gas, steam turbines and compressors.
- To gain knowledge regarding the fundamentals of fluid flow and their Applications.

POWER PLANT ENGINEERING 9 Hours
Introduction, Classification of Power Plants – Working principles of thermal (coal, gas and diesel), Hydro-electric and Nuclear Power plants – Merits and Demerits – Non-conventional power generation methods- Solar and wind power – Boilers - construction and working principles of Cochran, Babcock and Wilcox boilers

PRIME MOVERS 9 Hours
Steam turbines-Impulse (Delaval) and reaction turbines – Hydraulic prime movers- Pelton and Kaplan turbines- Internal combustion engines as automobile power plant – Working principles of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines.

REFRIGERATION AND AIR CONDITIONING 9 Hours
Positive displacement compressors – Reciprocating compressors- Rotary positive displacement compressors - Construction and working principles of centrifugal and axial flow compressors. Refrigeration –Vapour compression and vapour absorption refrigeration – Air conditioning- Terminology- Classification as to season of the year - window room air conditioning- thermoelectric cooling-applications.

FLUID PROPERTIES AND FLOW CHARACTERISTICS 9 Hours

FLUID FLOW APPLICATIONS 9 Hours

L: 45 Hr, T: 15 Hr, TOTAL: 60 HOURS
REFERENCES

COURSE OUTCOMES
- Demonstrate understanding of basic concepts of thermodynamics, power plants and prime movers.
- Understand the working of air conditioning systems.
- Solve problems in fluid properties and flow dynamics.
OBJECTIVES

- The experiments are designed to illustrate phenomena in different areas of Physics and to expose you to measuring instruments.
- The laboratory provides a unique opportunity to validate physical theories in a quantitative manner.
- Laboratory experience demonstrates the limitations in the application of physical theories to real physical situations.
- In general, the purpose of these laboratory exercises is both to demonstrate some physical principle and to teach techniques of careful measurement.

LIST OF EXPERIMENTS

Any Ten Experiments
1. Lee’s disc - determination of thermal conductivity of a bad conductor
2. Air wedge - determination of thickness of a given specimen.
3. Spectrometer - determination of wavelength of mercury source using grating
4. Compound pendulum - determination of acceleration due to gravity.
5. Carey foster bridge – determination of specific resistance of a given coil of wire.
7. Non-uniform bending – determination of Young’s modulus
8. Ultrasonic interferometer – determination of velocity of sound and compressibility of liquid.
9. Band gap determination of a semiconductor using post office box
10. Semiconductor laser:
   a. Determination of wavelength of laser using grating
   b. Particle size determination
   c. Acceptance angle of optical fibre
11. Torsional pendulum - determination of Rigidity modulus of the wire
12. Field along the axis of a coil – Determination of magnetic moment.

Demonstration experiments:
1. Determination of solar cell parameters
2. Hall effect
3. Four probe apparatus
4. Animations – (Laser, Fiber optics and hysteresis curve)

TOTAL: 45 HOURS

COURSE OUTCOMES

- Determine different physical properties of a material like the thermal conductivity, thickness of the material, etc.
- Perform experiments involving the physical phenomena like interference and diffraction.

Apply physical theories in real life situations by also taking into account its limitations.
OBJECTIVES

- Expected to gain knowledge regarding the working of IC engines and air compressors.
- Expected to gain knowledge regarding the fundamentals of fluid flow and their applications to flow through pipes and hydraulic machines.

LIST OF EXPERIMENTS

THERMODYNAMICS LAB
1. Study of a Petrol Engine
2. Study of a Diesel Engine
3. Study of a IC Engine
4. Performance evaluation of four stroke diesel engine using rope brake dynamometer
5. Test on reciprocating air compressor

FLUID MECHANICS LABORATORY
1. Flow measurements using venturi meter
2. Test to estimate frictional losses in pipe flow.
3. Test on positive displacement pump for obtaining its characteristics curves and design flow parameters.
4. Test on centrifugal pump for obtaining its characteristics curves and design flow parameters.
5. Test on jet pump for obtaining its characteristics curves and design flow parameters.
6. Test on reaction turbine for obtaining the characteristics curve and to design values of specific speed, discharge, output and efficiency.
7. Test on impulse turbine to obtain its characteristics curves and hydraulic design values.

TOTAL: 45 HOURS

COURSE OUTCOMES

- Conduct tests on engine performance.
- Study petrol and diesel engine working principles.
- Examine the pump characteristics and conduct test on turbines.
OBJECTIVES

- To impart hands on experience in verification of circuit laws and theorems, measurement of circuit parameters, study of circuit characteristics and simulation of time response.

LIST OF EXPERIMENTS

2. Verifications of Superposition theorem.
3. Verifications of Thevenin’s theorem.
4. Verifications of Norton’s theorem.
5. Verifications of Reciprocity theorem.
6. Verifications of Maximum power transfer theorem.
7. Verifications of Mesh analysis.
8. Verifications of Nodal analysis.
10. Frequency response RL & RC Circuits

TOTAL: 45 HOURS

COURSE OUTCOMES

- Reduce the given complex circuit to simple circuit by applying theorems and can verify the theoretical and practical outputs
- Find the impedance value of the given circuit at which the maximum power is transferred and also confirms with the practical results
- Find the magnitudes of voltages and currents in the given circuit and verifies experimentally using mesh and nodal analysis
- Demonstrate frequency response, Phasor relationships for the given RL, RC circuits and verify experimentally.
- Design a circuit to accept or reject a particular frequency using resonance principle.
U14GHP201/ FAMILY & PROFESSIONAL VALUES
(Common to all branches of Engineering and Technology)

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OBJECTIVES
- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C's & 5E's.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY 4 Hours

Greatness of womanhood: Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY 2 Hours
Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.
Training: Method of blessings.

FOOD IS MEDICINE 2 Hours
Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C’S & 5E’S 4 Hours
Personality Concepts: Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality- 5 C’s and 5 E’s.
Time Management: Importance – Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT 4 Hours
Leadership Traits – Carrying oneself - Factors of leadership – Principles of leadership.


Training: Method of Self-Control.

SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA 4 Hours
Spiritual development: Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.
Kaya Kalpa yoga: Aim - kayakalpa philosophy - Importance of kayakalpa training.

Training: Kaya Kalpa Yoga.
EXERCISE & MEDITATION
10 Hours
Simplified Physical Exercise & Meditation Practice.

L: 16 Hr, P: 14, Total: 30 Hours

REFERENCES BOOKS:
1. Dr. A. Chandra Mohan, “Leadership and Management”, Himalaya Publication House,

COURSE OUTCOMES:
• Behaves as a responsible family member.
• Develop skills for personality improvement.
• Acquire practical knowledge on self-control technique for teenagers.
• Identify the significant of Genetic Centre for the Soul functional base operation.
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**TOTAL – 32 HOURS**

**TOTAL CREDITS – 24**
OBJECTIVES

- To develop reading accuracy and English fluency
- To employ appropriate formats in writing and effective
- To compare and relate words/sounds and listen for specific information.
- To maximize the elements of spoken ability

INTERPRETATIONAL DEXTERITY 15 Hours
Homophones and homonyms - Encoding and decoding advertisements - Transcoding
Graphical Representations – Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree
Diagram - Reading brochures, leaflets, instruction manual - Cloze test - Reading
Comprehension- Note Making – Linear and non-linear - Book review, Article review

STYLES OF SCRIPTING 15 Hours
Types of sentences - Concord - Framing Questions – “Wh” questions, Yes/No questions and
Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a
passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative,
Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting
information, explaining a situation, letter of acceptance, declining letter, letter of application
and resume - Essay Writing

AUDITORY PROFICIENCY 15 Hours
Listening to monologues, Listening for general content - Listening to dialogues - Listening to
a telephonic conversation - Listening for specific information, numbers, time, duration -
Listening to conversations between three or more people- Listening to a group discussion and
providing factual information, Intensive listening

ORATORICAL EFFICIENCY 15 Hours
Discussing studies/interests/friends/families-Describe an object or event - Describing a
working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a
public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS

REFERENCES
1. Mark Ibbotson, Cambridge English for Engineering Published by Cambridge University
3. Jeremy Comfort, Pamela Rogerson, Trish Stott and Derek Utley, Speaking Effectively,
   Cambridge University Press,.1994
5. Dorothy Adams, Everyday English: A Course on Communicative English, Cengage
   learning, 2009
COURSE OUTCOMES
➢ Distinguish the application of technical diction for the data interpretation while reading
➢ Construct technical sentences and compose corporate letters
➢ Improve listening for inferring technical information
➢ Develop spoken communication needed for presentations and discussions
OBJECTIVES
On completion of the course, the students are expected
- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS 9 Hours
Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application : Area as double integral – Volume as triple integral .

VECTOR CALCULUS 9 Hours
Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green’s theorem in a plane, Gauss divergence theorem and Stoke’s theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION 9 Hours
Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : \( w = z + c, \ cz, 1/z \) and bilinear transformation.

COMPLEX INTEGRATION 9 Hours
Statement and applications of Cauchy’s integral theorem and Cauchy’s integral formula (excluding proofs) – Taylor’s and Laurent’s series expansions – Singularities – Residues – Cauchy’s residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).
LAPLACE TRANSFORM


9 Hours

L: 45 + T: 15 = 60

REFERENCES


Course Outcomes

After pursuing the above mentioned course, the students will be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.
OBJECTIVES
At end of the course students would be exposed to
- Conducting, superconducting, magnetic and dielectric materials in electrical devices.
- Semi conducting, optical and new engineering materials in switching and display devices, data storage.

CONDUCTING AND SUPERCONDUCTING MATERIALS
Classical free electron theory of metals - Electrical conductivity - Thermal conductivity - expression - Wiedemann Franz law (derivation) - Lorentz number - drawbacks of classical theory - Fermi distribution function - density of energy states - effect of temperature on Fermi energy.

Superconductors: Superconducting phenomena - properties of superconductors - Meissner effect, Isotope effect, Type I & Type II superconductors - High Tc superconductors - Applications - cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS
Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole - carrier concentration in an intrinsic semiconductor (derivation) - Fermi level - variation of Fermi level with temperature - Electrical conductivity - band gap semiconductor - carrier concentration in n-type and p-type semiconductors (derivation) - Variation of Fermi level with temperature and impurity concentration - Hall effect - Determination of Hall coefficient - experimental set up - Applications.

MAGNETIC & DIELECTRIC MATERIALS

Dielectric Materials: Electronic, ionic, orientation and space charge polarization - Frequency and temperature dependence of polarization - Dielectric loss - Dielectric breakdown - different types of break down mechanism - Ferro electric materials - properties and applications.

NEW ENGINEERING MATERIALS AND NANOTECHNOLOGY
New Engineering Materials: Metallic glasses preparation, properties and applications - Shape memory alloys (SMA) - characteristics, properties of NiTi alloy applications - advantages and disadvantages of SMA.

Nano Materials: synthesis - plasma arcing - Chemical vapour deposition - sol-gel - Electro deposition - ball milling - properties of nanoparticles and applications. - Carbon nano tubes -
fabrication - arc method – pulsed laser deposition - Chemical vapour deposition - structure, properties & applications.

OPTICAL MATERIALS 9 Hours

TOTAL: 45 HOURS

REFERENCES

COURSE OUTCOMES
- Apply core concepts in Materials Science to solve engineering problems
- Determine the position of the acceptor or donor levels and the band gap of an extrinsic semiconductor,
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the techniques to manufacturing of modern materials for engineering practice.
- Recognize the various nanomaterials for engineering and technological applications
OBJECTIVES
To impart a sound knowledge on basics of
- Theoretical and modern technological aspects of modern polymeric materials technology for micro electrical, electronics, instrumentation and communication fields.

INTRODUCTION TO CONDUCTING POLYMERIC MATERIALS 9 Hours

APPLIED CONDUCTING POLYMERS 9 Hours
Synthesis, structure, morphology, conductivity, doping theory and uses of Poly(sulfur nitride), polyacetylene, polyphenylene, poly(phenylene vinlylenes), poly(phenylene sulfide), Polypyrrole and Polythiophene, Polyaniline - Polymers with transition metals in the side-group structure and their uses (includes Stacked Phthalocyanine polymers).

MANUFACTURING METHODS OF ORGANO ELECTRONICS MATERIALS 9 Hours

ORGANIC ELECTRONIC MATERIALS 9 Hours
Organic thin-film transistor (OTFT) – architecture, operating mode - fabrication techniques - structure-property relationship - Methods of improving performance – structural perfection - device architecture - Electrical and environmental stability – chemical effects on stability - Gate dielectrics on electrical functionality.

ADVANCED MATERIALS FOR ORGANIC ELECTRONICS 9 Hours

TOTAL: 45 HOURS
REFERENCES

COURSE OUTCOMES
- Analyse and determine the required conducting polymers in fabrication of organic electronic devices
- Describe the mechanism of formation of conducting polymeric materials
- Design an Organic Thin film transistor
- Outline the performance of Pentacene transistors
OBJECTIVES

- Recognize and apply basic electrical units and terminology
- Identify the circuit elements and their corresponding schematic symbols - voltage and current sources (ac and dc), resistors, transformers, capacitors, inductors
- State and apply the laws, rules and theorems to analyze electrical circuit
- Analyze steady state and transient response of source free / driven RL and RC circuits.
- Design and analyze series and parallel Resonance circuits.

DC CIRCUITS ANALYSIS 
9 Hours

NETWORK THEOREMS
9 Hours
Superposition Theorem, Thevenin’s Theorem and Norton’s Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem, Verification of Theorems, Introduction to PSPICE.

SINUSOIDAL STEADY STATE ANALYSIS
9 Hours
AC Circuit Power Analysis-Instantaneous Power, Average Power, RMS Power, Apparent Power and Power Factor, Complex Power, Mesh Analysis & Nodal Analysis, Verification of Maximum Power Transfer theorem

FIRST ORDER AND SECOND ORDER CIRCUITS
9 Hours
Basic RL and RC Circuits: The Source-Free RL Circuit, the Source-Free RC Circuit, The Unit-Step Function, Driven RL Circuits, Driven RC Circuits- Source free series and parallel RLC circuits

RESONANCE AND COUPLED CIRCUITS
9 Hours
Frequency Response of Parallel and Series Resonance circuits-determination of Resonant Frequency, Q – Factor and Bandwidth.
Magnetically Coupled Circuits - Self Inductance, Mutual Inductance, Coefficient of Coupling, Energy in a coupled circuit, Linear Transformer, Ideal Transformer, Duality.

L:45 Hr, T:15 Hr  TOTAL: 60 HOURS
REFERENCES

COURSE OUTCOMES
- Able to model passive elements & sources
- Apply circuit theory concepts to compute voltage, current & resistance in DC&AC circuits.
- Use SPICE as a simulation tool to analyze electric circuits.
- Estimate the transient response of simple RL, RC & RLC circuits.
- Predict the frequency response of resonance circuits.
OBJECTIVES

- To describe how current flows through PN junction & relating this phenomena to the characteristics & operation of the diodes, bipolar, FET transistors.
- To expose students to the functions and application of diodes, BJT & FET in electronic circuits.

SEMICONDUCTOR DIODE


BI-POLAR TRANSISTOR


FIELD EFFECT TRANSISTORS


OPTO ELECTRONIC DEVICES

Photo emissivity and photo electric theory – Theory, construction and characteristics: light emitting diodes, liquid crystal cell, seven segment display, photo conductive cell, photodiode, solar cell, photo transistor, opto couplers and laser diode.

OTHER DEVICES

Theory, characteristics and application: SCR, TRIAC, PUT, tunnel diode, thermistors, piezo electric devices, zener diode, charge coupled devices, varactor diode and LDR.

TOTAL: 45 HOURS

REFERENCES

COURSE OUTCOMES
➢ Describe the working principle and characteristics of various electronic devices like FET, BJT, PN Junction Diode and other Electronics devices.
OBJECTIVES
- The experiments are designed to illustrate phenomena in different areas of Physics and to expose you to measuring instruments.
- The laboratory provides a unique opportunity to validate physical theories in a quantitative manner.
- Laboratory experience demonstrates the limitations in the application of physical theories to real physical situations.
- In general, the purpose of these laboratory exercises is both to demonstrate some physical principle and to teach techniques of careful measurement.

LIST OF EXPERIMENTS

Any Ten Experiments
1. Lee’s disc - determination of thermal conductivity of a bad conductor
2. Air wedge - determination of thickness of a given specimen.
3. Spectrometer - determination of wavelength of mercury source using grating
4. Compound pendulum - determination of acceleration due to gravity.
5. Carey Foster bridge – determination of specific resistance of given coil of wire.
7. Non-uniform bending – determination of Young’s modulus
8. Ultrasonic interferometer – determination of velocity of sound and compressibility of liquid.
9. Band gap determination of a semiconductor using post office box
10. Semiconductor laser:
   a. Determination of wavelength of laser using grating
   b. Particle size determination
   c. Acceptance angle of optical fibre
11. Torsional pendulum - determination of Rigidity modulus of the wire
12. Field along the axis of a coil – Determination of magnetic moment.

Demonstration experiments:
1. Determination of solar cell parameters
2. Hall effect
3. Four probe apparatus
4. Animations – (Laser, Fiber optics and hysteresis curve)

TOTAL: 45 HOURS

COURSE OUTCOMES
- Determine different physical properties of a material like the thermal conductivity, thickness of the material, etc.
- Perform experiments involving the physical phenomena like interference and diffraction. Apply physical theories in real life situations by also taking into account its limitations.
OBJECTIVES

- To analyze webpage and identify its elements and attributes
- Learn the basic language of the web: HTML.
- Be able to embed social media content into web pages.
- Implement and understand how to get used with MATLAB

List of Experiments

1. Study of HTML tags
2. Design a web page using basic html tags
3. Design a webpage using table tags
4. Design a webpage using forms and frames
5. Design a webpage using list tags
6. Develop a website of your interest(include a minimum of 3 web pages)
7. Study of MATLAB functions
8. Working with matrix operations
9. Working with image arithmetic
   a. Addition of two images
   b. Subtraction of two images
10. Write a Matlab program for the following
    a. Read an image and crop
    b. Read an image and resize
11. Working with Integration and Differentiation
12. Working with graphs

COURSE OUTCOMES

On successful completion of this course the student should be able to

1. Develop static web pages using HTML. [S]
2. Perform basic MATLAB operations. [S]
3. Make use of MATLAB to work with images and graphs. [S]
4. Perform integration and differentiation using MATLAB. [S]
5. Develop team spirit and professional attitude towards the development of simple web applications [A]
OBJECTIVES

- To experimentally verify the characteristics of P-N diode, BJT, FET, UJT, TRIAC, SCR.
- To verify the various theorems like superposition, Thevenin, Norton and Maximum power transfer theorem.

LIST OF EXPERIMENTS

2. Characteristics of transistor under CE configuration and Determination of h parameters.
3. Characteristics of transistor under CB configuration and Determination of h parameters.
4. Characteristics of JFET.
5. Characteristics of UJT.
6. Verification of ohms law, Kirchhoff’s voltage and current laws.
7. Verification of Thevenin’s and Norton’s Theorems.
8. Verification of Superposition and maximum power transfer theorem.
9. Characteristics of SCR.
10. Characteristics of Triac.
11. Characteristics of MOSFET.

TOTAL: 45 HOURS

COURSE OUTCOMES

- Demonstrate the working of various electronic devices.
- Compute and experimentally verify thevenin’s, Norton, Superposition, Maximum power transfer theorems.
OBJECTIVES

- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C’s & 5E’s.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY 4 Hours

Greatness of womanhood: Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY 2 Hours
Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.
Training: Method of blessings.

FOOD IS MEDICINE 2 Hours
Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C’S & 5E’S 4 Hours
Personality Concepts: Definition - Types of Personality- Personality development activities-Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality-5 C’s and 5 E’s.
Time Management: Importance –Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT 4 Hours
Leadership Traits – Carrying oneself - Factors of leadership – Principles of leadership.

Training: Method of Self-Control.

SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA 4 Hours
Spiritual development: Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.
KayaKalpa yoga: Aim - kayakalpa philosophy - Importance of kayakalpa training.
Training: Kaya Kalpa Yoga.

EXERCISE & MEDITATION
Simplified Physical Exercise & Meditation Practice.

L: 16 Hr, P: 14, Total: 30 Hours

REFERENCES BOOKS:
1. Dr. A. Chandra Mohan, “Leadership and Management”, Himalaya Publication House,

COURSE OUTCOMES:
• Behaves as a responsible family member.
• Develop skills for personality improvement.
• Acquire practical knowledge on self-control technique for teenagers.
• Identify the significant of Genetic Centre for the Soul functional base operation.
### B.Tech - TEXTILE TECHNOLOGY (FASHION TECHNOLOGY)

#### SEMESTER – II

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**TOTAL – 31 HOURS**

**TOTAL CREDIT – 23**
OBJECTIVES
- To develop reading accuracy and English fluency
- To Employ appropriate formats in writing and effective
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INTERPRETATIONAL DEXTERY 15 Hours
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STYLES OF SCRIPTING 15 Hours
Types of sentences - Concord - Framing Questions – “Wh” questions, Yes/No questions and Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative, Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting information, explaining a situation, letter of acceptance, declining letter, letter of application and resume - Essay Writing

AUDITORY PROFICIENCY 15 Hours
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ORATORICAL EFFICIENCY 15 Hours
Discussing studies/interests/friends/families-Describe an object or event - Describing a working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS
REFERENCES

COURSE OUTCOMES
➢ Distinguish the application of technical diction for the data interpretation while reading
➢ Construct technical sentences and compose corporate letters
➢ Improve listening for inferring technical information
➢ Develop spoken communication needed for presentations and discussions
OBJECTIVES
On completion of the course, the students are expected
• To understand double and triple integrations and enable them to find area and volume using multiple integrals.
• To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
• To understand analytic functions of complex variables and conformal mappings.
• To know the basics of residues, complex integration and contour integration.
• To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS 9 Hours
Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application: Area as double integral – Volume as triple integral.

VECTOR CALCULUS 9 Hours
Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green’s theorem in a plane, Gauss divergence theorem and Stoke’s theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION 9 Hours
Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy- Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping: w = z + c, cz, 1/z and bilinear transformation.

COMPLEX INTEGRATION 9 Hours
Statement and applications of Cauchy’s integral theorem and Cauchy’s integral formula (excluding proofs) – Taylor’s and Laurent’s series expansions – Singularities – Residues – Cauchy’s residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).
LAPLACE TRANSFORM


L: 45 + T: 15 = 60

REFERENCES


Course Outcomes

After pursuing the above mentioned course, the students will be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.
OBJECTIVES
At the end of the course the students would be exposed to

- Properties of conducting, superconducting, magnetic and dielectric materials.
- Properties of semi-conducting, optical and new engineering materials.
- Application of ultrasonic and nuclear physics in medicine.

CONDUCTING AND SUPERCONDUCTING MATERIALS 9 Hours

Superconducting Materials: Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I & Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS 9 Hours
Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semiconductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semiconductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS 9 Hours

NEW ENGINEERING MATERIALS  
9 Hours
Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications advantages and disadvantages of SMA.
Ceramics-Classification of ceramics- Fabrication, Properties and application. Biomaterials-Biomechanism - Classification of Biomaterials-Processing, Properties and applications.

NANO SCIENCE AND PLASMA TECHNOLOGY  
9 Hours

Plasma Technology: properties of plasma- types of plasma- thermal and non thermal plasma- Production of glow discharge plasma-Cold plasma- applications in textile and biomedical field.

TOTAL: 45 HOURS

REFERENCES
3. Avadhanalu M.N. and Kshirsagar P.G., A textbook of Engineering Physics, S. Chand & Company Ltd., New Delhi, 2005

COURSE OUTCOMES
- Apply core concepts in Materials Science to solve engineering problems
- Illustrate the electrical / thermal conductivity of semiconductors and determine the position of the acceptor or donor levels and the brand gap of an extrinsic semiconductor,
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the concepts of nanomaterials and modern materials for explaining surface properties like adhesion etc. in engineering practice.
- Identify methods for etching of fabrics
OBJECTIVES

- To correlate theoretical principles with application oriented studies
- To embark on the usage of theoretical and modern technological aspects in polymers and dyes to exhibit engineering and technical concepts as required for Textile and Fashion Technology students.

WATER TECHNOLOGY


POLYMERS

Introduction – Degree of polymerization – functionality – tacticity - classification based on source, application, thermal properties (thermosetting and thermoplastics) - effect of polymer structure on properties – types of polymerization (addition, condensation, co-polymerization, Ring polymerisation) - mechanism of polymerization (free radical mechanism)

Preparation (mechanism not required) and applications of polythene, polypropylene, polystyrene, polyamides (nylon 6,6), polyesters (PET)

CHEMICAL BONDING

Ionic, covalent and co-ordinate covalent bonds (overview only) -- hydrogen bonding and its consequences - van der Waal’s forces (dipole – dipole, dipole – induced dipole, induced dipole – induced dipole interactions) - Interaction of enzymes with fibres (basic concepts only). Interaction between fibers and dyes (basic concepts only) - Dyes substrate affinity (dyes for cellulose fibres, silk)

DYES

Introduction - Classification system of dyes - Chromophore and auxochromes – Important chemical chromophores of dyes classes (azo, anthraquinone, phthalocyanin, Indigoid, polymethine, phthalocyanine, metal complex, Fluorescent) - synthesis of azo dye (Congo red), triaryl methane dye (Malachite green), Anthraquinone dye (Alizarin - 1,2 dihydroxy anthraquinone), Indigoid dye (Indigo), phthalein dyes (Eosin)
ANTHOLOGY OF SPECIALITY CHEMICALS IN TEXTILES  

An introduction on chemistry of the following in textiles: Dispersing agents, levelling agents, Retarding agents, Dye fixing agents.
Thermal analysis (DSC): Principle, Instrumentation and application in Textiles

TOTAL: 45 HOURS

REFERENCES
7. Amarika Singh, Vairam S. and Suba Ramesh., Chemistry for engineers., Wiley India Ltd., New Delhi

COURSE OUTCOMES
- Design a water purifier
- Discuss the mechanism of polymer formation
- Classify dyes and describe its interaction with fibers using bonding.
- Analyse the usage of specialty chemicals in dyes
OBJECTIVES
- To acquire knowledge on properties of textile fibres and their manufacturing methods
- To impart knowledge on the conventional and modern yarn manufacturing process

TEXTILE FIBRES
9 Hours
Introduction: Definition of staple fibre, filament, bicomponent fibres. Classification of natural and man-made fibres, essential and desirable properties of fibres.
Production and cultivation of Natural Fibers: Cultivation of cotton, production of silk (sericulture), wool and jute – physical and chemical structure of these fibres.
Production sequence of modified cellulosic fibres: Viscose Rayon, Acetate Rayon, high wet modulus and high tenacity fibres. Physical and chemical properties of the above fibres.

PRODUCTION SEQUENCE AND PHYSICAL AND CHEMICAL PROPERTIES OF SYNTHETIC FIBERS
9 Hours
Polyester, Nylon and Acrylic. Introduction to spin finishes and texturisation.
Speciality fibres: High temperature and flame retardant fibres, elastomeric fibres, Polylactic Acid (PLA) fibre, nano-fibres, metallic fibres-Gold and Silver coated, super-absorbent fibres for medical and hygiene applications.

SHORT STAPLE SPINNING SYSTEM (COTTON)
9 Hours
Sequence of process in cotton spinning - Ginning-objectives, types, suitability and principle of working; objectives and principles of working of Blow room, Carding, Drawing, Combing, Simplex and spinning machines -Ring spinning and Ringless-Rotor spinning, Air jet spinning and DREF spinning machines.

LONG STAPLE SPINNING SYSTEM
9 Hours
Sequence of process in woolen and worsted spinning; objectives and principles of Scouring, Drying, Oiling, Dyeing, Blending, Carding, Gilling and Combing, Roving and Spinning – Siro, Solo and Compact spinning systems.

POST SPINNING
9 Hours
Objectives and principles of working of Reeling, Assembly winder, Ring doubler and Two for one twister (TFO); Single yarn and ply yarn characteristics and their applications. Sewing threads. Package faults (Cones, Cheese and Hanks) and identification.
REFERENCES

COURSE OUTCOMES
- Acquire knowledge on the basic forms of textiles namely fibres, their classification and properties, and on the cultivation/production of natural fibres as well as modified fibres from natural raw materials.
- Outline the production of synthetic fibres, and acquire knowledge on their physical and chemical properties as well as their applications.
- Outline sequentially the processes involved in spinning cotton and worsted yarns, and describe the working of various machines used, from fibre preparation to yarn spinning.
### OBJECTIVES
- Acquire knowledge in weaving preparatory process
- Develop skills in basic principles of working of shuttle and shuttleless loom mechanisms
- Understand the process of weaving and controlling quality

### YARN PREPARATION FOR WEAVING  
9 Hours
**Process Flow** – objectives of winding; principles of cheese and cone winding Machines; concepts in yarn clearing – mechanical, optical and electronic clearers; knotters and splicers; Yarn quality requirements for weaving.

### BEAM PREPARATION FOR WEAVING  
9 Hours
Objectives of warping, material flow in beam warping and creels used in warping machines; sectional warping machines.
Objectives of sizing; sizing materials and recipes used for different types of fibers; sizing machines; control systems used in sizing machine; sizing filament yarns; concept of single end sizing

### SHUTTLE WEAVING  
9 Hours
Objectives and working principles – primary, secondary and auxiliary motions; Types of looms – Handloom, Non-automatic, Semi-automatic and Automatic looms; Drop box looms; Terry loom, mechanisms of Tappet, Dobby and Jacquard weaving.

### SHUTTLELESS WEAVING  
9 Hours
Basic principles of various shuttleless weaving machines – Projectile, Rapier, Air-jet, Water-jet, Multi-phase; productivity and techno-economics of these machines.

### PROCESS CONTROL IN WEAVING  
9 Hours
Process and quality control measures in pirn winding, cone winding, beam warping, sectional warping, sizing, and weaving. Computerised fabric inspection, Loom data system.

**TOTAL: 45 HOURS**
REFERENCES

COURSE OUTCOMES
- Outline the objectives and working principles of various weaving preparatory processes.
- Describe the working principle of automatic and non-automatic looms used for fabric manufacture.
- Acquire knowledge on the process and quality control in the preparatory processes as well as in weaving.
OBJECTIVES

- The experiments are designed to illustrate phenomena in different areas of Physics and to expose you to measuring instruments.
- The laboratory provides a unique opportunity to validate physical theories in a quantitative manner.
- Laboratory experience demonstrates the limitations in the application of physical theories to real physical situations.
- In general, the purpose of these laboratory exercises is both to demonstrate some physical principle and to teach techniques of careful measurement.

LIST OF EXPERIMENTS

Any Ten Experiments
1. Lee’s disc - determination of thermal conductivity of a bad conductor
2. Air wedge - determination of thickness of a given specimen.
3. Spectrometer - determination of wavelength of mercury source using grating
4. Compound pendulum - determination of acceleration due to gravity.
5. Carey foster bridge – determination of specific resistance of a given coil of wire.
7. Non-uniform bending – determination of Young’s modulus
8. Ultrasonic interferometer – determination of velocity of sound and compressibility of liquid.
9. Band gap determination of a semiconductor using post office box
10. Semiconductor laser:
    a. Determination of wavelength of laser using grating
    b. Particle size determination
    c. Acceptance angle of optical fibre
11. Torsional pendulum - determination of Rigidity modulus of the wire
12. Field along the axis of a coil – Determination of magnetic moment.

Demonstration experiments:
1. Determination of solar cell parameters
2. Hall effect
3. Four probe apparatus
4. Animations –(Laser, Fiber optics and hysteresis curve)

TOTAL: 45 HOURS

COURSE OUTCOMES

- Determine different physical properties of a material like the thermal conductivity thickness of the material, etc.
- Perform experiments involving the physical phenomena like interference and diffraction.
- Apply physical theories in real life situations by also taking into account its limitations.
LIST OF EXPERIMENTS

1. Study of longitudinal and cross sectional view of natural and synthetic fibres
2. Identification of fibres through flammability test.
3. Identification of fibres through solubility test.
4. Determination of moisture regain of fibres
5. Determination of blend proportions of blends
6. Study of blow room
7. Study of carding
8. Study of Draw frame
9. Study of comber and simplex
10. Study of ring frame and Open end spinning.
11. Study of non automatic and automatic looms
12. Study of knitting machines

TOTAL: 45 HOURS

COURSE OUTCOMES

- Ability to identify the given fibre by choosing proper scientific method
- Knowledge of production process methods of yarn and woven and knit fabric
- Acquire Skill to determine the blend proportion
OBJECTIVES

- To analyze webpage and identify its elements and attributes
- Learn the basic language of the web: HTML.
- Be able to embed social media content into web pages.
- Implement and understand how to get used with MATLAB

List of Experiments

1. Study of HTML tags
2. Design a web page using basic html tags
3. Design a webpage using table tags
4. Design a webpage using forms and frames
5. Design a webpage using list tags
6. Develop a website of your interest (include a minimum of 3 web pages)
7. Study of MATLAB functions
8. Working with matrix operations
9. Working with image arithmetic
   a. Addition of two images
   b. Subtraction of two images
10. Write a Matlab program for the following
    a. Read an image and crop
    b. Read an image and resize
11. Working with Integration and Differentiation
12. Working with graphs

COURSE OUTCOMES

On successful completion of this course the student should be able to

1. Develop static web pages using HTML. [S]
2. Perform basic MATLAB operations. [S]
3. Make use of MATLAB to work with images and graphs. [S]
4. Perform integration and differentiation using MATLAB. [S]
5. Develop team spirit and professional attitude towards the development of simple web applications [A]
OBJECTIVES
- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C’s & 5E’s.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY  4 Hours

Greatness of womanhood: Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY  2 Hours
Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.
Training: Method of blessings.

FOOD IS MEDICINE  2 Hours
Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C’S & 5E’S  4 Hours
Personality Concepts: Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality-5 C’s and 5 E’s.
Time Management: Importance –Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT  4 Hours
Leadership Traits – Carrying oneself - Factors of leadership – Principles of leadership.


Training: Method of Self-Control.
SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA 4 Hours

Spiritual development: Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.

Kaya Kalpa yoga: Aim - kayakalpa philosophy - Importance of kayakalpa training.

Training: Kaya Kalpa Yoga.

EXERCISE & MEDITATION 10 Hours

Simplified Physical Exercise & Meditation Practice.

L: 16 Hr, P: 14, Total: 30 Hours

REFERENCES BOOKS:
1. Dr. A. Chandra Mohan, “Leadership and Management”, Himalaya Publication House,

COURSE OUTCOMES:
- Behaves as a responsible family member.
- Develop skills for personality improvement.
- Acquire practical knowledge on self-control technique for teenagers.
- Identify the significant of Genetic Centre for the Soul functional base operation.
### B.Tech - INFORMATION TECHNOLOGY

#### SEMESTER – II

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**TOTAL – 32 HOURS**

**TOTAL CREDIT – 24**
OBJECTIVES

- To develop reading accuracy and English fluency
- To Employ appropriate formats in writing and effective
- To compare and relate words/sounds and listen for specific information.
- To maximize the elements of spoken ability

INTERPRETATIONAL DEXTERITY 15 Hours

Homophones and homonyms - Encoding and decoding advertisements - Transcoding Graphical Representations – Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree diagram - Reading brochures, leaflets, instruction manual - Cloze test - Reading Comprehension- Note Making – Linear and non-linear - Book review, Article review

STYLES OF SCRIPTING 15 Hours

Types of sentences - Concord - Framing Questions – “Wh” questions, Yes/No questions and Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative, Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting information, explaining a situation, letter of acceptance, declining letter, letter of application and resume - Essay Writing

AUDITORY PROFICIENCY 15 Hours

Listening to monologues, Listening for general content - Listening to dialogues - Listening to a telephonic conversation - Listening for specific information, numbers, time, duration - Listening to conversations between three or more people- Listening to a group discussion and providing factual information, Intensive listening

ORATORICAL EFFICIENCY 15 Hours

Discussing studies/interests/friends/families-Describe an object or event - Describing a working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS
REFERENCES

COURSE OUTCOMES
- Distinguish the application of technical diction for the data interpretation while reading
- Construct technical sentences and compose corporate letters
- Improve listening for inferring technical information
- Develop spoken communication needed for presentations and discussions
OBJECTIVES

On completion of the course, the students are expected

- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS

9 Hours
Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application: Area as double integral – Volume as triple integral.

VECTOR CALCULUS

9 Hours
Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green’s theorem in a plane, Gauss divergence theorem and Stoke’s theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION

9 Hours
Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy- Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping: $w = z + c$, $cz$, $1/z$ and bilinear transformation.

COMPLEX INTEGRATION

9 Hours
Statement and applications of Cauchy’s integral theorem and Cauchy’s integral formula (excluding proofs) – Taylor’s and Laurent’s series expansions – Singularities – Residues – Cauchy’s residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).
LAPLACE TRANSFORM


\[ L: 45 + T: 15 = 60 \]

REFERENCES


Course Outcomes

After pursuing the above mentioned course, the students will be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.
OBJECTIVES
At end of the course students would be exposed to
- Conducting, super conducting, magnetic and dielectric materials in electrical devices.
- Semi conducting, optical and new engineering materials in switching and display devices, data storage.

CONDUCTING AND SUPERCONDUCTING MATERIALS 9 Hours

Superconducters: Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I &Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS 9 Hours
Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS 9 Hours

NEW ENGINEERING MATERIALS AND NANOTECHNOLOGY  9 Hours

New Engineering Materials: Metallic glasses – preparation, properties and applications – Shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications - advantages and disadvantages of SMA.


OPTICAL MATERIALS  9 Hours


TOTAL: 45 HOURS

REFERENCES

COURSE OUTCOMES
- Apply core concepts in Materials Science to solve engineering problems
- Determine the position of the acceptor or donor levels and the band gap of an extrinsic semiconductor,
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the techniques to manufacturing of modern materials for engineering practice.
- Recognize the various nanomaterials for engineering and technological applications
OBJECTIVES

- To study the characteristics of circuit elements
- To understand relationships among current, voltage and power in DC and AC circuits
- To study the construction, characteristics and applications of amplifiers and oscillators circuitry

DC CIRCUITS 9 Hours

AC CIRCUITS 9 Hours

SEMI CONDUCTOR DIODE AND APPLICATIONS 9 Hours

TRANSISTORS AND APPLICATIONS 9 Hours

OSCILLATORS AND OPERATIONAL AMPLIFIERS 9 Hours

L: 45 Hr T: 15 Hr TOTAL: 60 HOURS
REFERENCES

COURSE OUTCOMES
- Define & identify the basic electrical quantities and also able to calculate approximately the voltage, current parameters in DC circuits using basic laws.
- Understand the phasor representation of various AC circuit parameters and acquire knowledge on fundamentals of three phase ac circuits.
- Differentiate the various semiconductor diodes and rectifiers
- Summarize the characteristics of different types of transistors.
- Apply the achieved basic knowledge about oscillators & op-amp to different dc applications.
OBJECTIVES
To impart a sound knowledge on basics of
- Theoretical and modern technological aspects of modern polymeric materials technology for micro electrical, electronics, instrumentation and communication fields.

INTRODUCTION TO CONDUCTING POLYMERIC MATERIALS 9 Hours

APPLIED CONDUCTING POLYMERS 9 Hours
Synthesis, structure, morphology, conductivity, doping theory and uses of Poly(sulfur nitride), polyacetylene, polyphenylene, poly(phenylene vinylenes), poly(phenylene sulfide), Polypyrrole and Polythiophene, Polyaniline - Polymers with transition metals in the side-group structure and their uses (includes Stacked Phthalocyanine polymers).

MANUFACTURING METHODS OF ORGANO ELECTRONICS MATERIALS 9 Hours

ORGANIC ELECTRONIC MATERIALS 9 Hours
Organic thin-film transistor (OTFT) – architecture, operating mode - fabrication techniques - structure-property relationship - Methods of improving performance – structural perfection - device architecture - Electrical and environmental stability – chemical effects on stability - Gate dielectrics on electrical functionality.

ADVANCED MATERIALS FOR ORGANIC ELECTRONICS 9 Hours

TOTAL: 45 HOURS
REFERENCES

COURSE OUTCOMES
➢ Analyse and determine the required conducting polymers in fabrication of organic electronic devices
➢ Describe the mechanism of formation of conducting polymeric materials
➢ Design an Organic Thin film transistor
➢ Outline the performance of Pentacene transistors
OBJECTIVES

- Acquire an overview of data storage and manipulation in computers
- Understand the basic concepts of operating systems, networks and database
- Know the applications of Internet and Information Technology

**Computer Basics and Architecture**

**11 Hours**

**Computer Organization and Architecture**: Introduction-CPU-Communication among various units- Instruction Format-Instruction Cycle-Instruction Set-Data Representation in Computers.

**Computer Memory and Storage**: Memory Hierarchy-Types of Memory-CPU interaction with memory-Secondary Storage devices and its types

**Operating systems and Databases**

**10 Hours**

**Operating systems**: Evolution-Types of Operating System-Functions of Operating System-Coordinating machine activities-Handling competition among processes

**Database Fundamentals**: Logical and Physical Data Concepts- Database Management System-Architecture-Database Models-Types of databases.

**Basics of Networks and Data Communication**

**08 Hours**

**Networks**: Network Topologies-Communication Protocol-Network devices

**Data Communication**: Introduction-Data Communication-Transmission Media-Modulation-Multiplexing-Switching

**Basics of Data abstraction and Software Engineering**

**11 Hours**

**Data abstraction**: Basic data structures- Implementation- Classes and objects- Object Oriented Programming

**Software Engineering**: Lifecycle-Methodologies-Modularity-Quality Assurance-Documentation-Software Ownership and Liability

**Current and Future trends in IT**

**05 Hours**


**TOTAL: 45 HOURS**

**REFERENCES**

1. Introduction to Information Technology, Pearson Education, ITL Education solutions Ltd., 2012
COURSE OUTCOMES
- Outline various functional components of computer system.
- Summarize the functions of operating systems
- Define different types of network topologies and protocols.
- Explain the various internet tools and terminology.
- Explain the basic concept of data abstraction, database, software engineering.
OBJECTIVES

- To apply the theoretical principles and perform experiments
- Experience the importance of theory by using analytical equipments and quantitative and qualitative procedures.

LIST OF EXPERIMENTS

PREPARATION OF SOLUTIONS (STANDARD)
1. Preparation of normal solutions of the following substances - oxalic acid, sodium carbonate, hydrochloric acid.
2. Preparation of phosphate buffer using Henderson equation.

WATER TESTING
3. Determination of total, temporary and permanent hardness by EDTA method.
4. Estimation of DO by Winkler’s method.
5. Estimation of alkalinity by Indicator method.

ELECTRO CHEMICAL ANALYSIS
7. Estimation of hydrochloric acid by pH metry.
8. Conductometric titration of mixture of acids and strong base
10. Estimation of Iron by Potentiometry

PHOTOMETRY
11. Estimation of the Ferrous ions (Thiocyanate method) by Spectrophotometry.
12. Estimation of sodium and potassium by Flame photometry.

TOTAL: 45 HOURS

REFERENCES
COURSE OUTCOMES

- Prepare normal solutions
- Analyse the properties of water by applying the chemical concepts
- Estimate the concentration of solutions by electrochemical methods and apply it in real life situations like blood testing etc
OBJECTIVES
- Acquire in-depth practical knowledge of the computer hardware and computer networks.
- Understand the assembly of PC and connection of networks
- Develop skill related to the trouble shooting and configuration of PC.

LIST OF EXPERIMENTS
1. Study of different types of cables and network topologies
2. Study of different types of network devices
3. Study and identification of Major parts of PC
4. Assembly and Disassembly of PC
5. Connecting a small LAN
6. IP configuration and Subnet masking.
7. Study and troubleshoot the boot process
8. Installation and configuration of Windows 2000
9. Implementation of Wireless Network
10. Study, Identification, Assembly and Disassembly of Printer and Monitor

TOTAL: 45 HOURS

COURSE OUTCOMES
- Explain the various computer hardware components and their functionality. [S]
- Illustrate the assembling process of a computer system. [S]
- Explain the local area network and file sharing methods. [S]
- Perform the installation of Windows and Linux operating system. [S]
- Explain the configuration of wireless adapter. [S]
OBJECTIVES
- To study the characteristics of resonant circuits
- To obtain the characteristics of electronic devices
- To obtain the characteristics of amplifier circuits

LIST OF EXPERIMENTS
1. Verification of Kirchhoff’s Laws
2. Series & Parallel Resonance
4. Half wave and full wave rectifier
5. Zener diode Regulator
6. Common Emitter Transistor characteristics
7. JFET characteristics
8. Wein Bridge oscillator
9. Comparator, summing Amplifier using Op-Amp
10. Integrator and Differentiator using Op-Amp

TOTAL: 45 HOURS

COURSE OUTCOMES
- Understand and verify the breadboard connections.
- Check the working condition of a cathode ray oscilloscope.
- Understand the basic laws of electric circuits.
- Understand the working of various electronic devices.
- Understand the performance of an amplifier to carryout different operations.
OBJECTIVES

- Acquire in-depth practical knowledge of the computer hardware and computer networks.
- Understand the assembly of PC and connection of networks
- Develop skill related to the trouble shooting and configuration of PC.

LIST OF EXPERIMENTS

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TOTAL: 45 HOURS

COURSE OUTCOMES

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- Illustrate the assembling process of a computer system. [S]
- Explain the local area network and file sharing methods. [S]
- Perform the installation of Windows and Linux operating system. [S]
- Explain the configuration of wireless adapter. [S]
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- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C’s & 5E’s.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY
4 Hours

Greatness of womanhood: Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY
2 Hours
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2 Hours
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PERSONALITY DEVELOPMENT CONCEPTS - 5C’S & 5E’S
4 Hours
Personality Concepts: Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality-5 C’s and 5 E’s.
Time Management: Importance –Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT
4 Hours
Leadership Traits – Carrying oneself - Factors of leadership – Principles of leadership.


Training: Method of Self-Control.
SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA 4 Hours

**Spiritual development:** Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.

**KayaKalpa yoga:** Aim - kayakalpa philosophy - Importance of kayakalpa training.

**Training:** Kaya Kalpa Yoga.

EXERCISE & MEDITATION 10 Hours

Simplified Physical Exercise & Meditation Practice.

L: 16 Hr, P: 14, Total: 30 Hours

**REFERENCES BOOKS:**

1. Dr. A. Chandra Mohan, “Leadership and Management”, Himalaya Publication House,

**COURSE OUTCOMES:**

- Behaves as a responsible family member.
- Develop skills for personality improvement.
- Acquire practical knowledge on self-control technique for teenagers.
- Identify the significant of Genetic Centre for the Soul functional base operation.
### B.E - MECHANICAL ENGINEERING

#### SEMESTER – II

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**TOTAL – 32 HOURS**

**TOTAL CREDITS – 24**
U14EN7201/ FUNCTIONAL ENGLISH - II
(_Common to all branches of Engineering and Technology_)

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**OBJECTIVES**

- To develop reading accuracy and English fluency
- To Employ appropriate formats in writing and effective
- To compare and relate words/sounds and listen for specific information.
- To maximize the elements of spoken ability

**INTERPRETATIONAL DEXTERTY**

15 Hours
Homophones and homonyms - Encoding and decoding advertisements - Transcoding Graphical Representations – Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree diagram - Reading brochures, leaflets, instruction manual - Cloze test - Reading Comprehension- Note Making – Linear and non-linear - Book review, Article review

**STYLES OF SCRIPTING**

15 Hours
Types of sentences - Concord - Framing Questions – “Wh” questions, Yes/No questions and Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative, Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting information, explaining a situation, letter of acceptance, declining letter, letter of application and resume - Essay Writing

**AUDITORY PROFICIENCY**

15 Hours
Listening to monologues, Listening for general content - Listening to dialogues - Listening to a telephonic conversation - Listening for specific information, numbers, time, duration - Listening to conversations between three or more people- Listening to a group discussion and providing factual information, Intensive listening

**ORATORICAL EFFICIENCY**

15 Hours
Discussing studies/interests/friends/families-Describe an object or event - Describing a working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS

218
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COURSE OUTCOMES
- Distinguish the application of technical diction for the data interpretation while reading
- Construct technical sentences and compose corporate letters
- Improve listening for inferring technical information
- Develop spoken communication needed for presentations and discussions
OBJECTIVES
On completion of the course, the students are expected
- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS
9 Hours
Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application: Area as double integral – Volume as triple integral.

VECTOR CALCULUS
9 Hours
Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green’s theorem in a plane, Gauss divergence theorem and Stoke’s theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION
9 Hours
Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy- Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping: \( w = z + c, cz, 1/z \) and bilinear transformation.

COMPLEX INTEGRATION
9 Hours
Statement and applications of Cauchy’s integral theorem and Cauchy’s integral formula (excluding proofs) – Taylor’s and Laurent’s series expansions – Singularities – Residues – Cauchy’s residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).
LAPLACE TRANSFORM


L: 45 + T: 15 = 60

REFERENCES


Course Outcomes

After pursuing the above mentioned course, the students will be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.
OBJECTIVES
At the end of the course students would be exposed to
- Types of defects in engineering materials and mechanisms of strengthening
- Properties of conducting, super conducting, magnetic and dielectric materials.
- Properties of Semi conducting, optical and new engineering materials.

CONDUCTING AND SUPERCONDUCTING MATERIALS  9 Hours

Superconducting Materials : Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I &Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS  9 Hours
Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS  9 Hours

NANOTECHNOLOGY AND NEW ENGINEERING MATERIALS  9 Hours

New Engineering Materials: Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications advantages and disadvantages of SMA.


STRENGTHENING OF MATERIALS  9 Hours

Strengthening mechanisms for the improvement of mechanical properties - cold working precipitation hardening, solute hardening and diffusion hardening - Fracture-Mechanism of brittle fracture (Griffith’s theory ) and Ductile fracture - difference between brittle and ductile fracture - fatigue failure and its prevention - creep different stages in creep curve-Factors affecting mechanical properties Grain size and heat treatment - Mechanical test Tensile, compression, hardness, impact creep, fatigue and stress.

TOTAL: 45 HOURS

REFERENCE BOOKS
2. Avadhanalu M.N. and Kshirsagar P.G., A textbook of Engineering Physics, S. Chand & Company Ltd, New Delhi, 2005
5. Arumugam M., Physics-II, Materials science for mechanical engineering, Anuradha agencies publishers, Kumbakonam, 2005

COURSE OUTCOMES
- Apply core concepts in Materials Science to solve engineering problems
- Determine the position of the acceptor or donor levels and the brand gap of an extrinsic semiconductor
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the techniques to manufacturing of modern materials and nano materials for engineering applications
- Recognize the basic concepts of strengthening of materials in technological applications
OBJECTIVES

- To inculcate essential knowledge on theoretical and modern technological aspects of fuels and combustion, specialty materials, water technology, corrosion studies and powder metallurgy.

FUELS AND COMBUSTION 9 Hours
Classification of fuels - coal varieties - analysis of coal (proximate and ultimate analysis) - coke manufacture (Otto-Hoffman byproduct coke oven method) - characteristics of metallurgical coke - cracking (thermal and catalytic cracking definition only) – manufacturing of synthetic petrol (Fischer Tropsch method, Bergius process) – knocking (octane number, cetane number) - gaseous fuels (production, composition and uses of producer gas, water gas and natural gas).

Combustion: gross and net calorific value - determination of calorific value by bomb calorimeter - explosive range - spontaneous ignition temperature - flue gas analysis (Orsat apparatus).

MECHANICAL ENGINEERING MATERIALS 9 Hours
Abrasives: Moh’s scale of hardness - natural abrasives (diamond, corundum, emery, garnets and quartz) - artificial abrasives (silicon carbide, boron carbide).

Refractories: Characteristics - classification (acid, basic and natural refractories) - properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) - General manufacturing methods of refractories - preparation, properties and uses of high alumina bricks, magnesite and zirconia bricks.

Lubricants: Classification - Functions - properties (viscosity index, flash and fire point, oiliness, carbon residue, aniline point, cloud and pour point) - greases (calcium based, sodium based, lithium based) - solid lubricants (graphite, molybdenum disulphide).

CORROSION SCIENCE 9 Hours
Corrosion - Principles of electrochemical corrosion - difference between chemical and electrochemical corrosion - factors influencing corrosion.

Types of corrosion: galvanic corrosion - differential aeration corrosion (soil (microbial) corrosion, pitting corrosion, water line corrosion) - stress corrosion.

Corrosion control: cathodic protection (sacrificial anode) - Protective Coatings (Paint, Electroplating of Copper).
WATER TECHNOLOGY 9 Hours

Boiler feed water: requirements - disadvantages of hard water (formation of deposits in steam boilers, priming, foaming, caustic embrittlement & boiler corrosion).

Prevention of scale formation: external treatment (ion exchange method) - internal treatment (phosphate, calgon, carbonate, colloidal) - desalination by reverse osmosis - Treatment of Domestic water

PHASE RULE AND POWDER METALLURGY 9 Hours

Phase rule - condensed phase rule - construction of phase diagram (thermal analysis) – Applications of phase rule: Simple eutectic system (Ag - Pb, Fe - C system).

POWDER METALLURGY : Preparation of metal powders (mechanical pulverization, atomization, chemical reduction, electrolytic process, decomposition) - mixing and blending - compacting - sintering - advantages and limitations of powder metallurgy.

TOTAL: 45 HOURS

REFERENCES

COURSE OUTCOMES
- Classify the different types of fuels and their properties
- Categorize the engineering materials and their uses
- Defend the Corrosion problems
- Design a water purifier
- Identify the techniques of preparing metal powder
OBJECTIVES

- To understand the concept of equilibrium of particles and rigid bodies.
- To understand the concept of first and second moment of area.
- To understand the concept of various types of frictions.
- To understand the principle of work energy method, Newton’s law and impact of elastic bodies.

BASICS & STATICS OF PARTICLES


EQUILIBRIUM OF RIGID BODIES

Moment of a force about point – Varignon s theorem- Moment of a couple-Resolution of force in to force couple system-Resultant of coplanar non concurrent system - Types of supports and their reactions- Requirements of stable equilibrium - Equilibrium of Rigid bodies in two dimensions.

PROPERTIES OF SURFACES AND SOLIDS

First moment of area and the Centroid of sections Rectangle, circle, triangle, T section, I section Angle section and Hollow section. Second and product moments of plane area Rectangle, triangle, circle. T Section, I section, Angle section and Hollow section, Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia.

FRICION

Frictional force-Law of coloumb friction , simple contact friction, Rolling resistance and Belt friction, Ladder friction, Wedge friction.

DYNAMICS OF PARTICLES

Kinematics: Rectilinear & Curvilinear motion of particles, Displacements Velocity and acceleration.

L: 45 Hr, T: 15 Hr, TOTAL: 60 HOURS
REFERENCES

COURSE OUTCOMES
- Explain the concept of equilibrium of particles and rigid bodies.
- Apply the concepts of equilibrium and moment of inertia for various shapes sections.
- Make use of various concepts of friction.
- Solve problems using the concepts in kinematics and kinetics.
OBJECTIVES

- To study the characteristics of circuit elements
- To understand relationships among current, voltage and power in DC and AC circuits
- To study the construction, characteristics and applications of amplifiers and oscillators circuitry

ELECTRIC CIRCUITS FUNDAMENTALS


ELECTROMAGNETISM


AC-CIRCUITS


ELECTRICAL MACHINES (Qualitative Treatment Only)


ELECTRONIC CIRCUITS

Semiconductor diode – Half wave and Full wave rectifier – Bipolar Junction transistors – circuit configurations – static characteristics – load line and biasing – simple introduction to amplifiers – Introduction to Binary logic gates – AND, OR, NOT, NAND, NOR, EX-OR & EX-NOR.

TOTAL: 45 HOURS
REFERENCES
   edition, New Age International Pvt. Ltd.
4. Theraja B.L., Fundamentals of Electrical Engineering and Electronics, S. Chand Publishing,
   2012.

COURSE OUTCOMES
- Acquire the knowledge of fundamental laws of electrical and electronics engineering.
- State the definition of magnetic circuits.
- Choose suitable motor for desired application.
- The students have the ability to apply the fundamental laws of magnetic circuits to electrical
  machines.
- The learners can verify the truth table of digital logic gates.
OBJECTIVES

- To apply the theoretical principles and perform experiments
- Experience the importance of theory by using analytical equipments and quantitative and qualitative procedures.

LIST OF EXPERIMENTS

PREPARATION OF SOLUTIONS (STANDARD)
1. Preparation of normal solutions of the following substances - oxalic acid, sodium carbonate, hydrochloric acid.
2. Preparation of phosphate buffer using Henderson equation.

WATER TESTING
3. Determination of total, temporary and permanent hardness by EDTA method.
4. Estimation of DO by Winkler’s method.
5. Estimation of alkalinity by Indicator method.

ELECTRO CHEMICAL ANALYSIS
7. Estimation of hydrochloric acid by pH metry.
8. Conductometric titration of mixture of acids and strong base
10. Estimation of Iron by Potentiometry

PHOTOMETRY
11. Estimation of the Ferrous ions (Thiocyanate method) by Spectrophotometry.
12. Estimation of sodium and potassium by Flame photometry.

TOTAL: 45 HOURS

REFERENCES

COURSE OUTCOMES
- Prepare normal solutions
- Analyse the properties of water by applying the chemical concepts
- Estimate the concentration of solutions by electrochemical methods and apply it in real life situations like blood testing etc
OBJECTIVES

- To analyze webpage and identify its elements and attributes
- Learn the basic language of the web: HTML.
- Be able to embed social media content into web pages.
- Implement and understand how to get used with MATLAB

List of Experiments

1. Study of HTML tags
2. Design a web page using basic html tags
3. Design a webpage using table tags
4. Design a webpage using forms and frames
5. Design a webpage using list tags
6. Develop a website of your interest (include a minimum of 3 web pages)
7. Study of MATLAB functions
8. Working with matrix operations
9. Working with image arithmetic
   a. Addition of two images
   b. Subtraction of two images
10. Write a Matlab program for the following
    a. Read an image and crop
    b. Read an image and resize
11. Working with Integration and Differentiation
12. Working with graphs

COURSE OUTCOMES

On successful completion of this course the student should be able to

1. Develop static web pages using HTML. [S]
2. Perform basic MATLAB operations. [S]
3. Make use of MATLAB to work with images and graphs. [S]
4. Perform integration and differentiation using MATLAB. [S]
5. Develop team spirit and professional attitude towards the development of simple web applications [A]
AIM
To provide experimental skill in the operation of DC, AC machines and Hands on experience in the development of electronic circuits.

OBJECTIVES
- To experimentally verify the principle of operation, performance characteristics of DC Motors and AC Motors.
- To obtain the characteristics of electronic devices and its applications

LIST OF EXPERIMENTS
1. Load Test on DC Shunt Motor
2. Load Test on DC Series Motor
3. Speed Control of DC Shunt Motor
4. Load Test on three phase Induction Motor
5. Load Test on single phase Induction Motor
6. Load test on single phase transformer
7. Half wave and full wave rectifier
8. Characteristics of CE transistor configuration
9. Characteristics of PN diode
10. Verification of truth table of logic gates

TOTAL: 45 HOURS

COURSE OUTCOMES
- The Students will gain the basic knowledge and understanding the concept of AC and DC machines.
- Students will know the working principle, performance characteristics, (Torque, Speed, Efficiency) control and applications of Electrical Machines.
- Students will be able to design and conduct performance experiments in machines and Rectifiers.
- To familiarize the starting methods of all rotating machines.
- Students will be exposed to the practical applications of identify and solve machines related problems.
# OBJECTIVES

- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C’s & 5E’s.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

## PEACE IN FAMILY  
**4 Hours**


**Greatness of womanhood:** Good culture – Cultured behavioral patterns – Love and Compassion.

## BLESSING – EFFECTS IN FAMILY  
**2 Hours**

Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.

**Training:** Method of blessings.

## FOOD IS MEDICINE  
**2 Hours**

Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

## PERSONALITY DEVELOPMENT CONCEPTS - 5C’S & 5E’S  
**4 Hours**

**Personality Concepts:** Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality-5 C’s and 5 E’s.

**Time Management:** Importance –Training.

## LEADERSHIP TRAITS & SELF DEVELOPMENT  
**4 Hours**

**Leadership Traits** – Carrying oneself - Factors of leadership – Principles of leadership.

**Self Development:** Importance – Techniques to development oneself– How to develop oneself?–Ten Commandments of self-development– Self-control technique for teenagers.

**Training:** Method of Self-Control.
SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA

Spiritual development: Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.

KayaKalpa yoga: Aim - kayakalpa philosophy - Importance of kayakalpa training.

Training: Kaya Kalpa Yoga.

EXERCISE & MEDITATION

Simplified Physical Exercise & Meditation Practice.

REFERENCES BOOKS:
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COURSE OUTCOMES:

- Behaves as a responsible family member.
- Develop skills for personality improvement.
- Acquire practical knowledge on self-control technique for teenagers.
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### B.E - MECHATRONICS ENGINEERING

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OBJECTIVES

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Listening to monologues, Listening for general content - Listening to dialogues - Listening to a telephonic conversation - Listening for specific information, numbers, time, duration - Listening to conversations between three or more people- Listening to a group discussion and providing factual information, Intensive listening

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Discussing studies/interests/friends/families-Describe an object or event - Describing a working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a public issue - Responding to situations and providing solutions - Picture Perception

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➢ Distinguish the application of technical diction for the data interpretation while reading
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- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

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9 Hours
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Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green’s theorem in a plane, Gauss divergence theorem and Stoke’s theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

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9 Hours
Statement and applications of Cauchy’s integral theorem and Cauchy’s integral formula (excluding proofs) – Taylor’s and Laurent’s series expansions – Singularities – Residues – Cauchy’s residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).
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L: 45 + T: 15 = 60

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Course Outcomes

After pursuing the above mentioned course, the students will be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
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- Properties of conducting, super conducting, magnetic and dielectric materials.
- Properties of Semi conducting, optical and new engineering materials.

CONDUCTING AND SUPERCONDUCTING MATERIALS

9 Hours


Superconducting Materials: Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I &Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS

9 Hours

Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS

9 Hours


NANOTECHNOLOGY AND NEW ENGINEERING MATERIALS 9 Hours

New Engineering Materials: Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications advantages and disadvantages of SMA.


STRENGTHENING OF MATERIALS 9 Hours

Strengthening mechanisms for the improvement of mechanical properties - cold working precipitation hardening, solute hardening and diffusion hardening - Fracture-Mechanism of brittle fracture (Griffith’s theory ) and Ductile fracture - difference between brittle and ductile fracture - fatigue failure and its prevention - creep different stages in creep curve-Factors affecting mechanical properties Grain size and heat treatment - Mechanical test Tensile, compression, hardness, impact creep, fatigue and stress.

TOTAL: 45 HOURS

REFERENCE BOOKS
2. Avadhanalu M.N. and Kshirsagar P.G., A textbook of Engineering Physics, S. Chand & Company Ltd, New Delhi, 2005

COURSE OUTCOMES
- Apply core concepts in Materials Science to solve engineering problems
- Determine the position of the acceptor or donor levels and the band gap of an extrinsic semiconductor
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the techniques to manufacturing of modern materials and nano materials for engineering applications
- Recognize the basic concepts of strengthening of materials in technological applications
OBJECTIVES

- To inculcate essential knowledge on theoretical and modern technological aspects of fuels and combustion, specialty materials, water technology, corrosion studies and powder metallurgy.

FUELS AND COMBUSTION

Classification of fuels - coal varieties - analysis of coal (proximate and ultimate analysis) - coke manufacture (Otto-Hoffman byproduct coke oven method) - characteristics of metallurgical coke - cracking (thermal and catalytic cracking definition only) – manufacturing of synthetic petrol (Fischer Tropsch method, Bergius process) – knocking (octane number, cetane number) - gaseous fuels (production, composition and uses of producer gas, water gas and natural gas).

Combustion: gross and net calorific value - determination of calorific value by bomb calorimeter - explosive range - spontaneous ignition temperature - flue gas analysis (Orsat apparatus).

MECHANICAL ENGINEERING MATERIALS

Abrasives: Moh’s scale of hardness - natural abrasives (diamond, corundum, emery, garnets and quartz) - artificial abrasives (silicon carbide, boron carbide).

Refractories: Characteristics - classification (acid, basic and natural refractories) - properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) - General manufacturing methods of refractories - preparation, properties and uses of high alumina bricks, magnesite and zirconia bricks.

Lubricants: Classification - Functions - properties (viscosity index, flash and fire point, oiliness, carbon residue, aniline point, cloud and pour point) - greases (calcium based, sodium based, lithium based) - solid lubricants (graphite, molybdenum disulphide).

CORROSION SCIENCE

Corrosion: Principles of electrochemical corrosion - difference between chemical and electrochemical corrosion - factors influencing corrosion.

Types of corrosion: galvanic corrosion - differential aeration corrosion (soil (microbial) corrosion, pitting corrosion, water line corrosion) - stress corrosion.

Corrosion control: cathodic protection (sacrificial anode) - Protective Coatings (Paint, Electroplating of Copper).
WATER TECHNOLOGY  
**Boiler feed water:** requirements - disadvantages of hard water (formation of deposits in steam boilers, priming, foaming, caustic embrittlement & boiler corrosion).

**Prevention of scale formation:** external treatment (ion exchange method) - internal treatment (phosphate, calgon, carbonate, colloidal) - desalination by reverse osmosis - Treatment of Domestic water

PHASE RULE AND POWDER METALLURGY  
**Phase rule** - condensed phase rule - construction of phase diagram (thermal analysis) – Applications of phase rule: Simple eutectic system (Ag - Pb, Fe - C system).

POWDER METALLURGY: Preparation of metal powders (mechanical pulverization, atomization, chemical reduction, electrolytic process, decomposition) - mixing and blending - compacting - sintering - advantages and limitations of powder metallurgy.

**TOTAL:** 45 HOURS

REFERENCES

COURSE OUTCOMES
- Classify the different types of fuels and their properties
- Categorize the engineering materials and their uses
- Defend the Corrosion problems
- Design a water purifier
- Identify the techniques of preparing metal powder
OBJECTIVES
- To understand the concept of equilibrium of particles and rigid bodies.
- To understand the concept of first and second moment of area.
- To understand the concept of various types of frictions.
- To understand the principle of work energy method, Newton’s law and impact of elastic bodies.

BASICS & STATICS OF PARTICLES
9 Hours

EQUILIBRIUM OF RIGID BODIES
9 Hours
Moment of a force about point – Varignon s theorem- Moment of a couple-Resolution of force in to force couple system-Resultant of coplanar non concurrent system - Types of supports and their reactions- Requirements of stable equilibrium - Equilibrium of Rigid bodies in two dimensions.

PROPERTIES OF SURFACES AND SOLIDS
9 Hours
First moment of area and the Centroid of sections Rectangle, circle, triangle, T section, I section Angle section and Hollow section. Second and product moments of plane area Rectangle, triangle, circle. T Section, I section, Angle section and Hollow section, Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia.

FRICTION
9 Hours
Frictional force-Law of coloumb friction , simple contact friction, Rolling resistance and Belt friction, Ladder friction, Wedge friction.

DYNAMICS OF PARTICLES
9 Hours
Kinematics: Rectilinear & Curvilinear motion of particles, Displacements Velocity and acceleration.

L: 45 Hr, T: 15 Hr, TOTAL: 60 HOURS
REFERENCES

COURSE OUTCOMES
- Explain the concept of equilibrium of particles and rigid bodies.
- Apply the concepts of equilibrium and moment of inertia for various shapes sections.
- Make use of various concepts of friction.
- Solve problems using the concepts in kinematics and kinetics.
CIRCUIT THEORY  
9 Hours

THEORY OF SEMICONDUCTOR DEVICES  
9 Hours
PN junction – diode equation (Derivation not required) – forward and reverse bias – Diode dc and ac resistances – Zener diode – Bipolar Junction Transistor – CE, CB and CC configurations– Biasing of a transistor; fixed bias, collector feedback bias, self bias – FET – Common source and drain characteristics of JFET and MOSFET.

APPLICATIONS OF DIODES  
9 Hours
HW and FW rectifiers – Filters with Capacitor and Inductors -Clippers and Clampers – Voltage Multipliers – Voltage regulators – Zener, series and shunt types.

AMPLIFIERS AND OSCILLATORS  
9 Hours

OPERATIONAL AMPLIFIERS  
9 Hours

TOTAL: 45 HOURS

REFERENCES
COURSE OUTCOMES

➢ Use passive elements and basic theorems to solve the electric circuits.
➢ Relate the basic semiconductor physics to the characteristics and biasing of low powered electronic devices.
➢ Design regulators and rectifiers using diodes.
➢ Design amplifiers for oscillators using transistors.
➢ Use operational amplifiers to solve simple mathematical operations and build conventional vibrators.
OBJECTIVES

- To apply the theoretical principles and perform experiments
- Experience the importance of theory by using analytical equipments and quantitative and qualitative procedures.

LIST OF EXPERIMENTS

PREPARATION OF SOLUTIONS (STANDARD)
1. Preparation of normal solutions of the following substances - oxalic acid, sodium carbonate, hydrochloric acid.
2. Preparation of phosphate buffer using Henderson equation.

WATER TESTING
3. Determination of total, temporary and permanent hardness by EDTA method.
4. Estimation of DO by Winkler’s method.
5. Estimation of alkalinity by Indicator method.

ELECTRO CHEMICAL ANALYSIS
7. Estimation of hydrochloric acid by pH metry.
8. Conductometric titration of mixture of acids and strong base
9. Conductometric precipitation titration using BaCl₂ and Na₂SO₄.
10. Estimation of Iron by Potentiometry

PHOTOMETRY
11. Estimation of the Ferrous ions (Thiocyanate method) by Spectrophotometry.
12. Estimation of sodium and potassium by Flame photometry.

TOTAL: 45 HOURS

REFERENCES
COURSE OUTCOMES

- Prepare normal solutions
- Analyse the properties of water by applying the chemical concepts
- Estimate the concentration of solutions by electrochemical methods and apply it in real life situations like blood testing etc
OBJECTIVES

- To analyze webpage and identify its elements and attributes
- Learn the basic language of the web: HTML.
- Be able to embed social media content into web pages.
- Implement and understand how to get used with MATLAB

List of Experiments

1. Study of HTML tags
2. Design a web page using basic html tags
3. Design a webpage using table tags
4. Design a webpage using forms and frames
5. Design a webpage using list tags
6. Develop a website of your interest(include a minimum of 3 web pages)
7. Study of MATLAB functions
8. Working with matrix operations
9. Working with image arithmetic
   a. Addition of two images
   b. Subtraction of two images
10. Write a Matlab program for the following
    a. Read an image and crop
    b. Read an image and resize
11. Working with Integration and Differentiation
12. Working with graphs

COURSE OUTCOMES

On successful completion of this course the student should be able to

1. Develop static web pages using HTML. [S]
2. Perform basic MATLAB operations. [S]
3. Make use of MATLAB to work with images and graphs. [S]
4. Perform integration and differentiation using MATLAB. [S]
5. Develop team spirit and professional attitude towards the development of simple web applications [A]
OBJECTIVES
- To obtain the characteristics of electronic devices
- To obtain the characteristics of amplifier circuits
- To simulate electronic circuits using standard software packages

LIST OF EXPERIMENTS
1. Characteristics of Semiconductor diode and Zener diode
2. Input and Output characteristics of BJT
3. Characteristics of JFET
4. Frequency response of CE amplifier
5. Clipper and Clamper
6. Phase shift and Wein Bridge oscillators using OP-AMP
7. Astable multivibrator using OP-AMP
8. Monostable and Bistable multivibrator using OP-AMP
9. Voltage Regulator (Zener diode, Transistor series and shunt)
10. Half-wave and Full-wave Rectifier with and without filter.
11. Circuit design using software (Multisim, Pspice)
12. Printed Circuit Board (PCB) design and fabrication using (software) for simple circuits.

TOTAL: 45 HOURS

COURSE OUTCOMES
- Construct input output characteristics of electronic devices.
- Measure current voltage resistance capacitance of a given circuit.
- Design and construct regulators, rectifiers, amplifiers and oscillators using electronic devices and operational amplifiers.
- Simulate electronic circuits using software.
OBJECTIVES

- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C’s & 5E’s.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY 4 Hours


*Greatness of womanhood*: Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY 2 Hours

Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.

*Training*: Method of blessings.

FOOD IS MEDICINE 2 Hours

Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C’S & 5E’S 4 Hours

*Personality Concepts*: Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality-5 C’s and 5 E’s.

*Time Management*: Importance – Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT 4 Hours

*Leadership Traits* – Carrying oneself - Factors of leadership – Principles of leadership.


*Training*: Method of Self-Control.
SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA 4 Hours

Spiritual development: Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.

Kaya Kalpa yoga: Aim - kayakalpa philosophy - Importance of kayakalpa training.

Training: Kaya Kalpa Yoga.

EXERCISE & MEDITATION 10 Hours

Simplified Physical Exercise & Meditation Practice.

L: 16 Hr, P: 14, Total: 30 Hours

REFERENCES BOOKS:

COURSE OUTCOMES:
- Behaves as a responsible family member.
- Develop skills for personality improvement.
- Acquire practical knowledge on self-control technique for teenagers.
- Identify the significant of Genetic Centre for the Soul functional base operation.
### B.Tech - TEXTILE TECHNOLOGY

#### SEMESTER – II

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**TOTAL – 32 HOURS**

**TOTAL CREDITS – 24**
OBJECTIVES
- To develop reading accuracy and English fluency
- To Employ appropriate formats in writing and effective
- To compare and relate words/sounds and listen for specific information.
- To maximize the elements of spoken ability

INTERPRETATIONAL DEXTERITY 15 Hours
Homophones and homonyms - Encoding and decoding advertisements - Transcoding Graphical Representations – Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree diagram - Reading brochures, leaflets, instruction manual - Cloze test - Reading Comprehension- Note Making – Linear and non-linear - Book review, Article review

STYLES OF SCRIPTING 15 Hours
Types of sentences - Concord - Framing Questions – “Wh” questions, Yes/No questions and Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative, Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting information, explaining a situation, letter of acceptance, declining letter, letter of application and resume - Essay Writing

AUDITORY PROFICIENCY 15 Hours
Listening to monologues, Listening for general content - Listening to dialogues - Listening to a telephonic conversation - Listening for specific information, numbers, time, duration - Listening to conversations between three or more people- Listening to a group discussion and providing factual information, Intensive listening

ORATORICAL EFFICIENCY 15 Hours
Discussing studies/interests/friends/families-Describe an object or event - Describing a working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS

REFERENCES

COURSE OUTCOMES
- Distinguish the application of technical diction for the data interpretation while reading
- Construct technical sentences and compose corporate letters
- Improve listening for inferring technical information
- Develop spoken communication needed for presentations and discussions
OBJECTIVES
On completion of the course, the students are expected
- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS
9 Hours
Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application: Area as double integral – Volume as triple integral.

VECTOR CALCULUS
9 Hours
Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green’s theorem in a plane, Gauss divergence theorem and Stoke’s theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION
9 Hours
Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy- Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping: \( w = z + c, cz, 1/z \) and bilinear transformation.

COMPLEX INTEGRATION
9 Hours
Statement and applications of Cauchy’s integral theorem and Cauchy’s integral formula (excluding proofs) – Taylor’s and Laurent’s series expansions – Singularities – Residues – Cauchy’s residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).
LAPLACE TRANSFORM


L: 45 + T: 15 = 60

REFERENCES


Course Outcomes

After pursuing the above mentioned course, the students will be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.
OBJECTIVES
At the end of the course the students would be exposed to
- Properties of conducting, super conducting, magnetic and dielectric materials.
- Properties of Semi conducting, optical and new engineering materials.
- Application of ultrasonic and nuclear physics in medicine.

CONDUCTING AND SUPERCONDUCTING MATERIALS 9 Hours

Superconducting Materials: Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I & Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS 9 Hours
Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS 9 Hours

NEW ENGINEERING MATERIALS

Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications advantages and disadvantages of SMA .

Ceramics-Classification of ceramics- Fabrication, Properties and application. Biomaterials-Biomechanisim - Classification of Biomaterials-Processing, Properties and applications.

NANO SCIENCE AND PLASMA TECHNOLOGY


Plasma Technology: properties of plasma- types of plasma- thermal and non thermal plasma- Production of glow discharge plasma-Cold plasma- applications in textile and biomedical field.

REFERENCES
3. Avadhanalu M.N. and Kshirsagar P.G., A textbook of Engineering Physics, S. Chand & Company Ltd., New Delhi, 2005

COURSE OUTCOMES
- Apply core concepts in Materials Science to solve engineering problems
- Illustrate the electrical / thermal conductivity of semiconductors and determine the position of the acceptor or donor levels and the brand gap of an extrinsic semiconductor,
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the concepts of nanomaterials and modern materials for explaining surface properties like adhesion etc. in engineering practice.
- Identify methods for etching of fabrics
OBJECTIVES

- To correlate theoretical principles with application oriented studies
- To embark on the usage of theoretical and modern technological aspects in polymers and dyes to exhibit engineering and technical concepts as required for Textile and Fashion Technology students.

WATER TECHNOLOGY 9 Hours

POLYMERS 9 Hours
Introduction – Degree of polymerization – functionality – tacticity - classification based on source, application, thermal properties (thermosetting and thermoplastics) - effect of polymer structure on properties – types of polymerization (addition, condensation, co-polymerization, Ring polymerisation) - mechanism of polymerization (free radical mechanism)

Preparation (mechanism not required) and applications of polythene, polypropylene, polystyrene, polyamides (nylon 6,6), polyesters (PET)

CHEMICAL BONDING 9 Hours
Ionic, covalent and co-ordinate covalent bonds (overview only) -- hydrogen bonding and its consequences - van der Waal’s forces (dipole – dipole, dipole – induced dipole, induced dipole – induced dipole interactions) - Interaction of enzymes with fibres (basic concepts only). Interaction between fibers and dyes (basic concepts only) - Dyes substrate affinity (dyes for cellulose fibres, silk)

DYES 9 Hours
Introduction - Classification system of dyes - Chromophore and auxochromes – Important chemical chromophores of dyes classes (azo, anthraquinone, phthalocyanin, Indigoid, polymethine, phthalocyanine, metal complex, Fluorescent) - synthesis of azo dye (Congo red), triaryl methane dye (Malachite green), Anthraquinone dye (Alizarin - 1,2 dihydroxy anthraquinone), Indigoid dye (Indigo), phthalein dyes (Eosin)
ANTHOLOGY OF SPECIALITY CHEMICALS IN TEXTILES  
9 Hours
An introduction on chemistry of the following in textiles: Dispersing agents, levelling agents, Retarding agents, Dye fixing agents.
Thermal analysis (DSC): Principle, Instrumentation and application in Textiles

TOTAL: 45 HOURS

REFERENCES
7. Amarika Singh, Vairam S. and Suba Ramesh., Chemistry for engineers., Wiley India Ltd., New Delhi

COURSE OUTCOMES
✤ Design a water purifier
✤ Discuss the mechanism of polymer formation
✤ Classify dyes and describe its interaction with fibers using bonding.
✤ Analyse the usage of specialty chemicals in dyes
OBJECTIVES

- To understand the concept of equilibrium of particles and rigid bodies.
- To understand the concept of first and second moment of area.
- To understand the concept of various types of frictions.
- To understand the principle of work energy method, Newton’s law and impact of elastic bodies.

BASICS & STATICS OF PARTICLES 9 Hours

EQUILIBRIUM OF RIGID BODIES 9 Hours
Moment of a force about point – Varignon’s theorem- Moment of a couple-Resolution of force in to force couple system-Resultant of coplanar non concurrent system - Types of supports and their reactions- Requirements of stable equilibrium - Equilibrium of Rigid bodies in two dimensions.

PROPERTIES OF SURFACES AND SOLIDS 9 Hours
First moment of area and the Centroid of sections Rectangle, circle, triangle, T section, I section Angle section and Hollow section. Second and product moments of plane area Rectangle, triangle, circle. T Section, I section, Angle section and Hollow section, Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia.

FRICTION 9 Hours
Frictional force-Law of coloumb friction , simple contact friction, Rolling resistance and Belt friction, Ladder friction, Wedge friction.

DYNAMICS OF PARTICLES 9 Hours
Kinematics: Rectilinear & Curvilinear motion of particles, Displacements Velocity and acceleration.

L: 45 Hr, T: 15 Hr, TOTAL: 60 HOURS
REFERENCES

COURSE OUTCOMES
- Explain the concept of equilibrium of particles and rigid bodies.
- Apply the concepts of equilibrium and moment of inertia for various shapes sections.
- Make use of various concepts of friction.
- Solve problems using the concepts in kinematics and kinetics.
OBJECTIVES
At the end of the course the students would be exposed to
- Basic concepts about Textile Fibres
- Basic concepts about Specialty Fibres

INTRODUCTION
9 Hours

NATURAL FIBRES
9 Hours
Vegetable fibres:
Cotton: Development of fibre in seed, morphological & chemical structure, physical & chemical properties and applications.
Chemical constituents, physical, chemical properties and applications of jute and linen fibres.

Animal fibres:
Wool: Types of wool, grading of wool, morphological & chemical structure, physical & chemical properties and applications.
Silk: Types, morphological & chemical structure, physical & chemical properties and applications. Production of silk.

REGENERATED FIBRES
9 Hours
Basic production system of man-made fibres. Merits and demerits of man-made fibres; Viscose rayon: Raw material, physical & chemical properties and applications; Concept of high wet and low wet modulus fibres; Introduction to acetate & triacetate fibres, modal, lyocell and Tencel fibre.
Protein Base: General properties and applications of Caesin, soyabean and zein fibres.

SYNTHETIC FIBRES
9 Hours
Polyamide: Raw material, physical & chemical properties and applications of Nylon 6 & Nylon 6,6; Polyester: Raw material, physical & chemical properties and applications. Flame retardant PET, Hygroscopic PET fibre and their applications. Polyacrylonitrile fibre: Raw material, physical & chemical properties and applications of acrylic and modacrylic fibre; Polypropylene and polyethylene: Raw material, physical & chemical properties and applications.
SPECIALTY FIBRES AND FIBRE IDENTIFICATION  
9 Hours
Raw material, General properties and applications of Aramid fibre, Carbon, Glass, PVA, Polyurethane, PVC fibre; Identification of textile fibres by microscopic, solubility, flammability and density methods.

TOTAL: 45 HOURS

CASE STUDY:
1. Demographic cultivation and production of cotton fibre in India.
2. Production trend of synthetic fibres for last five years.

REFERENCES

COURSE OUTCOMES
- Classify the textile fibres
- Describe about the properties of major textile fibres
- Compare the fundamental properties of major fibres
- List the end uses of major textile fibres
- Describe about the structure of textile fibres
OBJECTIVES

- The experiments are designed to illustrate phenomena in different areas of Physics and to expose you to measuring instruments.
- The laboratory provides a unique opportunity to validate physical theories in a quantitative manner.
- Laboratory experience demonstrates the limitations in the application of physical theories to real physical situations.
- In general, the purpose of these laboratory exercises is both to demonstrate some physical principle and to teach techniques of careful measurement.

LIST OF EXPERIMENTS

Any Ten Experiments

1. Lee’s disc - determination of thermal conductivity of a bad conductor
2. Air wedge - determination of thickness of a given specimen.
3. Spectrometer - determination of wavelength of mercury source using grating
4. Compound pendulum - determination of acceleration due to gravity.
5. Carey foster bridge – determination of specific resistance of a given coil of wire.
7. Non-uniform bending – determination of Young’s modulus
8. Ultrasonic interferometer – determination of velocity of sound and compressibility of liquid.
9. Band gap determination of a semiconductor using post office box
10. Semiconductor laser:
   a. Determination of wavelength of laser using grating
   b. Particle size determination
   c. Acceptance angle of optical fibre
11. Torsional pendulum - determination of Rigidity modulus of the wire
12. Field along the axis of a coil – Determination of magnetic moment.

Demonstration experiments:

1. Determination of solar cell parameters
2. Hall effect
3. Four probe apparatus
4. Animations – (Laser, Fiber optics and hysteresis curve)

TOTAL: 45 HOURS

COURSE OUTCOMES

- Determine different physical properties of a material like the thermal conductivity thickness of the material, etc.
- Perform experiments involving the physical phenomena like interference and diffraction.
- Apply physical theories in real life situations by also taking into account its limitations.
OBJECTIVES

- To analyze webpage and identify its elements and attributes
- Learn the basic language of the web: HTML.
- Be able to embed social media content into web pages.
- Implement and understand how to get used with MATLAB

List of Experiments

1. Study of HTML tags
2. Design a web page using basic html tags
3. Design a webpage using table tags
4. Design a webpage using forms and frames
5. Design a webpage using list tags
6. Develop a website of your interest (include a minimum of 3 web pages)
7. Study of MATLAB functions
8. Working with matrix operations
9. Working with image arithmetic
   a. Addition of two images
   b. Subtraction of two images
10. Write a Matlab program for the following
    a. Read an image and crop
    b. Read an image and resize
11. Working with Integration and Differentiation
12. Working with graphs

COURSE OUTCOMES

On successful completion of this course the student should be able to

1. Develop static web pages using HTML. [S]
2. Perform basic MATLAB operations. [S]
3. Make use of MATLAB to work with images and graphs. [S]
4. Perform integration and differentiation using MATLAB. [S]
5. Develop team spirit and professional attitude towards the development of simple web applications [A]
LIST OF EXPERIMENTS

1. Identification of textile fibres by microscopy method.
2. Studying swelling behavior of cotton/Viscose fibres.
3. Fibre maturity measurement by caustic soda method.
4. Identification of textile fibres by flammability methods.
5. Determination of moisture absorption properties of textile fibres.
6. Identification of textile fibres through solubility test.
7. Determination of blend proportion of given samples.
8. Effect of acids on fibres under various factors (Temperature/Time /Concentration).
9. Effect of alkalis on fibres under various factors (Temperature/ Time / Concentration).
10. Effect of oxidizing agents on fibres under various factors (Temperature/ time/Concentration).
12. Study of spin finish in manufactured fibres through soxhlet extraction

Creative Evaluation (Any two)

1. Properties of various domestic cotton variety
2. Properties of various imported cotton variety
3. Collection and characteristics analysis of various micro denier fibres
4. Collection and study of modified polyester fibres samples

TOTAL: 45 HOURS

COURSE OUTCOMES

- Identify & distinguish the major textile fibres
- Estimate the moisture regain and blend proportion of textile fibres
- Experiment on effect of temperature, time and concentration on fibre degradation
- Sketch the cross sectional and longitudinal view of major textile fibres
- Evaluate the spin finish percentage of manmade fibre & molecular weight of a polymer
OBJECTIVES
- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C’s & 5E’s.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY 4 Hours

Greatness of womanhood: Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY 2 Hours
Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.
Training: Method of blessings.

FOOD IS MEDICINE 2 Hours
Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C’S & 5E’S 4 Hours
Personality Concepts: Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality- 5 C’s and 5 E’s.
Time Management: Importance –Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT 4 Hours
Leadership Traits – Carrying oneself - Factors of leadership – Principles of leadership.


Training: Method of Self-Control.
SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA  4 Hours

Spiritual development: Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.

Kaya Kalpa yoga: Aim - kayakalpa philosophy - Importance of kayakalpa training.

Training: Kaya Kalpa Yoga.

EXERCISE & MEDITATION  10 Hours

Simplified Physical Exercise & Meditation Practice.

L: 16 Hr, P: 14, Total: 30 Hours

REFERENCES BOOKS:
1. Dr. A. Chandra Mohan, “Leadership and Management”, Himalaya Publication House,

COURSE OUTCOMES:
- Behaves as a responsible family member.
- Develop skills for personality improvement.
- Acquire practical knowledge on self-control technique for teenagers.
- Identify the significant of Genetic Centre for the Soul functional base operation.
Department of Biotechnology

Vision
Create a strong teaching base in the area of biotechnology through technical knowledge dissemination to the students and to scale new heights in research by etching the concepts of professionalism, social justice, environmental impact and human ethics for welfare of the general public.

Mission
- Disseminate a blending of knowledge acquisition and its application in real-life situations to the students
- Equip the students to adapt to changing global and local needs through well designed curriculum and syllabus
- Groom students to uphold professional ethics and develop leadership qualities
- Train students on issues related to social welfare.

PEOs:

PEO 1
Successful professional career and/ or higher studies by gaining knowledge in fundamental mathematics and biological principles (Cognitive objective).
- PEO 1a Growth in professional career
- PEO 1b Record of higher studies

PEO 2
Provide strong foundation in the core biotechnology courses to evaluate real life problems and to propose biotechnological solutions with economical and social viability (Affectionate objective).
- PEO 2a Potentiality to analyze real life problems
- PEO 2b Appropriate biotechnological troubleshoot with economical and social viability

PEO 3 - Sensitize on environmental, health and bioethical issues, Intellectual property rights, professional ethics and life-long learning through application orientated activities (Behavioural objective).
- PEO 3a Awareness on biotechnological issues and ethics
- PEO 3b Accustomed to life-long learning

**POs:**

**PO1.** An ability to apply the knowledge of mathematics, science, and engineering fundamentals in the areas of biotechnology, such as Bioprocess engineering, Genetic Engineering, Bioinformatics, Downstream Processing etc.

**PO2.** An ability to identify and analyze the complex biotechnology-oriented problems and to nurture the issues by providing appropriate solution

**PO3.** An ability to design a bio-based system, component or process or protocol to address the essential issues related to public health, environment, society, culture and safety

**PO4.** An ability to design, analyze, interpret and conclude the biological data using broad research based knowledge

**PO5.** An ability to educate the appropriate selection and application of current/modern engineering techniques/tools in the area of biotechnology

**PO6.** An ability to inculcate awareness among the students about the impact of various biological issues related to society, ethics, health, culture and safety

**PO7.** An ability to understand and demonstrate the need for the development of sustainable biotechnological solutions for addressing the environmental issues aligned with society

**PO8.** An ability to realize, commit and apply professional ethics by means of technology practice

**PO9.** An ability to inculcate the habit among students to function efficiently as an individual or in multidisciplinary team

**PO10.** An ability to communicate effectively through verbal and written mode with technical audience

**PO11.** An ability to create competency in the engineering management, finance principles and its application in multidisciplinary projects

**PO12.** An ability to recognize the need for life-long learning for sustaining professional career.

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Signature of the BOS chairman/Biotechnology
# B.TECH BIOTECHNOLOGY CURRICULUM

## SEMESTER-III

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Total Credits: 26

Signature of the BOS chairman/Biotechnology
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* Students should conduct mini project during the 3rd year summer vacation

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For the † courses, students who prefer Fast Track to complete the course work can opt for these courses in 6th and 7th semester respectively as self study courses.

**Grand Total Credits: 190**

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# ELECTIVES FOR SIXTH SEMESTER

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# ELECTIVES FOR SEVENTH SEMESTER

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**General Elective**

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Signature of the BOS chairman/Biotechnology
ELECTIVES FOR EIGHTH SEMESTER

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Elective III

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Elective IV

A- Track A: Agriculture/Food technology
B- Track B: Biomedical science & technology
C- Track C: Applied Biotechnology
D- Track D: Energy & Environmental Biotechnology

ONE CREDIT INDUSTRY ORIENTED COURSES
(5th, 6th or 7th semesters)

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<td>U14BTIN001</td>
<td>Dairy Technology</td>
<td>Sakthi Dairy, Pollachi</td>
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<tr>
<td>U14BTIN002</td>
<td>Mushroom Technology</td>
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<td>U14BTIN003</td>
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<td>U14BTIN004</td>
<td>Bioethanol</td>
<td>Sakthi Sugars, Appakudal</td>
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Signature of the BOS chairman/Biotechnology
SEMESTER III
Objectives:
- To learn about the elements of nutrition
- To learn about the metabolism of carbohydrates, lipids, proteins and nucleic acids and their associated disorders
- To learn about the biochemistry related to physiology and hormones

Course Outcomes
CO1: Describe the daily requirement and digestion and absorption of carbohydrates, proteins and lipids.
CO2: Illustrate the metabolic pathways of carbohydrates, lipids and metabolic disorders associated with it.
CO3: Demonstrate the metabolic pathways of amino acids, nucleic acids and associated disorders.
CO4: Outline the concepts of physiological biochemistry.
CO5: Understand the concepts of hormones in human metabolism and their physiological functions.

Pre-requisite:
1 U14BTT201 Biomolecules and Genetics

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

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<th>COs</th>
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Signature of the BOS chairman/Biotechnology
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Course Content

**ELEMENTS OF NUTRITION**  
6 Hours

**METABOLISM OF CARBOHYDRATES AND LIPIDS**  
12 Hours
Metabolic disorders of carbohydrate metabolism (pathophysiology, clinical symptoms and treatment) – Diabetes mellitus
Metabolic disorders of lipid metabolism: familial hypercholesterolemia

**METABOLISM OF PROTEINS AND NUCLEIC ACIDS**  
9 Hours
Metabolic disorders of amino acid metabolism: Phenyl ketonuria, Maple syrup urine disease
Metabolic disorders of nucleic acid metabolism: Lesch-Nyhan syndrome

**PHYSIOLOGICAL BIOCHEMISTRY**  
9 Hours
Biochemistry of O₂ and Co₂ Transport, Composition of blood, Lymph and Cerebrospinal fluid, Plasma proteins, Serum Lipid profile, Liver function test, Renal function test. Gastric function test, Normal and abnormal constituents of Urine
HORMONE BIOCHEMISTRY  
9 Hours
Endocrine glands – Anatomy; Pituitary – organization, chemistry, regulation of secretions of anterior and Posterior pituitary hormones, Pancreas, Thyroid, Adrenal Cortex and Medulla, sex hormones; Clinical orientation.

Theory: 45 Hours  
Total Hours : 45

REFERENCES:

OTHER REFERENCES:
1 https://archive.org/details/LehningersPrinciplesOfBiochemistry5e
U13BTT302  MICROBIOLOGY

Objectives:
- To learn about the microbial world
- To understand different microbes and their morphology and other characteristics.
- To learn about various techniques to control microbes and to apply microbes in allied fields of microbial technology.

Course Outcomes:
CO1 : Comprehend knowledge about historical perspective of microbiology and its developments
CO2 : Recognize the fundamental concepts in the structure and functioning of a cell
CO3 : Demonstrate the microbial nutritional requirements for growth and metabolism
CO4 : Understand the controlling of microbes using physical and chemical methods
CO5 : Acquire knowledge about industrial and environmental microbial applications

Pre-requisite:
1 U14BTT201 Biomolecules and Genetics

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

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Course Content

HISTORICAL PERSPECTIVE OF MICROBIOLOGY AND MICROSCOPY 9 Hours
An overview of microbiology including a historical perspective of microbiology, Origin of Leeuwenhoek’s Animalcules, Germ theory of fermentation and disease, Development of laboratory techniques to study microorganisms, Developments in disease. Classification and Nomenclature of microorganisms; Basics of Microscopy – light and electron microscopy, Super resolution microscopy, Principles of staining methods to differentiate microbes.

MICROBIAL STRUCTURE AND MULTIPLICATION 9 Hours

MICROBIAL NUTRITION, GROWTH AND METABOLISM 9 Hours
Nutritional requirements and Microbiological media – chemical elements as nutrients, different media used for culture; Screening and isolation of organisms- Pure culture techniques; Preservation methods, Maintenance of strain improvement (mutant selection, recombinant DNA methods). Definition of microbial growth. Cell division. Growth curve in batch culture or closed system. Different methods to quantify bacterial growth, Aerobic and Anaerobic; Mathematics of growth-generation time and growth rate constant, factors affecting growth. Microbial metabolism- Entner–Doudoroff and Phosphoketolase pathway.
CONTROL OF MICROORGANISMS AND ANTIMICROBIALS

Physical and chemical control of microorganisms – sterilization: Moist heat, dry heat, radiation and filtration. Disinfection: phenol, alcohol and detergents; Chemotherapy and antibiotics- anti-bacterial, anti-fungal agents, anti-viral agents, common mode of actions to control microbes and resistance to antibiotics.

APPLIED MICROBIOLOGY – BASIC APPROACH

Interaction between Microorganisms – Commensalism, Synergism, Mutualism (symbiosis). Lichen symbiosis. Normal flora of human healthy host, host-parasite interactions: Non specific host resistance, importance of nosocomial infections, mode of transmission of airborne pathogens, food and water borne infections caused by bacteria, virus & protozoa; Interactions among soil microbes; Significations of microbes in food; Industrial microbial products and processes.

Theory: 45 Hours

Total Hours : 45

REFERENCES:


Other References:

1 http://www.austincc.edu/rohde/noteref.htm
3 http://www.microrao.com/mypgnotes.htm

Signature of the BOS chairman/Biotechnology
U14BTT303  CONCEPTS OF INDUSTRIAL BIOTECHNOLOGY

Objective (s)
- To introduce various types of fermentation
- To learn about the production of primary- and secondary metabolites
- To understand the production of modern biotechnology products

Course Outcomes:
CO1 : Understand about the various industrial bioprocesses
CO2 : Learn the basics of industrial bioprocesses for the production of various primary and secondary metabolites.
CO3 : Apply various modern biotechniques for producing several value added products.
CO4 : Understand the production of biotechnological products.

Pre-requisite:
1 U14BTT201 Biomolecules and Genetics

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Signature of the BOS chairman/Biotechnology
Course Content

INTRODUCTION TO INDUSTRIAL BIOTECHNOLOGY  
9 Hours
Introduction to Biotechnology, Colours of Biotechnology, Primary and secondary metabolites, Industrial important microorganisms and microbial products, Basic concepts of upstream and downstream processing, Types and modes of fermentation: Solid state, submerged, batch, continuous, fed-batch, Process flowsheeting - block diagrams, pictorial representation.

PRODUCTION OF SOLVENTS, ORGANIC AND AMINO ACIDS  
9 Hours
A brief outline of processes for the production of industrial important solvents: Ethanol, Acetone-butanol, Glycerol and butanediol, Organic acids: Citric, lactic, acetic, itaconic and gluconic acids, Amino acids: Glutamic acid, lysine and phenylalanine.

PRODUCTION OF ANTIBIOTICS, VITAMINS AND PIGMENTS  
9 Hours

PRODUCTION OF BIOMASS AND ENZYMES  
9 Hours
Production of industrial enzymes: Proteases, amylases, lipases, pectinases, xylanases and cellulases; Production of brewer’s and baker’s yeast, single cell protein, bacterial, fungal, yeast and algal proteins.

PRODUCTION OF BIOTECHNOLOGICAL PRODUCTS  
9 Hours
Biopreservatives (Nisin), Biopolymers (Xanthan gum and PHB), Biopesticides, Biofertilizers, Biofuels (Biodiesel, Biogas and Biooil), Biosurfactants, Overview of modern biotechnological products (Recombinant vaccines, Therapeutic proteins and monoclonal antibodies).

Theory: 45 Hr  
Total Hours: 45
REFERENCES
1 Casida, L.E., *Industrial Microbiology*, New Age International (P) Ltd, 2005

OTHERS REFERENCES
1 www.eucodis.com/index.php/company/white-biotechnology
2 http://www.europabio.org/industrial-or-white-biotechnology-driver-sustainable-growth-europe
3 https://www.biotechnologie.de/BIO/Navigation/EN/Background/basics,did=79876.html
Objectives:
- To enable the students to understand the applications of basic engineering principles in bioprocesses

Course Outcomes:
CO1: Remember and understand basic units and calculations in engineering.
CO2: Apply knowledge on material balances for unit operations in bioprocess industries
CO3: Apply knowledge on material balances for unit process in bioprocess industries
CO4: Apply knowledge on energy balances in bioprocess industries
CO5: Evaluate understanding of yield coefficients in bioprocess industries

Pre-requisite:
1 U14CHT101 Engineering Chemistry
2 U14CHT205 Chemistry for Biotechnology
3 U14BTT201 Biomolecules and Genetics

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Course Content

UNITS, DIMENSIONS AND BASIC CALCULATIONS

9 Hours

Units and Dimensions: Introduction, Dimensions and System of units, Fundamental and derived quantities, Unit conversions, Recommendations for use of units, Dimensional consistency, Dimensional equations; Basic chemical calculations: Introduction, Composition of solid mixtures, solutions and gaseous mixtures, Ideal gas law and its application, Dalton law, Raoult’s law, Henry’s law.

MATERIAL BALANCES WITHOUT CHEMICAL REACTIONS

9 Hours

Material balance without chemical reactions: Process flow sheet, Three general methods of solving material balance problems, Material balance of unit operations like distillation columns, extractors, dryers, evaporators, crystallizers and leaching equipments; Recycle, bypass and purge streams.

MATERIAL BALANCES WITH CHEMICAL REACTIONS

9 Hours

Material balance with chemical reactions: Concept of limiting and excess reactants, selectivity, conversion and yield, Recycle, bypass and purge streams, Fuels and combustion – Types of fuels, Calorific value of fuels, Problems on combustion of coal, liquid and gaseous fuels, Air requirement and flue gases, Combustion calculations; Applications of spreadsheet and word processing software in stoichiometry.
ENERGY BALANCE CALCULATIONS  
9 Hours

STOICHIOMETRY OF CELL GROWTH AND PRODUCT FORMATION  
9 Hours
Elemental balances, degrees of reduction of substrate and biomass and available electron balances, Yield coefficients of biomass and product formation, Maintenance coefficients, energetic analysis of microbial growth and product formation, Oxygen consumption and heat evolution in aerobic cultures, Thermodynamic efficiency of growth.

Theory: 45 Hours

Total Hours :45

REFERENCES:

**OTHERS REFERENCES**
U14BTT305 BIOORGANIC CHEMISTRY

Objectives:
- To enable understanding chemical principles governing biochemical reactions

Course Outcomes:
CO1: Understand molecular interaction and chemical reactions of biomolecules
CO2: Identify synthetic strategies for proteins and oligonucleotides
CO3: Identify the role of enzymes in organic synthesis
CO4: Understand the orchestration of events during enzyme catalysis and the role of coenzymes
CO5: Explain importance and influence of metal ions on protein function

Pre-requisite:
1. U14CHT101 Engineering chemistry
2. U14CHP101 Chemistry Lab
3. U14CHT205 Chemistry for Biomolecules
4. U14BTT201 Biomolecules and Genetics

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Course Content

CONCEPTS IN BIORGANIC CHEMISTRY  6 Hours
Nature of Bonding in Organic molecules; Weak Molecular interactions in biomolecules – Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction; Role of weak interactions in structural organization of proteins and nucleic acids, Interactions between partial charges – dipole moments, hydrogen bonding, Interactions between biological macromolecules and small molecules. Binding equilibria and the kinetics of binding, applied to small molecules/proteins/DNA

ORGANIC CHEMISTRY OF BIOMOLECULES  9 Hours
Classification of Organic reactions; Mechanisms of SN1, SN2, E1 and E2 reactions; Aromatics: structures/resonance; substitution reactions – mechanisms and directing groups, Acid base properties and pI of amino acids, general reactions of amino acids- side chain, carboxyl and amino group; Chemical reactions of amino acids with Ninhydrin, Sanger’s reagent, Edman’s reagent and Dansyl chloride Chemistry of carbohydrates – hemiacetal formation and the anomic effect; Reactions involving reducing property, Synthesis of oligosaccharides Chemical Reactions of fats; Saponification and transesterification reactions of fatty acids; Acid number, Saponification number, Iodine number

SYNTHETIC METHODS FOR BIOMOLECULES  6 Hours
Chemical synthesis of alpha aminoacids, Solid phase peptide synthesis; Peptide sequencing- Edman’s degradation; Oligonucleotide chemical synthesis, Chemical methods of DNA sequencing

CHEMISTRY OF NATURAL PRODUCTS  6 Hours
Alkaloids: structural elucidation, synthesis and biological properties of coniine, piperine Terpenoids and Carotenoids : General methods of synthesis of terpeniods; Isoprene rule; Structure and synthesis of menthol, General methods of Anthocyanines and flavones synthesis; Cyanidine chloride and Quercetin, Curcumin, structure and synthesis

MECHANISM OF ENZYME, COENZYME CATALYSIS  6 Hours
Coenzymes in catalysis, Mechanism and role of: pyridoxal phosphate (aminotransferases), NAD/NADP (dehydrogenases), Thiamine pyrophosphate (carboxylases) Case studies of structure and mechanism- Horse Liver alcohol dehydrogenase, alpha –chymotrypsin, hen egg white
lysozyme, Ribonuclease A.

**Case study**- engineering an enzyme- subtilisin; Case study- allosteric ATPase.

**SYNTHETIC STRATEGIES AND MOLECULAR MODELS**  **6 Hours**

FOR BIOMOLECULES


**METAL-LIGAND COMPLEXES IN PROTEINS**  **6 Hours**

Transition metal ions and oxidation states; Types of ligands; Role of iron in Myoglobin, Haemoglobin and cytochromes; Copper in Hemocyanin, Magnesium in chlorophyll, Cobalt in vitamin B-12 and Molybdenum in nitrogenase; Metalloenzymes; Geometrical and optical isomerism in coordination complexes

Theory: 45 Hours

**Total Hours :45**

**REFERENCES:**


**OTHER REFERENCES:**

3. http://nptel.ac.in/courses/104103018/1
Objectives:
- To be able to employ biochemical and chemical methodologies in the quantification, isolation, synthesis, extraction of molecules of biological significance.

Course Outcomes:
CO1: Isolate biomolecules from plant and animal tissues and carry out analysis
CO2: Carry out Qualitative and quantitative analysis of metabolites
CO3: Carry out enzymatic analysis with proper controls
CO4: Carry out synthesis of bioactive molecules;
CO5: Study molecular properties using invitro and insilico methods

Pre-requisite:
1 U14CHP101 Chemistry Lab
2 U14CHT205 Chemistry for Biomolecules
3 U14BTT201 Biomolecules and Genetics

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Course Content

BIOCHEMISTRY
1. Extraction, separation and determination of absorption spectra of plant pigments
2. Isolation and estimation of serum cholesterol
3. Qualitative and quantitative analysis of:
   (i) Saliva (α-amylase)
   (ii) Urine (urea, uric acid, phosphate, calcium)
   (iii) Blood glucose - DNS method
4. Experiments on blood
   (a) Estimation of haemoglobin
   (b) Determination of A/G ratio in serum
5. Catalase assay; Anitoxidant assay

BIOORGANIC CHEMISTRY
1. Biomolecule synthesis
   Synthesis of aspirin, acetaminophen

2. Biomolecule isolation/extraction:
   Extraction of caffeine from tea and lycopene from tomato paste

3. Bioproduct synthesis
   Biodiesel preparation
   Saponification reactions of vegetable oils

4. Studying molecular property
   To determine the specific rotation of given sample of sucrose by using polarimeter.
   Analysis of trypsin action
   Determination of logP of Organic compounds (eg. Succinic acid)

5. Bioorganic chiral synthesis:
   Enzymatic reduction of ethyl acetoacetate to chiral alcohol by yeast cells

6. Insilico studies
   Chemical structure drawing and structure analysis using molecular modeling tools

Theory: Nil  Practical: 45 hrs  Total Hours : 45

Signature of the BOS chairman/Biotechnology
REFERENCES:
5 Ashutosh Kar, Advanced Practical Medicinal Chemistry, New Age International Publishers
U14BTP302  MICROBIOLOGY LABORATORY

Objective(s):
- To understand and learn the basic techniques applicable for the biotech industry

Course Outcomes:
CO1: Understand and demonstrate the working principles, procedures of microbiology Lab experiments and equipments
CO2: Observe and practice different types of culture media and broth for microbial cultivation
CO3: Differentiate microbes using different staining methods
CO4: Estimate and evaluate the microbial screening, identification and characterization

Pre-requisite:
1. U14BTT201 Biomolecules and Genetics

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Course Content
1 Lab safety method and Regulations, Principles and methods of sterilization. Sterilization techniques and Study of instruments: Compound microscope, Autoclave, Hot air oven, Laminar Airflow
2 Preparation of media: Media preparation, plugging and sterilization. (NA/NB, PDA/PDB, MRBA, EMB agar, Blood agar, Mac Conkey agar). Nutrient broth, Nutrient agar, slants, soft agar
3 Pure culture technique – Serial dilutions, Pour plate, Spread plate & Streak plate.
Measurement of Microbial Size – Micrometry.
Quantification of microorganisms by Turbidimetry and Nephelometry – McFarland standards
Motility determination – Hanging drop method & Agar gel Stabbing Method
Enumeration of bacterial / yeast cells – Viable count, Total count Direct and Indirect methods (Haemocytometer & Total viable counts).
Growth curve, Determination of growth rate and generation time.
Anaerobic Cultivation – RCM, Fluid Thioglycolate broth and Anaerobic jar methods
Antibiotic sensitivity assay – Disc & Well diffusion method
Case study – Special Interest
Effect of pH, Temperature and Salinity on bacterial growth.
Slide culture technique for fungi morphology studies

Theory: Nil Practical: 45 Hrs Total Hours: 45

REFERENCES:
3 Barry Chess, Laboratory Applications in Microbiology: A Case Study Approach, 3e 2015
4 By Alfred Brown and Heidi Smith, Benson’s Microbiological Applications, 13e 2014
6 Joseph MC Farland, M.D.Jama. The nephelometer: an instrument for estimating the number of bacteria in suspensions used for calculating the opsonic index and for vaccines. 1907; (14):1176-1178

OTHER REFERENCES:
1 http://faculty.washington.edu/korshin/Class-86/MicrobiolTechniques.pdf

Signature of the BOS chairman/Biotechnology
Objectives:
To carry out industrial process in the laboratory scale

Course Outcomes:
CO1: Demonstrate about the production of various metabolites
CO2: Explain the production and estimation of *Spirulina*
CO3: Choose the materials required for immobilization of cells
CO4: Explain the isolation of degraders.

Pre-requisite:
U14BTT201 Biomolecules and Genetics

CO/PO Mapping
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Signature of the BOS chairman/Biotechnology
Course Content
1. Algal Culture- *Spirulina*
2. Production and estimation of citric acid from *Aspergillus* culture
3. Production and estimation of lactic acid and lactose
4. Immobilization of yeast cells
5. Preparation of wine
6. Estimation of alcohol by specific gravity method
7. Immobilization of enzymes (Invertase)
8. Isolation of cellulose degraders
9. Isolation of pesticide degraders
10. Production of Gibberellic acid

Theory: -Nil  
Practical: 45hrs  
Total Hours: 45

REFERENCES
OBJECTIVES

(i) To facilitate individuals to realize their social responsibilities

(ii) To help understand self transformation leads to social transformation

COURSE OUTCOMES:
CO1: Adopt and practice social values as his regular duties.
CO2: Take over the social responsibilities.
CO3: Give solutions and to manage the challenging social issues.
CO4: Voluntarily participate and organize social welfare programmes.
CO5: Explore his ideology of techno social issues and provide the best solution.

Pre-requisite: Nil

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Signature of the BOS chairman/Biotechnology
ORIGIN OF SOCIETY 5 Hours

Practical: Group Discussion on Evolution of Man and formation of society, Panel discussion on Social values - Pancha Bhoodha Navagraha Meditation.

SELF AND SOCIETY 2 Hours
Duty to self, family, society and world – Realization of Duties and Responsibilities of individuals in the society (Five fold cultures) – impact of social media on present day youth and correction measures.
Practical: Case study – interaction with different professionals.

EDUCATION & SOCIETY 3 Hours
Education: Ancient and Modern Models.
Practical: Making Short film on impact of education in social transformation.

DISPARITY AMONG HUMAN BEINGS 3 Hours
Wealth’s for humans, Factors leading to disparity in human beings and Remedies.
Practical: Debate on disparity and social values.

CONTRIBUTION OF SELF TO SOCIAL WELFARE 3 Hours
Practical: In campus, off campus projects.

GENERAL PRACTICAL 14 Hours
Standing: Pada Hastasana, Ardha Cakrasana, Trikonasana, Virukchsana (Eka Padaasana)
Sitting: Padmasana, Vakrasana, Ustrasana, Paschimatasana.
Prone: Uthanapathasana, Sarvangasana, Halasana, Cakrasana,
Supine: Salabhasana, Bhujangasana, Dhanurasana, Navukasana.

Theory: 16 Hrs  Practical: 14hrs  Total: 30 Hours

REFERENCES BOOKS:
SEMESTER IV
Course Outcomes

After successful completion of this course, the students should be able to

CO1: Play a important role in transferring a healthy environment for future generations

CO2: Analyze the impact of engineering solutions in a global and societal context

CO3: Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems

CO4: Ability to consider issues of environment and sustainable development in his personal and professional undertakings

CO5: Highlight the importance of ecosystem and biodiversity

CO6: Paraphrase the importance of conservation of resources

Pre Requisite : Nil.

**CO/PO Mapping**

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

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**Course Assessment methods:**

**Direct**

Internal tests(I, II, III), Assignment, End Semester Exam

**Indirect**

1. Course –End Survey

Signature of the BOS chairman/Biotechnology
INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 10 Hours
Definition, scope and importance – Need for public awareness – Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization 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 and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

ECOSYSTEMS AND BIODIVERSITY 14 Hours
ECOSYSTEM : Concept of an ecosystem – Structure and function of an ecosystem: Producers, consumers and decomposers, Energy flow in the ecosystem, Food chains, food webs and ecological pyramids - Ecological succession – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) –

ENVIRONMENTAL POLLUTION 8 Hours
Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) 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, earthquake, cyclone and landslides.

SOCIAL ISSUES AND THE ENVIRONMENT 7 Hours

HUMAN POPULATION AND THE ENVIRONMENT 6 Hours

Field Work
Visit to local area to document environmental assets- river / grassland / hill / mountain, visit to local polluted site- urban / rural / industrial / agricultural, study of common plants, insects, birds, study of simple ecosystems-pond, river, hill slopes etc.,

Theory: 45 Hrs

Total: 45 Hours
REFERENCE

U14BTT401  BIOTECHNIQUES

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Objectives:
- To provide the students an ability to understand the principles of instrumentation and biotechnology oriented techniques and their applications in the field of biology

Course Outcomes:
CO1: Understand the basics of measurements and different extraction methodologies, and their applications in biotechnology
CO2: Describe the instrumentation and applications of specialized molecular spectroscopic techniques
CO3: Demonstrate the principles and techniques of chromatography and electroanalytical methods and their applications in biotechnology
CO4: Explain the various electrophoretic techniques and their applications in biotechnology
CO5: Understand and interpret the various structural elucidation and radioisotope methods

Pre-requisite:
1. U14CHT101 Engineering Chemistry
2. U14BTT201 Biomolecules and Genetics
3. U14MAT305 Probability and Applied Statistics

CO/PO Mapping
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Course Content

MEASUREMENT BASICS AND EXTRACTION METHODS
9 hours

Classification of instrumental methods: Concepts of accuracy, precision and limits of detection (LOD); Types of errors – random and systematic; Calibration of instrumental methods – comparison with standards, external and internal standard addition methods; Introduction and significance of signal to noise ratio (S/N); Solvent extraction – introduction and principle; Extraction techniques – batch, stripping or back, continuous and counter-current-current; Principle of solid extraction (Soxhlet); Types - Temperature assisted, pressurized hot water and supercritical fluids based extraction.

SPECTROSCOPIC TECHNIQUES
9 hours

Flame photometry, nephelometry, spectrofluorimetry, circular dichroism (CD), UV-Vis, IR, FT-IR, and Raman Spectroscopy - principle, instrumentation and applications.

CHROMATOGRAPHY AND ELECTROANALYTICAL METHODS
9 hours

Factors affecting the resolution of chromatography; Rate and plate theory; Significance of VanDeemter equation; Thin layer chromatography, Supercritical fluid chromatography, Counter current chromatography, HPLC, Ultraperformance liquid chromatography (UPLC) and GC – principle, instrumentation and applications; Oxygen and pH electrodes – principle, instrumentation and applications.
ELECTROPHORESIS & THERMAL METHOD  
9 hours
Electrophoresis – introduction & trouble shooting parameters; Paper, agarose gel, polyacrylamide gel (PAGE), SDS-PAGE – principle, instrumentation and applications; Immuno, pulse field and capillary electrophoresis, and isoelectric focusing – principle and applications; Thermo gravimetric analysis (TGA) – principle, instrumentation and applications.
Case study – PAGE and SDS PAGE

STRUCTURAL ELUCIDATION AND RADIOISOTOPE  
9 hours
METHODS
Mass spectrometry – principle, instrumentation (electron spray ionization [ESI] & chemical ionization [CI]) and applications; MALDI-TOF – principle and instrumentation; x-ray diffraction and nuclear magnetic resonance (NMR) – principle, instrumentation and applications; Types of radioactive decay; Scintillation counters (ionization and excitation) - principle, instrumentation and applications.

Theory: 45 Hours

Total Hours : 45

REFERENCES:
OTHER REFERENCES:


U14BTT402  IPR AND BIOBUSINESS

Objectives:
- To provide knowledge on various aspects of intellectual property
- To learn procedures for patenting
- To learn concepts of biobusiness

Course Outcomes: Students will be able to:
CO1 : Understand different forms of Intellectual property.
CO2 : Understand types of patents and patenting system in India.
CO3 : Understand basics of biobusiness
CO4 : Learn different market approval procedure in India
CO5 : Understand group project presentation.

Pre-requisite:
1  U14BTT303 Concepts on Industrial Biotechnology
2  U14BTT301 Concepts of Biochemistry
3  U14BTT302 Microbiology

CO/PO Mapping
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INTELLECTUAL PROPERTY RIGHTS 9 Hours
Significance and types of IP- Patents, Trademarks, Copyright, Industrial Designs, Trade Mark, Trade secret and Geographical Indications; International framework for the protection of IP; Objective and functions of GATT, WTO, WIPO and TRIPS; Farmers rights.

INDUSTRIAL BIOSAFETY 9 Hours
Indian Patent Act 1970- Recent Amendments; Types of patents; Role of a Country Patent office; Patent applications-Forms and guidelines, fee structure, time frames; Types of patent application-provisional and complete specification; Concepts of Prior art; Patent databases-India, USPTO, and EPO.

BIOBUSINESS 9 Hours
Bio-business – Introduction; new and old biobusiness: Need, Scope, Demand and market potential in India; Agri-biotech products and their demand; Role of innovation in business development.

BIOBUSINESS OPPORTUNITY AND ISSUES 9 Hours
Biobusiness opportunity area- Health care, Biomedical science, agricultural Biotechnology, Environmental Biotechnology; Issues and challenges- Cultural, ethical, social and economical issues.

BIOBUSINESS AND MARKET APPROVAL 9 Hours
Basics of economics (for Bio-business) – Introduction to Macro and Micro economics.
Types and Business opportunities; Preparation of business plan; Pre-market approval, procedure in India; FDA and FPO approval procedure.

GROUP PROJECT PRESENTATION 9 Hours
Project survey, market potential analysis; Gap finding and analysis; Case studies of different industries and their strategic planning

Theory: 45 Hours

Total Hours : 45

REFERENCES:
1 Deepa Goel and Ms Shomini Parashar , (2013), IPR, Biosafety and Bioethics, Pearson Education publisher


Other References
1 https://cgspace.cgiar.org/bitstream/handle/10568/832/ILRI%20Intellectual%20Property%20Policy.pdf?sequence=1

2 http://ces.iisc.ernet.in/hpg/cesmg/iprdoc.html
Objectives:
- To enable students understand the applications of fluid mechanics in bioprocess engineering
- To enable students understand the applications of particle flow in bioprocess engineering

Course Outcomes:

CO1: Understand and apply the concepts of viscosity measurement in fermentation broth.

CO2: Learn and apply the applications of packed and fluidized beds in bioprocess industries.

CO3: Comprehend and apply the size reduction and enlargement principles in bioprocess industries.

CO4: Understand and apply agitation, separation principles in bioprocess industries.

CO5: Learn the transportation of solids and fluids.

Pre-requisite:
1 U14BTT304 Biochemical Process Calculations

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

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Course Content

FLUID MECHANICS ........................................... 9 Hours
Classification and properties of fluids, Broth rheology, Viscometers, Factors affecting broth viscosity, Pressure and its measurement (Manometers), Fluid dynamics: Streamlines, Reynolds number, Boundary layer, Continuity equation, Euler equation and Bernoulli equation; Hagen-Poiseuille equation and Darcy-Weisbach equation.

FLUID FLOW MEASUREMENT ........................................... 9 Hours
Flow measurements: Orificemeter, Venturimeter, Rotameter and Gas flowmeters; Flow through packed beds: Drag coefficient, Laminar and turbulent flow in packed beds; Flow through fluidized beds: Mechanism, types and applications; Valves: Gate, globe and butterfly valves.

COMMINUTION AND SCREENING ........................................... 9 Hours
Particle shapes, Determination of mean particle size, and particle size distribution; Communion: Crushing and grinding, Laws of comminution, Industrial comminution equipments; Screening: Types of screens. Screen effectiveness and efficiency. Particle size analysis using screens; Industrial screening equipments; Size enlargement: Granulation

PARTICLE FLOW ........................................... 9 Hours
Agitation and mixing: Purposes of agitation, Mechanism of mixing, Agitation equipments, Flow patterns in agitation, Standard design of agitator, Dimensional analysis for power correlation, Mixing in gassed and ungassed fluids, Scale up criteria for bioreactors; Filtration: Industrial equipments, Filter media and filter aids, Basic theory of filtration; Sedimentation: Mechanism, Industrial equipments.

TRANSPORTATION OF SOLIDS AND FLUIDS ........................................... 9 Hours
Transportation of particles: Belt conveyors, Screw conveyors, Pipe conveyors, Bucket elevators; Transportation of liquids: Classification, principles, working and applications of centrifugal and reciprocating pumps, Pumping of slurries; Transportation of gases: Fans, blowers and compressors.

Theory: 45 Hours ........................................... Total Hours: 45
REFERENCES:

OTHER REFERENCES
U14BTT404 CELL AND MOLECULAR BIOLOGY

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Objective(s):
- To understand cellular organization, transport of molecules cell interactions and signaling
- To describe DNA replication, gene expression at transcriptional and translational level gene regulation and DNA repair mechanisms

Course Outcomes:
CO1: Recognize the fundamental concepts in the structure and functioning of a cell and membrane transport processes.
CO2: Interpret precisely the diversified roles of cytoskeletal filaments and infer the cascade of events in signal transduction and their significance
CO3: Discuss and distinguish the replication of prokaryotic and eukaryotic DNA
CO4: Explain the synthesis of RNA and post-transcriptional modifications Describe genetic code and protein synthesis
CO5: Understand the gene regulation, DNA damage and repair mechanisms

Pre-requisite:
1 U14BTT301 Concepts in Biochemistry

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

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Course Content

CELLULAR ORGANIZATION AND MEMBRANE 9 Hours

TRANSPORT
Structural organization of prokaryotic and eukaryotic cells; intracellular organelles in a eukaryotic cell – structure and functions; cell cycle; plasma membrane – structure, composition, properties and functions; membrane transport – passive and active transport, roles of channel proteins, carrier proteins and pumps in membrane transport, bulk transport.

CELLULAR INTERACTIONS AND CELL SIGNALING 9 Hours

Cell adhesion molecules and formation of cell junctions, cytoskeletal proteins and their role in cellular organization and functions – microtubules, intermediate filaments and microfilaments, autocrine, endocrine and paracrine models of cell signaling; signal transduction cascade – role of signaling molecules, receptors, second messengers and protein kinases.

NUCLEIC ACIDS AND GENOME REPLICATION 9 Hours

DNA as genetic material – Griffith; Hershey and Chase; Avery McLeod & McCarty experiments. Extrachromosomal DNA, retroviruses, Molecular structure of genes and chromosomes; Conformations of DNA and RNA; DNA replication and control; Unit of replication, Enzymes in replication, Prokaryotic replication; Replication in eukaryotic chromosomes; Replication of telomeres in eukaryotes.

TRANSCRIPTION AND TRANSLATION 9 Hours

Features of promoters and enhancers; Transcription factors (activators and repressors); Classes of RNA molecules; Types of RNA polymerases; Transcription and its control in prokaryotes and eukaryotes. Post-
transcriptional modifications; RNA Splicing, Polyadenylation and Capping, RNA editing, types of RNA -SnRNA & hnRNAs; Antisense RNA , microRNA, and RNA Interference (RNAi), ribozymes. Wobble hypothesis, tRNA activation by amino acyl tRNA synthetases, Protein synthesis in prokaryotes and eukaryotes (Initiation, Elongation, and Termination); Inhibitors of Translation; Post-translational modifications.

**REGULATION OF GENE ACTIVITY AND DNA**

**REPAIR MECHANISMS**

Principles of gene Regulation in prokaryotes and eukaryotes, Transcriptional Regulation : *Lac* Operon; Tryptophan Operon; Attenuation; Constitutively Expressed Genes, Case study- lambda gene regulation in lytic and lysogenic cycles, gene silencing, PTGS, Introduction to Mutations; Physical, Chemical and Biological Mutagens; Reversion; DNA Repair Mechanisms, Direct Reversal; Excision Repair; The SOS Response.

**Theory: 45 Hours**

**Total Hours :45**

**REFERENCES:**


**OTHER REFERENCES:**


3. http://nptel.ac.in/courses/102106025/

BIOCHEMICAL THERMODYNAMICS AND BIOPHYSICAL CHEMISTRY

U14BTT405

Objective(s):
- To understand the biophysical basic of biological phenomenon
- To understand the application of thermodynamic principles to biological systems

Course Outcomes:
CO1: Understand concepts of thermodynamics and free energy as applied to biological systems
CO2: Explain the significance of bioenergetics and oxidative phosphorylation
CO3: Understand the principles of phase equilibria problems and their applications in industrial biotechnology
CO4: Understand chemical equilibrium principles as applied to biological equilibria
CO5: Explain biochemical kinetics and its importance

Pre-requisite:
1. U14BTT301 Concepts in Biochemistry
2. U14BTT305 Bioorganic chemistry

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Course Content

FREE ENERGY CHANGE AND BIOLOGICAL PROCESSES  
Laws of thermodynamics; Relationship between equilibrium constant and ΔG; Work and the Gibbs energy change; biological standard state & standard free energy change in coupled reactions. The Gibbs energy of assembly of proteins and biological membranes (Case study), Energy release by ATP (Case study)

BIOENERGETICS AND OXIDATIVE PHOSPHORYLATION  
Biological oxidation-reduction reactions, redox potentials,. High energy phosphate compounds, free energy of hydrolysis of ATP and sugar phosphates. Mitochondrial respiratory complexes, electrochemical gradient, chemiosmotic theory, oxidative phosphorylation, ATP synthase and mechanism of ATP synthesis, photosynthetic electron transport and generation of NADPH & ATP, cyclic and non-cyclic photophosphorylations

SOLUTIONS AND PHASE EQUILIBRIA  
The thermodynamics of phase transition, Phase diagrams, Phase transitions in biopolymers and aggregates, Gas solubility and breathing (Case study), Colligative properties, osmosis, The osmotic pressure of solutions of biopolymers

CHEMICAL EQUILIBRIUM AND ACID-BASE CHEMISTRY  
Thermodynamic background, Binding of oxygen to myoglobin and hemoglobin (case study), The response of equilibria to - presence of a catalyst, and effect of
Modern concepts of acids and bases—Arrhenius, Lowry–Bronsted and Lewis
concepts. Limitations of each concept. Ionisation constant Ka and pKa of weak
acids, pH concept, Buffers—types, buffer action and buffer capacity. Henderson–
Hasselbalch equation, preparation of buffers, problems. Buffer action in blood
(Case study)

**BIOCHEMICAL KINETICS**

9 Hours

Reaction rates, Rate laws and rate constants, Reaction order, Integrated rate
laws—1st order, 2nd order, Pharmacokinetics (case study), The temperature
dependence of reaction rates—Arrhenius equation, : Enzymes and the
acceleration of biochemical reactions (case study)

Reaction mechanisms (enzymes, protein folding), Reaction dynamics—Collision
theory, Transition state theory

**REFERENCES:**
2. Peter Atkins and Julio de Paula, *Physical Chemistry for Life Sciences*,
   Johnson & P. Shing Ho, Prentice Hall, 2005

**OTHER REFERENCES**
2. http://www.cchem.berkeley.edu/gchem130/
Objective:
- To provide hands-on training in bioanalytical techniques and related instruments which enable the students to solve the issues

Course Outcomes:
CO1: Validate an experiment using absorption spectroscopy
CO2: Prepare the buffers using pH metry technique applied in many biotechnology industries
CO3: Operate the spectrophotometer, flame photometer, nephelometer and fluoroimeter for the estimation of bioanalytes
CO4: Gain the skill in the area of chromatography

Pre-requisite:
1 U14CHP101 Chemistry Lab
2 U14BTP201 Biomolecules and Genetics Lab

CO/PO Mapping
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Signature of the BOS chairman/Biotechnology
Course Content

EXPERIMENTS: 45 hrs

1. Extraction and quantification of bioanalytes from plant sources. Calculation of correlation, precision, validity and LOD (Appropriate software programs can be used)
2. Preparation of buffers and determination of pH of an unknown solution (Biological fluids/plant sources can be used), and Determination of isoelectric point of an amino acid by pH metric titration with a weak acid/weak base
3. Estimation of paracetamol by UV-spectrophotometry
4. Estimation of sodium and potassium by flame photometry
5. Estimation of sulphate or urinary proteins by nephelometry
6. Estimation of Aluminum by alizarin red S method using fluorimetry
7. Estimation of calcium by potassium permanganate method using titrimetry
8. Identification of biomolecules by thin layer chromatography (TLC)
9. Isolation of biomolecules using preparative thin layer chromatography (PTLC) (Demonstration)
10. Isolation of molecules using HPLC (Demonstration)
11. Data Interpretation – LC-MS or NMR or X-ray diffraction techniques (Demonstration)

Theory: Nil  Practical: 45 Hrs  Total Hours: 45
REFERENCES:
Objective:
- To provide extensive knowledge on various unit operations and flow measuring equipments in bioprocess industries

Course Outcomes:
CO1: Understand the important of fluid mechanics applications.
CO2: Experiment and learn the mechanical operations.
CO3: Understand the heat transfer concept and its applications.
CO4: Experiment the mass transfer concepts applicable in biotech industries.
CO5: Understand the safety precautions in industries.

Pre-requisite:
1 U14BTT304 Biochemical process calculations

CO/PO Mapping
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Course Content

1. Flow measurement – Venturimeter / Orificemeter / Rotameter
2. Flow through pipes – Straight / Annular
3. Pressure drop studies – Packed / Fluidized beds
4. Size Reduction Equipment – Jaw Crusher
5. Screening Equipments – Rotap / Gyratory
6. Filters – Plate and Frame / Vacuum Leaf
7. Batch Sedimentation test with starch
8. Heat Exchangers – Shell and Tube / Double Pipe
9. Distillation – Simple / Steam / Packed
10. Bioleaching of hexavalent chromium using *Acidithiobacillus thiooxidans* / Reverse Micellar Extraction of Acid dyes / Biosorption of reactive dyes
11. To prepare and submit industrial hazards by chemical/electrical/mechanical/dust and their safety precautions
12. To prepare and submit chart of various materials (glass/steel/concrete) used in construction.

Theory:--Hr          Practical: 45 Hrs          Total Hours : 45

REFERENCES


OTHER REFERENCES:

2. www.che.iitb.ac.in/courses/uglab/manuals/labmanual.pdf
3. www.iitk.ac.in/july14mse/data/MSE314A.pdf
Objective(s):
- To familiarize with cell counting and cell separation techniques.
- To acquire practical skills related to DNA/ RNA isolation methods.
- To gain hands on experience with action of restriction endonucleases and ligase on DNA.

Course Outcomes:
- CO1: Demonstrate cell counting and cell separation techniques.
- CO2: Experiment to isolate DNA and RNA from various biological tissues.
- CO3: Analyse and interpret DNA and RNA data.
- CO4: Explain the activity of restriction enzymes and ligation of DNA.
- CO5: Demonstrate bacterial genetics through conjugation experiment and Execute the effect of UV irradiation on bacterial genome.

Pre-requisite:
1. U14BTP301 Biochemistry and bioorganic chemistry lab
2. U14BTP302 Microbiology Lab

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Course Content

1. Cells microscopy and measurement/ counting
2. Sonication/ Homogenization of cells followed by differential centrifugation and sub cellular enzyme localization by enzyme marker
3. Preparation genomic and plasmid DNA and analysis DNA using agarose gel electrophoresis
4. Preparation , Purification (PCI method) and Quantification ( UV spectrophotometer) of DNA of DNA from bacteria/plant/animal sources
5. Preparation and quantification of total RNA
6. Restriction analysis of DNA
7. Ligation of DNA fragments
8. Demonstration of bacterial conjugation
9. Understanding DNA mutation using UV light exposure of bacteria
10. Preparation of Phage lysate and analysis of phage DNA

Theory:-- Practical: 45 hours Total Hours : 45

REFERENCES:
3 http://www.dnalc.org

Signature of the BOS chairman/Biotechnology
Objective(s):

- To make every individual to realize and practice global values.
- To bring in awareness of Universal brotherhood and protect mother earth

Course Outcome:
CO1: Act as a good and responsible citizen.
CO2: Conserve and protect eco cycle.
CO3: Voluntarily work with global welfare organization and provide solution for global peace.
CO4: Invent his Technical design by considering humanity and nature.

Pre-requisite: Nil

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Signature of the BOS chairman/Biotechnology
ROLE OF A RESPONSIBLE CITIZEN 4 Hours
Citizen - its significance—National and Global perspectives.
Practical: Group discussion on National and Global values.

GREATNESS OF INDIAN CULTURE 2 Hours
Emerging India – past and present, about Culture, Morality and spirituality– Beauty of Unity in diversity - Impact of western culture in India and Indian culture over other countries.
Practical: Demonstration and impact measurements of simple and good actions.

GLOBAL WELFARE ORGANISATIONS 2 Hours
Education – Health – Nature – Peace
Practical: Organizing an event linking with one of the Organizations In campus /off campus.

PRESERVING NATURE 2 Hours
Appreciating the flora and fauna on Earth - Importance of Ecological balance – Conservation.
Practical: Trekking, field visit.

GLOBAL PEACE 4 Hours
One World and One Humanity - Global Peace.
Practical: Group discussion on individual plans for world peace.

GENERAL PRACTICAL 16 Hours
Simplified physical Exercise – Kayakalpa practice (Follow up practice) – Meditation -
Theory & Practice
Pranayama : Bhastrika, Kapala Bhati, Nadi suddhi, Sikari, Sitali.

Theory: 14 Hrs Practical: 16hrs Total: 30Hours

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REFERENCES BOOKS:


SEMESTER V
Objectives:

- To learn various types of vector-host systems and steps in creating a recombinant DNA molecule
- To gain knowledge on various recombinant DNA techniques and their applications.

Course Outcomes:

CO1: Understand the steps in recombinant DNA preparation
CO2: Explain the features of various types of gene cloning vectors
CO3: Comprehend various types of gene isolation and screening methods
CO4: Describe and apply molecular techniques
CO5: Demonstrate the different applications of GMOs

Pre-requisite:

1. U14BTP403 Cell and Molecular Biology

CO/PO Mapping

S-Strong, M-Medium, W-Weak

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Course Content

BASICS OF RECOMBINANT DNA TECHNOLOGY 9 Hours
Restriction and modifying enzymes, construction of recombinant DNA molecules, transformation of r-DNA molecules into target host organisms; Calcium chloride mediated- electroporation- microinjection- gene gun, selection methods for recombinants; antibiotic resistance - blue & white selection, GFP and Luciferase based selection.

CLONING AND EXPRESSION VECTORS 9 Hours
Cloning vector; properties of a cloning vector, (origin of replication, polylinker region, selectable marker gene) Plasmid Vectors; Lambda phage vectors, phagemid, cosmid, shuttle vector, expression vectors; yeast vectors ,Baculoviral based insect vector- mammalian expression vectors, plant transformation vector; binary vector (Ti plasmid based), high capacity vectors, YAC.
Case study: Latest multipurpose expression vector

GENE CLONING AND EXPRESSION METHODS 9 Hours
Construction of genomic and cDNA libraries, PCR based cloning, differential cloning, positional cloning; Gene targeting-transposon mediated cloning, library screening methods; nucleic acid hybridization based screening , nucleic acid Probe preparation methods -radioactive and non-radioactive -PCR based screening- immunochemical screening, over-expression and purification of recombinant His tag fusion proteins using Ni+ column.
Case study: Discussion on gene cloning and expression from a research paper

MOLECULAR TECHNIQUES AND THEIR APPLICATION 9 Hours
Blotting techniques; Southern-northern-western blotting, Polymerase Chain Reaction (PCR); principle- types- applications of PCR, DNA fingerprinting using molecular markers; RAPD-RFLP-application in plant variety characterization, Automated DNA sequencing, next generation DNA sequencing, RNAi and gene knock-out techniques, gene modification

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using site directed mutagenesis, Genome sequencing methods, genomics and its importance, systems biology.

**Case study:** Use of PCR and RFLP in forensic field.

**APPLICATION OF rDNA TECHNOLOGY**  
9 Hours

Application of genetically modified organisms; medicine-recombinant therapeutic proteins- recombinant vaccines- Molecular Diagnosis of human genetic diseases, pathogenic virus and bacteria, agriculture – Transgenic Bt cotton- round-up ready soybean transgenic crops, Biosafety levels for microbial, plant and animals, safety guidelines and release procedure for GMOs in India, effect of GMOs on environment, patenting of gene sequences and its issues.

**Industry Connection:** molecular diagnosis of pathogens using PCR

**Theory: 45 hrs**  
**Total Hours: 45**

**REFERENCES:**

**OTHER REFERENCES:**
1. http://nptel.ac.in/courses/102103013/
U14BTT502 ENZYME TECHNOLOGY

Objectives:
- To understand the basics of enzymes and classification and enzyme kinetics
- To study the production, purification and characterization of enzymes
- To study the enzyme applications and biosensors

Course Outcomes:
CO1 Understand the basics of enzymes, nomenclature and classification
CO2 Apply the knowledge to derive the kinetics for enzymes
CO3 Learn and apply the different techniques for immobilization of enzymes and kinetics
CO4 Study and apply the knowledge on design of enzyme reactors
CO5 Discuss the applications of enzymes in different industries and biosensors

Pre-requisite:
1 U14BTT301 Concepts in Biochemistry
2 U14BTT303 Concepts of Industrial Biotechnology

CO/PO Mapping
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Course Content

INTRODUCTION TO ENZYMES 9 Hours
Introduction of enzymes; Nomenclature and Classification of enzymes; concept of active site, substrate binding site, allosteric site, and energetics of enzyme substrate complex formation; specificity of enzyme action, Mechanisms of enzyme action, – Enzymes in organic solvents; Introduction to enzyme activity and specific activity - calculations.

ENZYME KINETICS 9 Hours
Kinetics of single substrate reactions - Michelis – Menten equation and Briggs Haldane equation; Estimation of Michaelis – Menten parameters – Lineweaver-Burk plot, Eadie-Hofstee plot and Hanes plot; Bisubstrate reactions – single displacement and ping pong mechanism; multi substrate reactions - King and Altmann equation; types of inhibition– Competitive, Uncompetitive, non competitive and substrate; Allosteric regulation of enzymes, Monod-Changeux-Wyman model.

ENZYME IMMOBILIZATION 9 Hours
Physical and chemical techniques for enzyme immobilization – adsorption, matrix entrapment, encapsulation, cross-linking and covalent binding and their advantages and disadvantages; Applications of immobilized enzymes; Electrostatic Effect, effect of charged and uncharged support, Effect of external and internal mass transfer, Damkohler number, effectiveness factor, Intraparticle diffusion kinetics, Biot number
PURIFICATION AND CHARACTERIZATION OF ENZYMES FROM NATURAL SOURCES

Production and purification of crude enzyme extracts from plant, animal and microbial sources – Methods of characterization of enzymes – Development of enzymatic assays Case study on production of Papain, Chymosin and cellulase enzymes

ENZYME APPLICATIONS

Application of enzymes in industries – Food, detergent, leather, wool, brewery, and environment, chemicals processing. Design of enzyme electrodes and their applications as biosensors in industry, health care and environment. Case study - Development of enzyme based biosensors for heavy metal ions determination in water.

Theory: 45hrs

Total Hours: 45

REFERENCES:

OTHER REFERENCES:
U14BTT503  PRINCIPLES OF BIOPROCESS ENGINEERING

Objectives:
- To learn the different types of bioreactors and their components
- To understand microbial growth kinetics in batch, fed-batch and continuous mode
- To study the basics of scale-up criteria for bioreactor

Course Outcomes:
CO1 : Understand the different bioreactors and their applications
CO2 : Discuss and distinguish the medium requirements and optimization methods
CO3 : Explain the sterilization kinetics of medium and equipments
CO4 : Describe batch, fed-batch and continuous cultivation and their kinetics.
CO5 : Understand the scale-up criteria for bioreactors.

Pre-requisite:
1 U14BTT302 Microbiology
2 U14BTT303 Concepts of Industrial Biotechnology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Course Content

TYPES AND APPLICATIONS OF BIOREACTORS  
Types and industrial applications of bioreactors – stirred-tank reactor and its ancillaries, bubble-column reactor, packed-bed reactor, fluidized-bed, air-lift reactor and photobioreactor, aeration and agitation, rheology of fermentation fluids, main parameters to be monitored and controlled in fermentation processes.

RAW MATERIALS AND MEDIA OPTIMIZATION  
Criteria for good medium, Various carbon, nitrogen, minerals, vitamins and other complex nutrients for fermentation industry, Simple and complex media for microbial, plant and animal cells, oxygen requirements, medium formulation for optimal growth and product formation, medium optimization methods-Plackett-Burman design, simplex design and response-surface methodology.

Case study: Enzyme production using Plackett-Burman design

STERILIZATION KINETICS  
Thermal death kinetics of microorganisms, batch and continuous heat sterilization of liquid media, filter sterilization of liquid media, sterilization of air, design of sterilization equipment for batch and continuous process.

KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION  

Case study: Production of penicillin by fed-batch cultivation

SCALE-UP OF BIOREACTORS  
Scale-up criteria for bioreactors. Major factors involved in scale-up. Scaling-up of mixing systems. Scale-up of aeration/agitation regimes in stirred tank reactors. Scale-up of air-lift reactors.

Case study: Scale-up of a reactor for biological metabolites prowastewater treatment using mixed culture / metabolite production

Theory: 45 Hours

Total Hours: 105
REFERENCES:

OTHER REFERENCES:
2 http://www.nptel.ac.in/syllabus/syllabus.php?subjectId=102107029
3 http://users.ox.ac.uk/~dplb0149/publication/NPRBiocatalysisRev.pdf
U14BTT504 HEAT AND MASS TRANSFER IN BIOPROCESS

Objectives:
- To make the students understand the applications of heat transfer in bioprocess engineering
- To learn and understand the applications of mass transfer in bioprocess engineering

Course Outcomes:
CO1 : The students would understand the modes of heat of transfer.
CO2 : The students would understand and apply the applications of heat transfer in bioprocess industries.
CO3 : The students would understand the principles of diffusion and apply the concepts of interphase mass transfer in bioreactor.
CO4 : The students would understand and apply distillation and adsorption in bioprocess industries.
CO5 : The students would understand and apply extraction and leaching in bioprocess industries.

Pre-requisite:
1 U14BTT304 Biochemical Process Calculations
2 U14BTT403 Fluid And Particle Mechanics in Bioprocesses

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Course Content

HEAT TRANSFER
9 Hours
Modes of heat transfer; Conduction: Fourier's law, Thermal conductivity of biological materials, Conduction through plane wall, hollow cylinder and hollow sphere, Insulating materials-General properties and applications; Convection: Individual and overall heat transfer coefficients, Dimensional analysis for free and forced convection, Heat transfer to fluids with and without phase change.

HEAT TRANSFER EQUIPMENTS
9 Hours
Heat Exchangers: Basic calculations, Heat transfer configurations for bioreactors, Heat exchangers for sterilization, Compact and extended surface heat exchangers; Mechanism of condensation and boiling; Evaporators: Industrial evaporators, Methods of operation, Overall heat transfer coefficient, Single effect evaporator calculations, Evaporation of biological materials.

DIFFUSION AND INTERPHASE MASS TRANSFER
9 Hours
Modes of mass transfer; Diffusion: Fick’s first law, Molecular diffusion in gases, liquids and solids; Interphase mass transfer: Individual and overall mass transfer coefficients for liquids and gases, Theories of mass transfer, Mass transfer in bioreactors: Methods for the determination of \( k_{La} \), Factors affecting oxygen transfer rate.

DISTILLATION AND ADSORPTION
9 Hours
Distillation: Overview of vapour-liquid equilibria, Flash, differential, continuous, steam, azeotropic and extractive distillation, Determination
of number of stages by McCabe-Thiele method; Adsorption: Types of adsorption, Nature of adsorbents, Adsorption isotherms-Langmuir and Freundlich, Adsorption kinetics and thermodynamics, Batch and continuous adsorption, Overview of biosorption.

EXTRACTION AND LEACHING 9 Hours
Extraction: Ternary liquid-liquid equilibria, choice of solvent, Single and multistage extraction: Cocurrent and cross current extraction; Leaching: Single stage leaching, Extraction and leaching equipments, Overview of bioleaching.

Theory: 45 hrs  Total Hours : 45

REFERENCES:

OTHER REFERENCES:
Objectives:
- To learn about the general concepts of immune system and immune organs
- To understand the properties of antigens and antibodies and the concept of antigen-antibody interactions
- To know about the mechanisms related to cell mediated immunity, complement system, hypersensitivity and transplantation immunology.

Course Outcomes:
CO1: Outline the general concepts of immune system and describe the cells and organs of the immune system
CO2: Describe the properties of antigens and antibodies with special emphasis on haptens
CO3: Demonstrate various antigen-antibody interactions and techniques
CO4: Explain the concept of cell mediated immunity and complement system
CO5: Illustrate the mechanisms behind hypersensitivity and transplantation immunology

Pre-requisite:
1. U14BTT404 Cell and molecular biology

CO/PO Mapping
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Signature of the BOS chairman/Biotechnology
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Course Content

**CELLS AND ORGANS OF IMMUNE SYSTEM 9 Hours**
Historical background, general concepts of the immune system. Innate and adaptive immunity. Structure, properties and functions of the immune cells & organs: Hematopoeisis, T and B-lymphocytes, NK cells; Monocytes and macrophages; Neutrophils, eosinophils, and basophils. Mast cells and dendritic cells. Thymus and bone marrow; Lymph nodes, spleen, MALT, GALT and CALT.

**ANTIGENS AND ANTIBODIES 9 Hours**
Antigens and haptens; Properties; Adjuvants. B and T cell epitopes. T-dependent and T-independent antigens. Antibodies: Classification, Structure, function and properties of the antibodies; Antibody as B cell receptor, antigenic determinants on antibodies (isotype, allotype and idiootype).

**TECHNIQUES OF ANTIGEN-ANTIBODY INTERACTIONS 9 Hours**
Immunological principles of various reactions and techniques: Affinity and avidity, cross reactivity, precipitation, agglutination, immunodiffusion, immunoelectrophoresis, ELISA -types, Western Blotting. Hybridoma technology-Monoclonal antibodies production and applications.

**CELL MEDIATED IMMUNITY & COMPLEMENT 9 Hours**
Major histocompatibility gene complex: Organization of MHC-Types and Functions, Structure and cellular distribution of HLA antigens. Cell mediated immunity: Cell types (CTLs, NK cells, macrophages and TDTH cells), effector mechanisms and effector molecules of cell mediated
Hypersensitivity: Types and mechanism of hypersensitive reactions


Case study - Tumor immunology

Theory: 45 hrs

Total Hours: 45

REFERENCES:

OTHER REFERENCES:
1 http://www.raymondcheong.com/Year1/immuno.html
3 http://www.umich.edu/~bmsteach/lopatin/Immunology/Immunology.html
Objective(s):
- To learn the fundamentals of plant and animal tissue culture.
- To study plant and animal transgenesis.
- To learn gene transfer techniques

Course Outcomes:
CO1 : Outline and learn the basics of plant and tissue culture and requirements to setup the lab
CO2 : Distinguish the direct and indirect gene transfer techniques in plants and animal cells
CO3 : Apply the techniques for development of transgenic plants and animal
CO4 : Outline and learn the basics of plant animal cell cultures and medium for growth
CO5 : Distinguish and apply the techniques for development of transgenic plants and animals

Pre-requisite:
1  U14BTT201 Biomolecules and Genetics
2  U14BTT302 Microbiology
3  U14BTT404 Cell and Molecular Biology

CO/PO Mapping

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S-Strong, M-Medium, W-Weak
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Course Content

**GENERAL REQUIREMENTS FOR CELL CULTURE** 9 Hours
Maintenance- Aseptic Laboratory, Aseptic workstation; Precautions to maintain aseptic conditions; challenges in tissue culture; Scope and importance in plant and animal tissue culture; biosafety in cell culture lab.

**PLANT TISSUE CULTURE** 9 Hours
Plant growth regulators; Preparation of stock solutions- Macro and micro minerals; culturing techniques- Anther culture; pollen culture; root tip culture and advantages and disadvantages; isolation of protoplast; fusion techniques.

**PLANT CELL CULTURE TECHNIQUES** 9 Hours
Types of tissue culture- Batch, continuous, cell suspension culture, anther culture, root and shoot tip culture, Hairy root culture; concept of turbido stat and chemo stat; Protoplast isolation and fusion; Callus induction and differentiation.

**MAMMALIAN CULTURE TECHNIQUES** 9 Hours
Scale-up and kinetics of growth and production formation, Serum and serum free media; Types of cell lines; primary culture and establishment of cell line; characterization of cell lines; Cell culture techniques; Measurement of cell death; Cell synchronization, scescene and apoptosis, Measurement of viability and cytotoxicity.; Immobilized cultures; Genetic engineering in animal cell culture; Hybridoma technology.

**BIOENGINEERING OF CELL CULTURE** 9 Hours
Bioreactor engineering for recombinant protein production from plant suspension culture, Molecular pharming; Applications for producing fine chemicals, drugs, and alternative fuels.

**Theory: 45 hrs**

**Total Hours : 45**
REFERENCES:

OTHER REFERENCES:
1  http://www.ncbi.nlm.nih.gov/books/NBK26851/
2  http://www.biotechnology4u.com/question_bank_question_answer.html
Objective(s):
- To gain hands on experience in amplifying a gene
- To acquire skill preparing recombinant DNA molecule
- To perform DNA fingerprinting using RAPD

Course Outcomes:
CO1: Design and set up plant tissue culture lab.
CO2: Construct and analyse explants preparation and induction of callus
CO3: Analyse cell viability test
CO4: Apply basic knowledge on extraction and quantification of metabolites from cell lines
CO5: Execute preparation and preservation of cell line

Pre-requisite:
1 U14BTP403 Cell and Molecular Biology Lab.

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Signature of the BOS chairman/Biotechnology
Course Content

**PLANT CELL CULTURE**

1. Media Preparation and Sterilization
2. Selection of explants and Induction of callus from explants
3. Regeneration of plants from callus and hardening
4. Preparation of Suspension cultures for secondary metabolite production
5. Protoplast isolation and viability staining

**ANIMAL CELL CULTURE**

6. Animal cell culture media preparation and sterilization
7. Establishment of primary cell line and cell culture
8. Cell viability (Tryphan Blue assay) and cytotoxicity test- (MTT assay)
9. Apoptosis in mouse thymus cells by acridium orange and propidium iodide staining
10. Cryopreservation of animal cells
11. Recovery and purification of industrially importance metabolite from animal cell culture.

**Theory:** Nil  
**Practical 45 Hours**  
**Total Hours : 45**

**REFERENCES:**


**OTHER REFERENCES:**

Objectives:
- Provide hands-on training on the assay of different enzymes and kinetics
- To familiarize the students with solid state fermentation and its applications
- To expose the students to the proper handling of fermenters

Course Outcomes:
CO1: Illustrate partial purification of enzymes
CO2: Analysis of enzyme activity with soluble enzymes and immobilized enzyme
CO3: Explain the production and applications of enzymes
CO4: Demonstrate the bioreactor and modes of operation

Pre-requisite:
1. U14BTP302 Microbiology Lab.
2. U14BTP301 Biochemistry lab.

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Signature of the BOS chairman/Biotechnology
Course Content
1. Isolation of industrially important microbes
2. Production of enzymes by SmF / SSF using industrial / agriculture residues
3. Enzyme assay - α-Galactosidase / Papain / Amylase / xylanase / cellulase
4. Partial purification of enzymes by acetone precipitation / Ultra-filtration
5. Enzyme kinetics – Michaelis-Menten parameters
6. Enzyme inhibition kinetics
7. Effect of temperature and pH on enzyme activity
8. Enzyme immobilization – Gel entrapment / cross-linking
9. Hydrolysis of raffinose and stachyose by immobilized α-galactosidase
10. Degradation of recalcitrant dyes with immobilized enzymes / cells
11. Introduction to fermenters (case study)

Practical: 45 Hours

Total Hours : 45

REFERENCES:
Objective(s):
- To gain hands on experience in amplify a gene
- To acquire skill preparing recombinant DNA molecule
- To perform DNA fingerprinting using RAPD

Course Outcomes:
CO1: Design primers for PCR and analyse PCR product
CO2: Construct and analyse a recombinant DNA from cloned DNA fragment
CO3: Analyse recombinant proteins
CO4: Apply PCR for disease diagnosis
CO5: Execute DNA fingerprinting technique to construct phylogenetic tree

Pre-requisite:
1 U14BTP403 Cell and Molecular Biology Lab

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

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Signature of the BOS chairman/Biotechnology
Course Content

1. PCR amplification of DNA fragment using gene (GFP gene) specific primers
2. Elution of DNA from agarose gel using silica column and calculation of Insert-vector ratio.
3. Ligation of a PCR product in T-vector
4. Preparation and Transformation of competent cells (BL21 (DE3) E.coli by heat-shock method
5. Selection of recombinant clones using blue & white selection
6. Confirmation of presence of insert in the recombinant clones by colony PCR
7. Optimization of inducer concentration for recombinant protein production
8. Recombinant protein purification and analysis in SDS-PAGE
9. Confirmation of recombinant protein using Western blotting
10. DNA fingerprinting by RAPD analysis (Bacteria)
11. Molecular diagnosis of viral/bacterial pathogen using PCR

Practical: 45 Hours

Total Hours : 45

REFERENCES:

OTHER REFERENCES:
**U14BTP504 IMMUNOLOGY LABORATORY**

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**Objectives:**

- To develop skills of students in Immunological techniques by performing simple experiments in the laboratory
- To perform techniques like blood grouping, ELISA, & identification of T-cell
- To study the applications of immunotechniques.

**Course Outcomes:**

- **CO1**: Learn to handle animals and prepare antigens.
- **CO2**: Identify blood cells and its components.
- **CO3**: Understand and apply Immunological techniques.
- **CO4**: Perform Immuno assay tests.
- **CO5**: Separation and identification immunological cells.

**Pre-requisite:**

1. U14BTP403 Cell and Molecular Biology Lab

**CO/PO Mapping**

(S-Strong, M-Medium, W-Weak)

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Signature of the BOS chairman/Biotechnology
**Course Content**

1. Selection of animals, Preparation of antigens, immunization and method of bleeding, Serum separation and storage
2. Blood smear identification of leucocytes by Giemsa stain
3. Ouchterlony Double Diffusion Test
4. Single radial diffusion test
5. Immunoelectrophoresis
6. Rocket Electrophoresis
7. Testing for typhoid antigens by Widal test
8. Identification of blood group
9. Separation of leucocytes by dextran method
10. Separation of mononuclear cells by Ficoll-Hypaque
11. Enzyme Linked Immuno Sorbent Assay (ELISA)

**Theory:** Nil  
**Practical:** 45hrs  
**Total Hours:** 45

**REFERENCES:**


**OTHER REFERENCES:**

1. https://sites.google.com/site/hoaisclassroom/classroom-news/labmanual-immunology
SEMESTER VI
U14BTT601  BIOPROCESS CONTROL AND AUTOMATION

Objective:
- To make the students understand the applications of process control in bioprocess engineering

Course Outcomes:
CO1: The students would understand basic principles of process control system.
CO2: The students would understand controllers and control elements in process control.
CO3: The students would design control system for bioreactors.
CO4: The students would apply knowledge on control system in bioprocess industries.
CO5: The students would apply knowledge on control system in bioreactors.

Pre-requisite:
1  U14BTT304 Biochemical Process Calculations
2  U14BTT403 Fluid and Particle Mechanics in Bioprocesses
3  U14BTT504 Heat and Mass Transfer in Bioprocesses

CO/PO Mapping
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Signature of the BOS chairman/Biotechnology
Course Content

LINEAR OPEN LOOP SYSTEMS 9 Hours

LINEAR CLOSED-LOOP SYSTEMS 9 Hours
The Control System, Controllers and Final Control Elements, Block Diagram of a Reactor Control System, Closed-Loop Transfer Functions, Transient Response of Simple Control Systems, Stability, Root Locus

FREQUENCY RESPONSE 9 Hours
Introduction to Frequency Response, Control System Design by Frequency Response

PROCESS APPLICATIONS 9 Hours
Advanced Control Strategies, Controller Tuning and Process Identification, Control Valves, Theoretical Analysis of Complex Processes

BIOPROCESS CONTROL 9 Hours
Basic configuration of bioreactors and their ancillaries, Online estimation and monitoring of pH, temperature, dissolved oxygen and liquid level in bioreactors, Stability analysis of bioreactors, Overview of piping and instrumentation diagram, distributed control system, programmable logic controllers and building automation system in bioreactors.

Theory: 45hours Total Hours: 45

REFERENCES:
2 Stephanopoulous, G., Chemical Process Control: An Introduction to Theory and Practice, Prentice Hall of India 1984
OTHER REFERENCES:
1  K. Krishnaswamy, “Process Control” New Age International. 2007
4  https://noppa.aalto.fi/noppa/kurssi/as-84.3165/materiaali/AS-84_3165_part_5_-_alford___advances_and_challenges_2.pdf
Objectives:
- To learn the various topologies of supersecondary, tertiary and quaternary structures
- To understand the relationship between protein structure and function using some models
- To learn the fundamentals of protein engineering and design

Course Outcomes:
CO1: Explain and analyze the secondary and supersecondary structural features
CO2: Discuss and distinguish the tertiary structure with quaternary structure of proteins
CO3: Demonstrate the protein–non-protein interactions
CO4: Understand the basics and steps involved in protein engineering
CO5: Describe the protein engineering design to construct various proteins

Pre-requisite:
1. U14CHT101 Engineering Chemistry
2. U14BTT201 Biomolecules and Genetics
3. U14BTT501 Genetic Engineering

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Course Content

SECONDARY AND SUPER SECONDARY STRUCTURES 9 Hours
Primary structure - Insulin; Secondary structures- Alpha (keratin), beta (silk fibroin) and loop structures, Structure of collagen; Super secondary structures - Helix-turn-helix, hairpin β motif, Greek key motif, Beta-alpha-beta motif and topology diagrams; Ramachandran plot.

TERTIARY AND QUATERNARY STRUCTURES 9 Hours
Tertiary structure – types of different domains (α, β and α / β); α domain – Coiled to coil structure and Four helix bundle; β domain – up and down, Greek key and jelly roll barrels; α / β domains – TIM barrel, glycolate oxidase, methyl malonyl CoA mutase, Rossman fold and Horseshoe fold; Protein folding – role of molecular chaperones, protein disulphide isomerase and peptidyl prolyl cis-trans isomerase; Quaternary structure- Modular nature and formation of complexes.

PROTEIN STRUCTURE-FUNCTION RELATIONSHIP 9 Hours
DNA-binding proteins- Prokaryotic transcription factors, helix-turn-helix motif of Trp- repressor & Cro protein in DNA binding; Eukaryotic transcription factors- TATA box-binding proteins, TFIIA and TFIIB; Homeodomain; Zn-fingers; Membrane Proteins: General characteristics, K-Channel, Bacteriorhodopsin, and Photosynthetic reaction center.

FUNDAMENTALS OF PROTEIN ENGINEERING 9 Hours
Introduction; Strategies for protein engineering – rational and de novo design; strategies to improve the protein stability; Site directed mutagenesis - M13, plasmid DNA, error prone PCR, nucleotide analogs, phage display and DNA shuffling; Solvent engineering - Lipase.
PROTEIN ENGINEERING DESIGN

Protein engineering design - Thermal stability of T4-lysozyme, prevention of insulin aggregation, Ras proteins and pertussis and E. coli heat labile toxin; *In silico* engineering of proteins; Abzymes; Enzymes - Understanding catalytic design by engineering alcohol dehydrogenase and β-glycoside hydrolases; Streptavidin & STREP-tag for affinity purification; Antibody engineering - introduction and production of recombinant bispecific antibodies

**Case study:** Design and expression of heterologous protein (insulin) in *Pichia pastoris*

**Theory: 45 Hours**

**Total Hours : 45**

**REFERENCES:**

OTHER REFERENCES:
1  http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2763986/
2  www.niscair.res.in/sciencecommunication/ResearchJournals/rejour/ijbt/ijbt2k6/ijbt_july06.asp
3  http://books.google.co.in/books?id=x0UyTLIhWSAC&pg=PA227&source=gbs_toc_r&cad=3#v=onepage&q&f=false
4  http://books.google.co.in/books/about/Antibody_Engineering.html?id=x0UyTLIhWSAC
Objective:
- To understand the importance of drug control, standard and manufacture process

Course Outcomes:

CO1: Outline drug standards and pharmacopoeia commission
CO2: Describe the principles of drug action and mechanism of action
CO3: Discuss and obtain knowledge on the drug development and manufacture process
CO4: Explain the principles and materials involved during the drug manufacture in pharmaceutical industries
CO5: Discuss the clinical uses of biopharmaceutical therapeutics

Pre-requisite:
1. U14BTT302 Microbiology
2. U14BTT505 Immunology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Signature of the BOS chairman/Biotechnology
Course Content

OVERVIEW OF PHARMACEUTICALS 9 Hours
Introduction to drugs and pharmacy: History of pharmacy & pharmaceutical industry, age of biopharmaceutical, drug standards (United States Pharmacopeia & Indian Pharmacopeia), Drug regulation and control- Food and Drug Administration (FDA), New Drug Application (NDA), Indian Pharmacopoeia commission (IPC).

PHarmacokinetics AND PRINCIPLES OF DRUG ACTION 9 Hours
Route of drug administration - Enteral and parenteral, Pharmacokinetics - Drug Absorption, Distribution, Metabolism and Elimination (ADME); factors influencing ADME process; Pharmacodynamics – basic principles of drug action, Mechanism of drug action, through enzymes, drug receptor interactions; radiopharmaceutical.

DRUG DEVELOPMENT AND MANUFACTURE PROCESS 9 Hours
New Drug development: Drug discovery, patenting, preclinical and clinical trials, and regulatory authorities; Manufacturing process: special manufacturing facilities, sources of biopharmaceuticals, production of final product and analysis of the final product. Good Manufacturing Practice (GMP).

PRINCIPLES OF DRUG MANUFACTURE IN PHARMACEUTICALS 9 Hours
Dosage form design: Need for dosage forms, General considerations in Dosage form design; Solid dosage forms – powders, granules, capsules and tablets; Semisolid dosage forms – ointments, creams and gels; transdermal drug delivery system; Pharmaceutical inserts – suppositories and inserts; Liquid dosage forms – solutions; Sterile dosage forms – parenteral (injections), Biologics (vaccine).
BIOPHARMACEUTICAL THERAPEUTICS AND CLINICAL USES

Theory: 45 Hours

REFERENCES:

OTHER REFERENCES
3 http://watcut.uwaterloo.ca/webnotes/Pharmacology/
Objective:
- To enable the students understand the bioreactor analysis and design

Course Outcomes:
CO1: The students would remember and understand the basic principles of reaction mechanism and kinetics.
CO2: The students would apply non-ideal systems in bioreactors
CO3: The students would design single bioreactors for submerged fermentation
CO4: The students would design multiple bioreactors for submerged fermentation
CO5: The students would design bioreactors from mechanical aspects

Pre-requisite:
1. U14BTT304 Biochemical Process Calculations
2. U14BTT403 Fluid And Particle Mechanics in Bioprocesses
3. U14BTT504 Heat And Mass Transfer in Bioprocesses

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Signature of the BOS chairman/Biotechnology
Course Content

REACTION KINETICS IN REACTORS  
9 Hours
Search for enzymatic and microbial reaction mechanism, Methods of analyzing batch reactor data - Integral and differential, Analysis of total pressure data obtained in constant and variable volume system; Performance equations of ideal batch, plug and mixed flow reactors, Space time and Space velocity.

IDEAL AND NON-IDEAL REACTORS  
9 Hours
Size comparison of single and multiple reactor systems, Reactors for autocatalytic reactions, recycle reactors, ills of bioreactors, RTD- E and F in bioreactor design, Models for Non ideal flow, Applications of RTD based models to Non ideal reactors.

BIOREACTOR DESIGN FOR SUBMERGED  
FERMENTATION
9 Hours
Batch bioreactor, Continuous flow stirred tank bioreactor, Plug flow tubular bioreactor and Recycle reactor

BIOREACTOR DESIGN FOR ENZYME REACTION AND  
IMMOBILISED CELLS
9 Hours
Multistage and semicontinuous bioreactors, Analysis of film and pore diffusion effects on kinetics of immobilized enzyme reactions, formulation of dimensionless groups and calculation of effectiveness factors, Design of immobilized packed bed, fluidized bed and membrane reactors.

MECHANICAL ASPECTS OF BIOREACTOR DESIGN  
9 Hours
Guidelines for bioreactor design, bioreactor vessels, bioreactor assembly

Theory:45 Hours

Total Hours :45

REFERENCES:
2  Levenspiel, Octave, “Chemical Reaction Engineering”, 3rd Edition,


OTHER REFERENCES:


2 www.academia.edu/5278317/Bioreactors_Design_and_Analysis

3 oaji.net/articles/2014/215-1402978704.pdf

4 http://nptel.ac.in/syllabus/syllabus.php?subjectId=103107079
Objective:
- To learn about food and nutrients
- To understand the role of functional foods
- To know the strategies to produce specific food ingredients

Course Outcomes:
CO1: Describe about food and nutrients.
CO2: Explain the expanding role of functional foods and nutraceuticals in the promotion of human health and nutrition.
CO3: Perceive the advantages and disadvantages of probiotics and prebiotics.
CO4: Enable students to modify foods using biotechnology.
CO5: Learn the strategies to produce specific food ingredients.

Pre-requisite:
1. U14BTT303 Concepts in Industrial Biotechnology
2. U14BTT302 Microbiology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Signature of the BOS chairman/Biotechnology
Course Content

THE RELATIONSHIP BETWEEN FOOD AND HEALTH  9 Hours
Food: definition; five food groups; Nutrition: Balanced diet, Essential amino acids and fatty acids, PER, Water soluble and fat soluble vitamins, Role of minerals in nutrition, Antinutrients, Nutrition deficiency diseases. – Diabetes mellitus, marasmus, Kwashiokar, scurvy, Beri-beri, Rickets.

FUNCTIONAL FOODS AND NUTRACEUTICALS  9 Hours

PROBIOTICS AND PREBIOTICS  9 Hours
Probiotics – definition, potential benefits, strains, advantages and disadvantage, genomics of probiotic lactic acid bacteria: impact on functional foods; prebiotics: definition, types of new prebiotics and their bifidogenic effects, health effects of prebiotics and synbiotics.

BIOTECHNOLOGICAL APPROACHES TO MODIFY FOOD  9 Hours
Modern biotechnology for the production of dairy products; Modification of poultry and egg: genetic modification of the birds for meat and egg types birds, Bacterial food additives and dietary supplements; biotechnological modification of Saccharomyces cerevisiae. Biotechnological approaches to improve nutritional quality and shelf life of fruits and vegetables.

FOOD SAFETY AND QUALITY CONTROL  9 Hours

Theory: 45 Hours  Total Hours: 45
REFERENCES:

OTHER REFERENCES:
1 Potter N, *Food science*. CBS publishers & distributors, Delhi, 1996.
U14GST007  PROFESSIONAL ETHICS

Objectives:
- To create an awareness on Engineering Ethics and its use in ones profession
- To instil moral values, social values and loyalty
- To provide an insight into ones professional rights and a view of professional ethics in the global context

Course Outcomes:
CO1: Understand the basics of measurements and different extraction methodologies, and their applications in biotechnology
CO2: Describe the instrumentation and applications of specialized molecular spectroscopic techniques
CO3: Demonstrate the principles and techniques of chromatography and electroanalytical methods and their applications in biotechnology
CO4: Explain the various electrophoretic techniques and their applications in biotechnology
CO5: Understand and interpret the various structural elucidation and radioisotope methods

Pre-requisite:
1 Nil

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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ENGINEERING ETHICS AND THEORIES 9 hours
Definition, Moral issues, Types of inquiry, Morality and issues of morality, Kohlberg and Gilligan’s theories, consensus and controversy, Professional and professionalism, moral reasoning and ethical theories, virtues, professional responsibility, integrity, self respect, duty ethics, ethical rights, self interest, egos, moral obligations.

SOCIAL ETHICS AND ENGINEERING AS SOCIAL EXPERIMENTATION 9 hours
Engineering as social experimentation, codes of ethics, Legal aspects of social ethics, the challenger case study, Engineers duty to society and environment.

SAFETY 9 hours

RESPONSIBILITIES AND RIGHTS OF ENGINEERS 9 hours

GLOBAL ISSUES AND ENGINEERS AS MANAGERS, CONSULTANTS AND LEADERS 9 hours
Multinational Corporations – Environmental ethics – computer ethics – weapons development – engineers as managers – consulting engineers – engineers as expert witnesses and advisors – moral leadership – Engineers as trend setters for global values.

Theory: 45 Hours  
Total Hours :45
REFERENCES:
Objective(s):

- Provide hands-on training on the operation of fermenters
- To familiarize the students with microbial growth kinetics
- To know mass transfer in fermenters and production of metabolites

Course Outcomes:

CO1: Analysis of microbial growth in batch, fed-batch and continuous cultivation

CO2: Analyze and interpret the results of estimation of $K_La$ by different methods

CO3: Explain medium optimization methods in biotechnology research

CO4: Demonstrate the production of metabolites

Pre-requisite:
1. UBTP502 Enzyme technology lab.
2. UBTP302 Microbiology lab.

CO/PO Mapping

S-Strong, M-Medium, W-Weak

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Course Assessment methods:

Direct

1. Model examination
2. End semester examination

Indirect

1. Course end survey
2. Faculty survey
3. Industry
4. Alumni
Course Content
1. Batch sterilization design
2. Batch cultivation - calculation of $\mu$ and product formation rate (Yp/s)
3. Fed-batch cultivation - calculation of $\mu$ and product formation rate (Yp/s)
4. Continuous cultivation - calculation of $\mu$ and product formation rate (Yp/s)
5. Medium optimization by Plackett-Burman design
6. Estimation of $K_{L_a}$ – power correlation method
7. Estimation of $K_{L_a}$ – sulfite oxidation method / dynamic gassing method
8. Residence Time Distribution (RTD)
9. Production of microbial metabolites (enzymes / antibiotics) in bioreactors
10. Production of biofertilizers / biopesticides / mushroom
11. Medium optimization by response surface methodology (RSM)

Practical: 45 Hours

Total Hours : 45

REFERENCES:
BIOPROCESS DESIGN AND SIMULATION LABORATORY

Objective:
- Provide hands-on training on the operation of fermenters
- To familiarize the students with microbial growth kinetics
- To know mass transfer in fermenters and production of metabolites

Course Outcomes:
- CO1: Provide hands-on training on the operation of fermenters
- CO2: To familiarize the students with microbial growth kinetics
- CO3: To know mass transfer in fermenters and production of metabolites
- CO4: Provide hands-on training on SuperPro Designer

Pre-requisite:
1 UBTP402 Unit Operations Lab

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Signature of the BOS chairman/Biotechnology
Course Content

1. Introduction to process flowsheeting and simulation
2. Model assisted design and simulation of enzyme production by submerged fermentation (SmF)
3. Model assisted design and simulation of enzyme production by solid state fermentation (SSF)
4. Model assisted design and simulation of biodiesel production from degummed oil
5. Model assisted design and simulation of bioethanol production from corn
6. Model assisted design and simulation of manufacturing Clopidogrel (CPG)
7. Modelling and simulation of FructosylTransferase
8. Modelling and simulation of oil production from algae
9. Modelling and simulation of Human insulin production
10. Modelling and simulation of citric acid production
11. Modelling and simulation of therapeutic monoclonal antibody production

Practical: 45 Hours

Total Hours: 45

REFERENCES:

OTHER REFERENCES
1 www.biosep.ou.edu
2 www.intelligen.com/literature.html
U14ENP401 COMMUNICATION SKILLS LABORATORY

(Common to all branches of Engineering and Technology)

OBJECTIVES

- To impart communicative ability to exhibit the individual’s subject knowledge
- To achieve the desirable communicative competence by the students to meet the expectation of corporate
- To show the need for a comprehensive link language to share subject expertise
- To offer adequate exposure to soft skills needed for the corporate.
- To sensitize towards corporate culture.

COURSE OUTCOMES

CO1: Imparting the role of communicative ability as one of the softskills needed for placement
CO2: Developing communicative ability and softskills needed for placement
CO3: Making students Industry-Ready through inculcating team-playing capacity

Prerequisite course: U14ENT101 Functional English

CO/PO Mapping

S-Strong, M-Medium, W-Weak

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Signature of the BOS chairman/Biotechnology
GRAMMAR IN COMMUNICATION 9 hours
Grammar and Usage – Building Blocks, Homonyms, Subject and Verb Agreement, Error Correction - Grammar Application, Framing Questions – Question words, Verbal Questions, Tags, Giving Replies – Types of Sentences, Listening Comprehension – Listening and Ear training.

ASSERTIVE COMMUNICATION 9 hours
Listening Comprehension in Cross-Cultural Ambience, Telephonic Conversations/Etiquette, Role Play Activities, Dramatizing Situations-Extempore – Idioms and Phrases.

CORPORATE COMMUNICATION 9 hours

PUBLIC SPEAKING 9 hours
Giving Seminars and Presentations, Nuances of Addressing a Gathering - one to one/ one to a few/ one to many, Communication Process, Visual Aids & their Preparation, Accent Neutralization, Analyzing the Audience, Nonverbal Communication.

INTERVIEW & GD TECHNIQUES 9 hours

REFERENCES:
SEMESTER VII
Objective(s):
- To understand the significance of string alignment
- To construct the phylogenetic tree
- To understand the fundamentals of protein structure prediction and microarray analysis

Course Outcomes:
CO1: Explain various types of network protocols and biological databases
CO2: Demonstrate and interpret the string matching and dynamic program algorithms of macromolecular strings
CO3: Apply, solve and interpret the heuristics based pairwise and multiple sequence analysis of macromolecules
CO4: Construct and interpret the molecular phylogenetic trees
CO5: Predict and understand the gene and protein structures, and microarrays

Pre-requisite:
1. U14BTT201 Biomolecules and Genetics
2. U14BTT404 Cell and Molecular
3. U14BTT602 Protein structure and Engineering
4. U14BTT603 Biopharmaceutical Technology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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**Course Assessment methods:**

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**Course Content**

**BIOLOGICAL DATABASES**  
9 Hours
Operating systems- types; UNIX commands; Network Protocols – OSI, TCP/IP and ftp; Introduction to databases – Biological databases; Primary nucleotide databases (EMBL, GeneBank and DDBJ); Primary protein databases (SwissProt, TrEMBL and PIR); Composite protein sequence database – OWL and NRDB; Secondary protein databases (PROSITE, BLOCKS and Profiles); Structural databases – SCOP and CATH.

**STRING MATCHING AND DYNAMIC PROGRAMMING**  
9 Hours
Introduction to strings; substrings; Concepts of identity, similarity and INDEL; Biological significance of gaps and types of gap penalties; Introduction to Naïve and Boyer – Moore algorithm; Algorithm of dot matrix analysis; Introduction to pairwise sequence alignment – local vs. global; Dynamic programming – Needleman –Wunsch algorithm & Smith – Waterman algorithm; Parametric and suboptimal alignments.

**DATABASE SEARCH ALGORITHMS**  
9 Hours
Substitution matrices – PAM and BLOSUM; Position specific scoring matrices (PSSM); Heuristic methods – Algorithm and applications of FASTA, BLAST and PSI BLAST; Multiple sequence alignment (msa) – Sums of pairs method (SP), CLUSTAL W and PILEUP; Introduction to iterative msa methods; SAGA; Expectation – Maximization (EM) algorithm; Machine learning – Hidden Markov models.
PHYLOGENY ANALYSIS AND GENE PREDICTION 9 Hours
Molecular Clock theory (old and new); Jukes-Cantor and Kimura’s model; Distance matrix methods – Unweighted pair group method of arithmetic mean (UPGMA) algorithm, Fitch-Margoliasch algorithm (FM), Neighbor – Joining method (NJ); Character based methods – Maximum parsimony and maximum likelihood; Bootstrapping technique; Prokaryotic and eukaryotic gene prediction methods – Feature and homology based methods.

STRUCTURE PREDICTION OF PROTEINS 9 Hours
Micro array analysis – Spotted and oligonucleotide arrays; Clustering gene expression profiles – Hierarchical clustering, Nearest neighboring clustering and Unweighted pair group clustering; Protein secondary structure prediction – Chow-Fasman method, GOR method, ab initio approach and threading method; Systems biology – Introduction to metabolic pathways; Introduction to computer aided drug design (CAD).

Theory: 45 Hrs  Total Hours: 45

REFERENCES:
OTHER REFERENCES:
1 http://mally.stanford.edu/~sr/computing/basic-unix.html
2 http://www.avatar.se/molbioinfo2001/seqali-dyn.html
6 http://nptel.ac.in/courses.php
7 http://nptel.ac.in/downloads/102103044/
U14BTT702  DOWNSTREAM PROCESSING

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Objective:
- To provide an insightful overview of the fundamentals of downstream processing for biochemical product recovery

Course Outcomes:
CO1: Understanding of different stages of downstream processing
CO2: Illustrate the solid-liquid unit operation involved in downstream processing
CO3: Knowledge of principles and working of different unit operations for the isolation and extraction of bio-products
CO4: Describe the various methods of chromatography used in protein purification
CO5: Knowledge of different methods and industrial equipments used for the concentration, purification and final polishing of bio-products at the industrial level

Pre-requisite:
1  U14BTT503 Principles of Bioprocess Engineering
2  U14BTT504 Heat and Mass Transfer in Bioprocesses
3  U14BTT502 Enzyme Technology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Course Content

Introduction to Downstream Processing and primary separation 9 Hours

Introduction to Downstream processing principles, Characteristics of Biomolecules and bioprocesses. Cell disruption methods for intracellular products release: Mechanical methods, Chemical and Enzymatic methods. Unit operations for solid-liquid separation—Filtration (General theory for filtration, Types of equipments, batch-continuous, pretreatment methods) and Centrifugation (General theory for Centrifugation, Types of centrifuges, Scale-up of centrifugation, centrifugal filtration)

ENRICHMENT OPERATIONS 9 Hours

Adsorption, Extractive separation: Solvent extraction, Aqueous Two Phase and Three Phase Extractions, Reverse Micelle Extraction, Super Critical Extraction. Precipitation methods: Salts, Organic solvents and polymers, Membrane Based Separation: Ultrafiltration, Reverse Osmosis, Dialysis and Electrodialysis

PRODUCT PURIFICATION 9 Hours


PRODUCT POLISHING 9 Hours

Crystallization: Methods of super saturation, types of nucleation and crystal growth, Material and energy balance, yield of crystal, Types of crystallization and equipments. Drying: types of moistures, batch drying process, mechanism of drying, drying time calculation, drying equipments
ANALYSIS OF THE FINAL PRODUCT 
FORMULATION
5 Hours

Analysis of the final product - Protein-based contaminants, Removal of altered forms of the protein of interest from the product stream, Product potency, Detection of protein-based product impurities: High-pressure liquid chromatography (HPLC), Mass spectrometry, Immunological approaches to detection of contaminants, Amino acid analysis, Peptide mapping, N-terminal sequencing, Analysis of secondary and tertiary structure, Endotoxin and other pyrogenic contaminants, Endotoxin - the molecule, Pyrogen detection, DNA, Microbial and viral contaminants, Viral assays, Miscellaneous contaminants, Validation studies.

ANALYSIS OF THE FINAL PRODUCT 
FORMULATION
4 Hours

Some influences that can alter the biological activity of proteins: Proteolytic degradation and alteration of sugar side-chains, Protein deamidation, Oxidation and disulfide exchange, Stabilizing excipients used in final product formulations, Final product fill, Freeze-drying, labelling and packing.

Theory: 45 Hours

Total Hours: 45

REFERENCES:


**OTHER REFERENCES:**
1 Scopes, R.K, Protein Purification – Principles and Practice, 2nd ed. Narosa Publications, 2005
3 http://nptel.ac.in/courses/102106022/
Objective:
- Student will understand the regulatory practices formulated for manufacturing biologicals

Course Outcomes:
- CO1: Understand the regulatory processes and bodies
- CO2: Describe good laboratory practices
- CO3: Explain quality assurance
- CO4: Understand concepts of monitoring quality control
- CO5: Describe validation principles as applied to biomanufacturing

Pre-requisite:
1 U14BTT603 Biopharmaceutical Technology

CO/PO Mapping
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Programme Outcomes(POs)

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Course Content

REGULATORY BODIES  9 Hours
National Regulatory requirements: National Drug Policy, Drugs and Cosmetics Act and its amendments, overview of schedules, detail study of schedule M and Schedule Y. International regulation: USFDA, FDA guidelines on IND, NDA and ANDA approvals, and SUPAC changes and understanding on 505 (b) (2) applications

GOOD LABORATORY PRACTIVES  9 Hours
Requirement of GLP Guidance and recommendation on Dissolution and Bio-equivalence requirement. Types of ANDA filing (Para I, II, III, IV filing). Exclusivities (NCE, NS, NP, NDF, PED, ODE, PC) ICH objectives and Guidelines- stability testing, WHO guidelines, ISOs- Production design, certification. ICH 8(QbD), ICH Q9 and ICHQ10

QUALITY ASSURANCE PROCESS  9 Hours
Concepts of Quality Assurance, Total Quality Management, Philosophy of GMP and cGMP Preparation of audit, Conducting audit, Audit Analysis, Audit Report and Audit follow up

QUALITY CONTROL IN BIOMANUFACTURING  9 Hours
Organization and personnel, responsibilities, training hygiene, Premises: Location, design, plan Layout, construction, maintenance and sanitations, environmental control, sterile areas, control of contamination. Equipments: Selection, purchase specifications, maintenance, clean in place (CIP), sterilize in place (SIP). Raw materials: Purchase specifications, maintenance of stores, selection of vendors, controls and raw materials, Packaging and labeling controls, line clearance and other packaging materials

MONITORING QUALITY CONTROL  9 Hours
Quality Control Laboratory: Responsibilities, good laboratory practices, routine controls, instruments, protocols, non-clinical testing, controls on animal house, data generation and storage. Manufacturing documents, Master Formula, Batch Formula, Records, Standard Operating Procedures, In process quality control on various dosage forms sterile and biological
products, standard operating procedures for various operations like cleaning, filling drying, compression, coating, disinfection, sterilization, membrane filtration, Guidelines for Quality Assurance of Human Blood Products and large volume parenterals

**CONCEPTS OF VALIDATION**  
9 Hours
Types of validation, Master plan, protocol for process validation, cleaning validation, validation of air handling, validation of equipment and facilities in sterile and non-sterile areas. Prevalidation activities, Protocol preparation, Protocol execution, Deviations and change controls, summary and certification. Revalidation

**Theory: 45 Hours**  
**Total Hours : 45**

**REFERENCES:**
2. D.H. Shah, *SOP Guidelines*
4. C.V.S.Subramanyam, *Drug regulatory affairs*
5. Manohar A.Potdar, *Current good manufacturing practices for pharmaceuticals*
U14BTT704  INDUSTRIAL BIOSAFETY AND BIOETHICS

Objectives:
- To provide knowledge on various aspects of Industrial biosafety
- To learn procedures and guidelines for biosafety
- To learn concepts of bioethics

Course Outcomes:
CO1 : Students able to understand risks and different accidents at industrial level.
CO2 : Students should understand types of level of biosafety.
CO3 : Students should learn FDA and biosafety guidelines.
CO4 : Students can able to learn GMO’s and its regulation in environmental release
CO5 : Students should understand ethical issues and its guideline.

Pre-requisite:
1. U14BTT302 Microbiology;
2. U14BTT501 Genetic engineering;
3. U14BTT603 Biopharmaceutical technology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Course Content

**INDUSTRIAL BIOSAFETY** 9 Hours
Introduction to Biosafety; Causes- classification, identification of hazards; issues handling; aware of accidents at industrial level; types of accidents; first aid, precautionary measure. Clean room procedures- Classification specification; Personal protective equipments working with biohazards; Proper gowering and hygiene for clean room work; Behavioral requirements in a controlled environment. Basic methods for safe handling, transport, and storage of biological and chemical materials; Equipment related hazards; safe laboratory techniques; Contingency plan and emergency procedures.

**LEVELS OF BIOSAFETY** 9 Hours
Introduction to Biological safety cabinets; Horizontal & *Vertical Laminar Air Flow Cabine*; Fume hood; Primary and secondary containments; Biosafety levels of specific Microorganisms (food and water borne pathogens), Infectious Agents (Chemicals and carcinogens); MSDS- Material Safety Data Sheet- Understanding, and infected animals (test animals).

**FDA AND FPO BIOSAFETY GUIDELINES** 9 Hours
FDA guideline and approval; FPO specification and guidelines for food products; GOI - Biosafety procedure, time frames and specification for Production and manufacturing industries- Case study.
INTRODUCTION TO BIOETHICS 9 Hours
Definition of bioethics; Environmental release of GMOs- Risk analysis, Risk assessment, Risk management and Communication; Precaution before and after environmental release of GMO’s – case study.

REGULATORY AFFAIRS 9 Hours
Overview of national regulation and international agreement on GMO; Cartagena protocol- articles; Ethical committee- administration channel; Role of NIH, IACUC,IBSC

Theory: 44 Hours  Case study: 1 Hour  Total Hours : 45

REFERENCES:
1 Deepa Goel and Ms Shomini Parashar , (2013) IPR, Biosafety and Bioethics, Pearson Education publisher.

OTHER REFERENCES:
1 https://cgspace.cgiar.org/bitstream/handle/10568/832/ILRI%20Intellectual%20Property%20Policy.pdf?sequence=1
2 http://ces.iisc.ernet.in/hpg/cesmg/iprdoc.html

Signature of the BOS chairman/Biotechnology
Objective:
- To teach the basic concepts of statistics with biological problems and introduce the significance of research

Course Outcomes:
- **CO1**: Understand the impact and significance of research
- **CO2**: Interpret the various methods of data collection
- **CO3**: Solve and interpret the biological problems using simple statistics
- **CO4**: Formulate and test the hypothesis of biological oriented problems
- **CO5**: Write a structured report

Pre-requisite:
1. U14MAT305 Probability and Applied Statistics

**CO/PO Mapping**

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Course Content

OVERVIEW OF RESEARCH  9 Hours
Objectives of research; Motivation in research; Types of research; Significance of research; Criteria of good research; Defining the research problem; Research design – need and basic principles;

METHODS OF DATA COLLECTION  9 Hours
Collection of primary data - observation and interview method; Collection of data through questionnaires; ; Collection of data through schedules; Other methods of data collection – warranty cards, pantry audits, consumer panel, use of mechanical devices, depth interviews and projective techniques; Collection of secondary data ; Characteristics of secondary data; Significance of case study.

BIOSTATISTICAL ANALYSIS  9 Hours
Arithmetic mean; Standard deviation; Coefficient of variation; standard error of mean; Correlation analysis; Regression analysis. [PROBLEMS ALONE SHOULD BE SOLVED]

HYPOTHESIS TESTING  9 Hours
Introduction; General concepts; Characteristics; Type I and II errors; Student’s t-Test; Chi square test; One way ANOVA; Multiple comparison post hoc tests; Two way ANOVA. [PROBLEMS ALONE SHOULD BE SOLVED].

WRITING A RESEARCH REPORT  9 Hours
Introduction; Types of report – Survey based and algorithmic report; Report format; Bibliography.

Theory:45 Hours Total Hours : 45

REFERENCES:
Objective(s):
- To understand, perform and interpret the pairwise sequence & multiple sequence alignment analysis
- To acquire skill in the construction of phylogenetic trees and to learn the basics of gene prediction methods
- To perform and gain experience in microarray analysis & docking techniques

Course Outcomes:
CO1 : Retrieve, align and interpret the macromolecular sequences (pairwise & multiple) using various methods
CO2 : Construct the molecular phylogenetic tree and correlate the similarity
CO3 : Predict gene and microarray analysis
CO4 : Write simple programs and carry out ligand-protein docking

Pre-requisite:
1 U14BTT201 Biomolecules and Genetics
2 U14BTT201 Advanced Bioinformatics

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Course Content

EXPERIMENTS:
1. Biological Databanks – Retrieval and annotation of macromolecular sequences and structures from the biodatabases
2. String matching and similarity analysis – Dot matrix method and Dynamic programming (EMBOSS)
3. Database search and sequence similarity analysis – FASTA, BLAST and PSI-BLAST
4. Multiple sequence alignment using CLUSTAL W or CLUSTAL OMEGA or MULTALIN
5. Molecular phylogeny analysis using PHYLIP or NCBI tools or EBI tools
6. Protein sequence analysis using ExPAsY
7. Gene prediction - GENSCAN
8. Molecular visualization of protein structure using RASMOL
9. Microarray analysis
10. Protein – ligand docking
11. Sequence analysis using Perl programming

Theory: Nil  Practical: 45 Hours  Total Hours : 45

REFERENCES:

OTHER REFERENCES:
1 Websites of NCBI, EBI, SWISS INSTITUTE OF BIOINFORMATICS, DDBJ etc.
Objective:
- To develop skills of students perform in various purification techniques used in separation of biomolecules

Course Outcomes:
CO1: Understanding of different stages of downstream processing
CO2: Illustrate the solid-liquid unit operation involved in downstream processing
CO3: Knowledge of principles and working of different unit operations for the isolation and extraction of bio-products
CO4: Describe the various methods of chromatography used in protein purification
CO5: Knowledge of different methods and industrial equipments used for the concentration, purification and final polishing of bio-products at the industrial level

Pre-requisite:
1 U14BTP601 Bioprocess Engineering Lab
2 U14BTP602 Bioprocess Designing and Stimulation Lab

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Course Content

1. Aqueous two phase extraction of biological samples
2. Solid liquid separation by microfiltration
3. Enzyme concentration by ultra filtration
4. Partial purification of enzymes using salt precipitation and cell disruption techniques
5. Purification of recombinant green fluorescent protein
6. Purification of His-tagged protein purification on Ni-Column
7. Purification of lysozyme using Ion exchange chromatography
8. Protein purification using gel filtration chromatography, shown on SDS-PAGE.
9. Assessing purity of enzyme(s)/protein(s) by SDS-PAGE
10. Purification of recombinant green fluorescent protein
11. Freeze-Drying of Yeast Cultures Lyophilization
12. Protein purification using High performance liquid chromatography (HPLC)
13. Evaluate the performance and drying characteristics of a laboratory scale spray dryer

Theory: Nil
Practical: 45 hrs
Total Hours: 45

REFERENCES:
Objective:
- To formulate a research problem and collect relevant literature

Course Outcomes:
CO1: Formulate an experimental design to solve biological problems
CO2: Conduct survey of literature
CO3: Scientific Presentation skills

Pre-requisite:
1. All previous courses

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Guidelines
1. Students should do carry out Project (Phase 1) under the guidance of a faculty member of the department
2. Evaluation will be done by an internal panel
SEMESTER-VIII
U14BTP801 PROJECT (Phase II)  

Objectives
- To obtain research proficiency in biotechnology

Course Outcomes:
CO1: Formulate an experimental design to solve biotechnological problems
CO2: Develop skills for independent & team oriented research and process innovation
CO3: Analyze, evaluate, interpret and justify an experimental data
CO4: Write a dissertation report

Prerequisite course: All Core and elective courses

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Guidelines
1. Evaluation will be via continuous review followed by an external members panel
ELECTIVES
Objective(s):  
- To learn the fundamentals of plant breeding tools  
- To study gene manipulation in plants.  
- To learn GM crops and their ethical issues.

Course Outcomes:  
CO1: Outline and learn the basics of plant breeding programs.  
CO2: Distinguish the mitochondrial genome and chloroplast genome  
CO3: Outline and learn gene manipulation in plants  
CO4: Apply the techniques for development of Hybrids, screening and selection procedure  
CO5: Understand GM crops and their ethical issues.

Pre-requisite:  
1. U14BTT404 Cell and Molecular Biology  
2. U14BTT501 Genetic Engineering  
3. U14BTT506 Mammalian and plant tissue culture  

CO/PO Mapping  
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Course Content

PLANT GENOME AND ORGANIZATION  9 Hours
Molecular and classical genetics in modern agriculture; plant genomes- the organization and expression of plant genes concept of genetic selection; Chloroplast and Mitochondria genome- Organization and expression (with examples)

CONCEPTS IN PLANT BREEDING  9 Hours
History- Mendelian principles (trihybrid ratio- 2 variables); concept of Green revolution; conventional practices for plant production; Selective and cross plant breeding programs; Plant breeding rights; classic genetic improvement- case study

PLANTS IMPROVEMENT  9 Hours
Improvement of crop yield and Quality (Molecular markers) screening of recombinants; application in agriculture and food industries; Transgenic plants- Biotic and abiotic stress development with examples- Case study.

PLANT BREEDING TECHNIQUES  9 Hours
Plant breeding tools; concept of Hybrid, cybrid-procedure and establishment; screening and selection of hybrids; concept of Male sterility- CMS,GMS,CGMS; Development of biotic and abiotic stress resistance plants.

GM CROPS AND ETHICAL ISSUES  9 Hours
Gene manipulation and their impacts (Environmental, cultural, ethical and socio economical issues); Environmental release of GMO’s; Role of IBSC (RCGM and GEAC); GM crops- Current status, concern about GM crops; Regulation of GM crops and products- Greener genetic engineering.

Theory:45 Hours  Total Hours :45
REFERENCES:
4 http://nptel.ac.in/courses/102103013/
5 http://www.lsic.ucla.edu/ls3/tutorials/gene_cloning.html
U14BTE102  CONCEPTS IN FOOD SCIENCE

Objective(s):
- To understand the basic nutrients of food
- To learn the effect of cooking on the constituents in food
- To know the process for producing various food products

Course Outcomes:
CO1: Describe about cereals and pulses and its effect on cooking.
CO2: Classify fruits and vegetables and their composition
CO3: Perceive the advantages of egg, poultry and meat.
CO4: Understand about milk, milk products and fats
CO5: Learn about sugar cookery, beverages and spices.

Pre-requisite:
1. U14BTT301 Concepts in Biochemistry
2. U14BTT302 Microbiology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Signature of the BOS chairman/Biotechnology
Course Content

CEREALS AND PULSES 9 Hours
Cereals - Rice & wheat and other Millets - Composition and Nutritive Value.
Pulses - Composition, types, Cooking methods, factors affecting cooking quality, nutritive value, toxic constituents and its removal, Germination and factors affecting Germination.

VEGETABLES AND FRUITS 9 Hours
Vegetables - Structure, Classification, Composition, Methods of Cooking, Changes on Cooking - pigments, Nutritive value.
Fruits - Structure, Classification, Composition, Ripening of fruits, changes on ripening, Pectic substances, Cooking changes.

EGG, MEAT AND FISH 9 Hours
Egg - Structure, Composition, Nutritive value, Grading, Methods of Cooking and Role of egg in cookery.
Meat - Structure, Composition, Nutritive value, Classes and Grades of meat cuts, Changes on cooking and Rigor mortis. Poultry - Composition, Nutritive value, Grades, Methods of cooking, Effects of cooking.
Fish - Composition, Nutritive value, Types, Cuts, Selection, Spoilage, Cooking and Factors effecting cooking quality.

MILK AND FAT 9 Hours
Fats & Oils - Types properties of fat relating to cooking, Rancidity, Tests
for radcidity, Hydrogenation, Changes in fat during heating, Factors affecting fat absorption, Shortening, Use of fat in tenderness of cooked products.

**SUGAR, BEVERAGES AND SPICES**

Sugar cookery - Types of sugar, Properties, Crystallization, Stages in Sugar cookery.
Beverages – Classification- alcoholic and non-alcoholic beverages, Nutritive value, Production of beverages. Spices and Condiments – Classification and uses.

**Theory: 45 Hours**

**Total Hours: 45**

**REFERENCES:**
1. Food science, Potter N.N., CBS publishers & distributors, Delhi, 1996.

**OTHER REFERENCES:**
1. Potter N, Food science. CBS publishers & distributors, Delhi, 1996.
Objective(s):
- To learn the production process in biofertilizer
- To learn the various process in biopesticide production.
- To learn various environmental application of biofertilizer and biopesticides

Course Outcomes:
CO1 : Students able to understand nitrogen fixing bacteria and soil fertility.
CO2 : Students should learn various production process and formulation of biofertilizer
CO3 : Students should learn various agricultural applications of biopesticides.
CO4 : Students can able to learn biocontrol agents and their applications.
CO5 : Students able to understand various environmental applications..

Pre-requisite:
1 U14BTT302 Microbiology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Signature of the BOS chairman/Biotechnology
Course Content

**SOIL AND AGRICULTURAL MICROBIOLOGY**  
9 Hours

Soil Habitat; Nitrogen fixation (symbiotic and nonsymbiotic), Microbial interaction; Isolation and screening of industrially important microbes; Large scale cultivation of industrial microbes. Brief account of beneficial microorganisms – *Rhizobium* *Azotobacter* and *Azospirillum*; Phosphate solubilizing microorganisms; Vesicular Arbuscular Mycorrhizae (VAM); *Azolla*; Blue Green Algae (BGA); Plant growth promoting rhizobacteria (PGPR); Green manure

**BIOFERTILIZER PRODUCTION PROCESS AND FORMULATION**  
9 Hours

Strain selection and improvement; culturing methods; mass production-sterilization; selection of raw material and dose determination, storage and maintenance. Formulation- EC, WP, Granules etc., Quality checking and approval; advantages over inorganic fertilizers.

**BIOPESTICIDE PRODUCTION PROCESS AND FORMULATION**  
9 Hours

Market potential- need and demand; Impact on biopesticides; Formulation; Microbial preparation for agricultural applications- Insecticide, herbicide, Nematicide. Impact on flora and fauna. Pesticide usage trend and its harmful effects, Integrated Pest and Disease Management System (IPDMS); Biological control - conservation of natural enemies, release of parasites, use of microbial agents; Need-based application of pesticides, use of selective pesticide.

**BIOCONTROL AGENTS**  
9 Hours

Biological control of insects - Fungal insecticides, bacterial insecticides - *Bacillus thuringiensis* (BT); Development of resistance; Improvements in BT through genetic engineering; Limitations of BT; Viral insecticides - Nuclear Polyhedrosis Virus; Protozon insecticides; Botanical pesticides; Pheramom trap; Trichocards; Nematodes as biological control agents; Biological control of weeds; Biological control of plant diseases - Soilborne diseases, foliar Diseases
ENVIRONMENTAL APPLICATIONS OF MICROBIAL FERTILIZER

Different methods for biofertilizer application – granular and liquid; Different methods of inoculation - seed inoculation, top dressing of biofertilizers, broadcasting of granular biofertilizers, granular biofertilizer mixed with seed; Methods of application of liquid inoculation; Methods of application of other biofertilizers; Formulations for biocontrol agents; Factors affecting crop response to biofertilizers; Potential of biofertilizers and biocontrol agents in Indian agriculture.

Theory: 45 Hours

REFERENCES:

Total Hours : 45

Signature of the BOS chairman/Biotechnology
Objective(s):
- Students understand principles of microbial pathogenesis, clinical importance of specific pathogens.

Course Outcomes:
CO1: Understand principles of microbial pathogenesis, clinical importance of specific pathogens.
CO2: Learn importance of Host defense mechanisms and pathogen adaptation against host defense.
CO3: Comprehend molecular mechanisms involved in Pathogenesis of diseases.
CO4: Learn host-pathogen interaction with respect to pathological damage of pathogens.
CO5: Discern different diagnostic techniques like ELISA, RIA etc.,

Pre-requisite:
1 U14BTT505 Immunology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Course Content

MICROBIAL PATHOGENESIS 9 Hours
Introduction to the infectious diseases - Molecular Koch postulates; Clinical importance of pathogenic bacteria, fungi, virus and parasite with Examples; Principles of microbial pathogenesis- Microbial modes of entry mechanism and colonization; Components of microbial pathogenesis; Inflammation process.

HOST-DEFENSE AGAINST PATHOGENS AND PATHOGENIC STRATEGIES 9 Hours
Virulence, virulence factors, virulence-associated factors and virulence lifestyle factors; Introduction to host defense- First line and second line defense mechanisms; Antimicrobial compounds; Mechanism of killing by humoral and cellular defense mechanisms; Pathogenic adaptations to overcome the above defenses; complement system - types of complement system.

MOLECULAR MICROBIAL PATHOGENESIS (SPECIFIC EXAMPLES) 9 Hours
Clinical features and molecular mechanism of pathogenesis: Enteric pathogens- *E.coli* pathogens- Enteropathogenic (EPEC), Enterotoxicigenic (ETEC), Enteroinvasive *E.coli* (EIEC); Shigella ; Salmonella; Vibrio - PAI; Superficial mycoses- Dermatophytes, *Candidiasis*; Malaria – Plasmodium life cycle; Influenza virus: Intracellular stage-H1N1 ; HIV.

EXPERIMENTAL STUDIES ON HOST-PATHOGEN INTERACTIONS 9 Hours
Virulence assay: Adherence, cytopathic, cytotoxic; Criteria and tests in identifying virulence factors- Classical, biochemical, genetic and genome approaches; Molecular characterization of virulence factors.
MODERN DIAGNOSIS TO CONTROL PATHOGENS  9 Hours
Modern diagnosis based on highly conserved virulence factors – Immuno and DNA-based techniques- Precipitation, agglutination, ELISA, RIA, PCR, Blotting techniques- Southern and Western blotting; Vaccines – types, applications and their advantages and disadvantages.

Theory: 45 Hours  Total Hours :45

REFERENCES:

OTHER REFERENCES:
1 http://www.textbookofbacteriology.net/
2 https://www.boundless.com/microbiology/
3 http://www.microbiologybook.org/
U14BTE105  FORENSIC BIOTECHNOLOGY

Objectives:
- To learn about forensic science and toxicology
- To understand the concepts of biological evidence collection
- To know about the methods used to identify criminals

Course Outcomes:
CO1 : Outline the basis of forensic science and chemistry
CO2 : Explain the mechanism of toxicology as applied to forensic science
CO3 : Illustrate the concept of biological evidence collection and analysis
CO4 : Explain the basic methods of body fluid analysis
CO5 : Enumerate the role of biotechnology in resolving legal disputes

Pre-requisite:
1  U14BTT301 Concepts in Biochemistry
2  U14BTT404 Cell and Molecular Biology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Course Content

**SCOPE OF FORENSIC SCIENCE**  9 Hours

**FORENSIC CHEMISTRY**  9 Hours
Types of cases which require chemical analysis, Limitations of forensic samples, conventional methods of chemical analysis, presumptive tests (colour/spot tests), Microcrystal tests, Elemental analysis (organic and inorganic). Examination of contact Traces: Introduction to cosmetics and detective dyes, collection, sampling and analysis.

**FORENSIC TOXICOLOGY**  9 Hours
Introduction, Role of the toxicologist, significance of toxicological findings, poisons, definition, classification on the basis of their origin, physiological action and chemical nature, poisons and poisoning in India, Management of Toxicological cases in the hospital - Signs and symptoms of common poisons, antidotes. Collection and preservation of viscera for various types of poisons: Choice of preservatives, containers and storage.

**BIOLOGICAL EVIDENCE**  9 Hours
Importance, nature, location, collection and evaluation. Hair and Fibres: Importance, nature, location, collection, evaluation and tests for their identification. Importance and identification of Botanical evidence as Pollen grains, wood, leaves and seeds.

**BLOOD SAMPLING AND ANALYSIS**  9 Hours
BODY FLUIDS AND ENZYME ANALYSIS

Semen: Forensic significance, location, collection, evaluation and tests for identification
Forensic significance of other body fluids as saliva, sweat, milk etc. Their collection and identification Polymorphic enzymes: Forensic significance, identification from fresh blood and stains.

Paternity disputes: Causes, Various serological and biochemical methods, calculation of paternity index and probability for paternity and maternity.

Theory: 45Hrs

REFERENCES:
2 Modis (2000): Medical Jurisprudence & Toxicology, M. M. Trirathi Press Ltd. Allahabad,
3 S.N. Tiwari (1997): Analytical Toxicology, Govt. of India Publications, New Delhi.

OTHER REFERENCES:
1 http://study.com/articles/Forensic_Scientist_How_Do_I_Start_a_Care er_in_Forensic_Science.html
Objectives:
- To learn about the neuroanatomy and neurophysiology
- To understand the concept of synaptic transmission and mechanism of action of neurotransmitters
- To know about the basic mechanisms of sensations and disorders related to nervous system.

Course Outcomes:
CO1 : Outline the basis of central and peripheral nervous system and describe the structure of neurons and supporting cells
CO2 : Explain the mechanism of action potential conduction and working of voltage dependent channels
CO3 : Illustrate the concept of synaptic transmission and mechanism of action of neurotransmitters
CO4 : Explain the basic mechanisms of sensations with special emphasis on skeletal muscle contraction.
CO5 : Enumerate the mechanisms associated with motivation and describe the disorders associated with nervous system

Pre-requisite:
1 U14BTT301 Concepts in Biochemistry
2 U14BTT401 Cell and Molecular Biology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Course Content

**NEUROANATOMY**
9 Hours
Overview of central and peripheral nervous system, Neurons – structure, types and functions; Glial cells – types; Synapses – types and functions; myelination; Blood Brain barrier; Neural Development; Cerebrospinal fluid – origin and composition; Spinal cord - functions.

**NEUROPHYSIOLOGY**
9 Hours
Resting and action potential; Mechanism of action potential conduction; Voltage dependent channels – sodium and potassium channels; Electrical transmission; information representation and coding by neurons. Case study - information representation by neurons

**NEUROPHARMACOLOGY**
9 Hours
Synapse formation; Synaptic transmission, neurotransmitters and their mechanism of action – acetyl choline, serotonin and dopamine; fast and slow transmission; hypothalamic control of neuronal function.

**APPLIED NEUROBIOLOGY**
9 Hours
Basic mechanisms of sensations – touch, pain, smell, taste; neurological mechanisms of vision and audition; skeletal muscle contraction

**BEHAVIOURAL SCIENCE**
9 Hours
Basic mechanisms associated with motivation; regulation of feeding, sleep, hearing and memory; Disorders associated with nervous system – Parkinson’s disease, Alzheimer’s disease, Schizophrenia, Epilepsy, Anxiety and mood disorders – depression, Agrophobia. Case study - Parkinsons and Alzheimers disease.

Theory: 45Hrs

Total Hours : 45
REFERENCES:
1 Mark F. Bear, Barry W. Connors and Michael A. Paradiso, 
*Neuroscience – Exploring the Brain*, 2\textsuperscript{nd} edition, USA, Lippincott Williams & Wilkins., 2001
U14BTE201   GENETIC ENGINEERING OF VALUE ADDED FOODS

Objectives:
- To understand the relationship between nutraceuticals and value addition in foods
- To understand various methods of value addition of foods.
- To learn the biological processes for value addition in foods.

Course Outcomes:
CO1 : Use the basic and applied knowledge gained through other courses in biotechnology to relate to nutraceuticals and value addition of foods.
CO2 : Understand various methods of value addition of foods.
CO3 : Perceive the expected benefits of value addition.
CO4 : Learn to use genetic engineering to modify and manipulate biological processes for value addition of foods.
CO5 : Understand the impact of value addition of foods.

Pre-requisite:
1   U14BTT301 Concepts in Biochemistry
2   U14BTT501 Genetic Engineering

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

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Course Content

**INTRODUCTION TO NUTRACEUTICALS**  
9hrs
The history and scope of nutraceutical research. Microbial: fermented foods, bakery products, dairy products and mushrooms. Plant foods: cereals, pulses, legumes, oilseeds, vegetables and fruit crops. Fish, poultry, dairy and animal foods.

**THE IMPORTANCE OF VALUE ADDITION OF FOODS**  
9hrs
Major and minor food constituents: Carbohydrates, proteins, fats, vitamins and minerals, value addition, types of value additions. The benefits of value addition to the foods.

**VALUE ADDITION BY GENETIC MODIFICATION**  
9hrs
Value added microbial foods, value added transgenic plants. Value added transgenic animals. Floriculture and flower industry, Modification of farm products for better transportation, storage, consumer preference.

**VALUE ADDITION OF FOODS FOR SUITABILITILITY TO INDUSTRIAL PROCESSING**  
9hrs
Improvement of raw materials by conventional methods. Improvement of raw material by application of biotechnology methods. Value added crops, designer crops, improvements of raw material for food processing industry.

**IMPACT OF VALUE ADDITION OF FOODS ON FARM, NATIONAL ECONOMY AND TRADE**  
9hrs
Importance of value added crops in the farms. Improvement in farm value and economy, farmer and industrial partnership. Impact of biotech-products on national economy and international trade.

Theory: 45 Hr  
Total Hours: 45
REFERENCES:

OTHER REFERENCES:
1 Lindsey K and Jones MGK, Plant biotechnology in Agriculture. Prentice Hall, USA, 1990.
Objectives:
- To understand the quality aspects of foods
- To know the food standards and laws
- To learn the general principles of food safety

Course Outcomes:
CO1: Aware about the important parameters of food quality.
CO2: Capable of understanding the quality policy and identify the hazards in food industries.
CO3: Gain knowledge about the general principles of food safety.
CO4: Know about food law and standards.
CO5: Know about various international bodies involved in food standards.

Pre-requisite:
1. U14BTT301 Biochemistry
2. U14BTT302 Microbiology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Course Content

**FOOD QUALITY**  
9 Hours  

**GENERAL PRINCIPLES FOR FOOD SAFETY AND HYGIENE**  
9 Hours  

**GENERAL PRINCIPLES FOR FOOD SAFETY REGULATION AT NATIONAL/REGIONAL LEVEL**  
9 Hours  

**NATIONAL STANDARDS AND GUIDELINES**  
9 Hours  

**INTERNATIONAL BODIES DEALING IN STANDARDIZATION**  
9 Hours  

Theory: 45 Hours

Total Hours: 45
REFERENCES:

OTHER REFERENCES:
Objectives:
- To learn about the fundamentals of carcinogenesis and role of oncogenes
- To understand the regulation of cell cycle in cancer and mechanism of cancer metastasis
- To know about the strategies for cancer diagnosis and therapy

Course Outcomes:
CO1: Understand the mechanism of proto-oncogene and oncogene and apoptosis
CO2: Describe the mechanism of cell cycle regulation in cancer
CO3: Attain the knowledge in the fundamentals of carcinogenesis and its role in cancer
CO4: Illustrate the mechanism of cancer metastasis and
CO5: Comprehend the basis of cancer diagnosis and therapy

Pre-requisite:
1 UBTT404 Cell and Molecular Biology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Course Content

**ONCOGENES AND PROTO ONCOGENES**  
9 Hours
Mechanism of oncogene and proto oncogene – epidermal growth factor (EGF), platelet derived growth factor (PDGF), transforming growth factor (TGF), src and myc; RAS cycle; Oncogenes – Identification and detection; Apoptosis – intrinsic and extrinsic pathways. Genetic rearrangements in progenitor cells

**CELL CYCLE REGULATION**  
9 Hours
Regulation of cell cycle - S. pombe, S. cerevesiae and mammalian system; Types of mutations that cause changes in signal molecules; Effects on receptor; Tumor suppressor genes -p53 and Rb proteins; Modulation of cell cycle in cancer; Mechanism of action of telomerase. Interaction of cancer cells with normal cells

**MECHANISM OF CARCINOGENESIS**  
9 Hours
Carcinogenesis – introduction and types; Chemical carcinogenesis – Direct acting and indirect acting carcinogens; Metabolism of carcinogens - CYP450 reductase mechanism; Mechanism of radiation carcinogenesis – ionizing and non ionizing radiation; Retroviruses - RSV life cycle and its role in cancer; Identification of carcinogens- Long and short term bioassays.

**MECHANISM OF CANCER METASTASIS**  
9 Hours
Metastasis – Introduction and cascade; Clinical significances and three step theory of invasion; Significance of proteases in basement membrane disruption; Properties of cancer cell; Oral, lung, uterus, breast & blood – etiology, diagnosis and treatment.

**Case study** – oral, breast and blood cancers

**CANCER DIAGNOSIS AND THERAPY**  
9 Hours
Action of cancers – biochemical assays; Tumor markers; Molecular tools for early diagnosis of cancer; Prediction of aggressiveness of cancer; Different forms of therapy – Chemotherapy, Radiation therapy and Immunotherapy; Role of antioxidants in preventing cancer

Theory: 45Hr                  Total Hours : 45
REFERENCES:

OTHER REFERENCES:
Objectives:
- To learn about the biology of stem cells and their differentiation
- To understand the concept of tissue engineering
- To know about the application of tissue engineering in regenerative medicine

Course Outcomes:
CO1: Understand the basics concepts of stem cells and their differentiation
CO2: Comprehend the concepts of tissue engineering, scaffolds materials and designing
CO3: Illustrate the applications of tissue engineering in tissue repair and dysfunction

Pre-requisite:
1 U14BTT505 Immunology

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

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Course Content

STEM CELLS  9 Hours
Stem cells: definition, properties and potency of stem cells; Sources: embryonic and adult stem cells; Examples- mesenchymal, liver and neuronal stem cells; cord blood banking; telomeres and self renewal; stem cell plasticity.

STEM CELL DIFFERENTIATION  9 Hours
Culture media for human embryonic and adult stem cells; growth factors; inducible pluripotent cells
Characterization and Differentiation of human embryonic stem cells - hematopoietic, neural and germ cell differentiation; conceptual and dynamic models of stem cell proliferative behavior.

CONCEPTS IN TISSUE ENGINEERING  9 Hours
Cells as therapeutic agents- examples; cell numbers and growth rates; Tissue organization – components and types; Tissue dynamics – dynamic states, homeostasis and tissue repair. Tissue Morphogenesis.

BIOMATERIALS IN TISSUE ENGINEERING  9 Hours
Microscale patterning of cells and their environment. Cell interactions with polymers, Matrix effects, polymer scaffold fabrication, Biodegradable polymers, Micro and nano fabricated scaffolds, three dimensional scaffolds.

REGENERATIVE MEDICINE  9 Hours
Medical and surgical therapies for tissue dysfunction; Tissue engineered therapies – Artificial Blood, Tissue Engineering of Bone Marrow. Wound healing process and angiogenesis.
Case study – mesodermal (articular cartilage), ectodermal (skin), endodermal (liver).

Theory: 45Hrs  Total Hours : 45
REFERENCES:

OTHER REFERENCES
Objectives:
- To learn and understand the fundamentals of systems modeling and simulation biochemical pathways.

Course Outcomes:
CO1: Understand the basics of systems modeling
CO2: Demonstrate the biochemical networks
CO3: Explain the kinetic models pertaining to cell – cell interactions
CO4: Understand the advanced modeling networks
CO5: Understand the computational simulation of framing the biochemical pathways

Pre-requisite:
1. U14BTT301 Concepts in Biochemistry
2. U14CHT205 Chemistry for Biotechnology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Programme Outcomes (POs)

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Course Content

INTRODUCTION 9 Hours
Introduction - System-level Understanding of Biological Systems - Advanced Measurement; Systems Modeling Genetic Networks

MODELLING NETWORKS 9 Hours

KINETIC MODELS 9 Hours
Kinetic Models of Excitable Membranes and Synaptic Interactions - Stochastic Simulation of Cell Signaling Pathways - Analysis of Complex Dynamics in Cell Cycle Regulation.

ADVANCED MODELLING NETWORKS 9 Hours

COMPUTATIONAL SIMULATION 9 Hours

Theory: 45 Hr

Total Hours: 45

REFERENCES:
1 Foundations of Systems Biology, Hiroaki Kitano (Editor), MIT Press, 2001
3 Gene Regulation and Metabolism: Postgenomic Computational Approaches, Julio Collado-Vides (Editor), Ralf Hofestadt (Editor), MIT Press, 2002
Objectives:
- To study the classification of genetic diseases and mechanism behind the pathogenesis of genetic diseases
- To understand the molecular diagnosis of diseases
- To learn about the therapeutic strategies available for alleviating the symptoms of molecular diseases

Course Outcomes:
CO1: Understand the classification of genetic diseases
CO2: Learn the molecular basis behind the pathogenesis of genetic diseases
CO3: Develop skills in diagnosing the outcome of the diseases
CO4: Enumerate the gene therapy strategies for alleviating molecular diseases
CO5: List out the gene products available in medicine to treat the molecular diseases.

Pre-requisite:
1. U14BTT404 Cell and Molecular Biology
2. U14BTT501 Genetic Engineering

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Course Content

CLASSIFICATION OF GENETIC DISEASES 9 Hours
Chromosomal disorders – Numerical disorders, trisomies, monosomies; Chromosomal instability syndromes; Gene controlled diseases – Autosomal and X-linked Disorders; Candidate gene approach – Marfan’s syndrome, Alzheimers disease; Gene Hunting-schizophrenia, bipolar disorder.

MOLECULAR BASIS OF GENETIC DISEASES 9 Hours
Molecular basis of human diseases - Pathogenic mutations, Gain of function mutations – Oncogenes; Huntingtons Disease; lethal bleeding diathesis - Pittsburg variant of alpha 1 antitrypsin; Genomic mprinting - Mechanisms, Praderwilli / Angelman syndrome, Mitochondrial diseases-MELAS, LHON, MERRF; Immuno Pathology.

MOLECULAR & MEDICAL DIAGNOSTICS 9 Hours
Conventional methods of diagnosis – amniocentesis, ultrasonography; G-banded chromosomal preparations for detection of autosomes of autosomal/sexchromosomal disorder - Down’s syndrome; PCR bases diagnosis – fragile-X syndrome; mutation detection by PCR-SSCP - sickle cell anemia;  SNP analysis for known SNPs;  PAGE- band detection of enzyme variants, Microarray technology- genomic and cDNA arrays, application to diseases.

MOLECULAR THERAPEUTICS 9 Hours
Gene therapy- Ex vivo, Inv iv0, In situ; Strategies of gene therapy – gene augmentation, antisense therapy; Viral vectors - retrovirus, adenoviruses, Herpes simplex virus; non viral methods - liposomes, receptor mediated gene transfer. Stem cell therapy - Embryonic and adult Stem Cells, Totipotent, Pluripotent and Multipotent Cells; Potential use of stem cells – Cell based therapies; Nanomedicine – Basic approach and clinical application.

THERAPEUTIC GENE PRODUCTS 9 Hours
Gene products in medicine – Humulin, Erythropoietin, Growth Hormone/Somatostatin, tPA, Interferon; Vaccines-Simple recombinant protein vaccines; Gene vaccines; DNA based vaccines; plant edible vaccines; subunit vaccines, Attenuated Vaccines. Therapeutic antibodies and Immunotherapy; other recombinant proteins – cytokines; colony stimulating factors

Theory: 45 Hrs

Total Hours : 45
REFERENCES:
U14BTE301  NANOBIO TECHNOLOGY

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Objectives:
- To develop the knowledge on nanomaterials synthesis characterization
- To gain knowledge in involvement of macromolecules in nanobiotechnology
- To study the application in drug delivery and cancer treatment

Course Outcomes:
CO1 : Understand the basics of nanobiotechnology and synthesis of nanomaterials
CO2 : Apply the knowledge on characterization of nanoparticles with different techniques
CO3 : Understand the different nanomaterials applications
CO4 : Know the interactions of nanomolecules in biosystem towards applications
CO5 : Discuss the applications of nanotechnology in biotechnology

Pre-requisite:
1 U14CHT101 Engineering Chemistry
2 U14PHT101 Engineering Physics
3 U14BTT201 Biomolecules and Genetics

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Course Content

INTRODUCTION TO NANOBIOENGINEERING 9 Hours
Introduction to Nanotechnology and nanobiotechnology – Properties at nanoscale; overview of nanodevices and techniques. General synthesis methods of nanoscale materials; top down and bottom up approaches, Biological approach to self assembly.

NANOPARTICLES CHARACTERIZATION 9 Hours

TECHNIQUES
X-ray diffraction technique, Scanning Electron Microscopy with EDX - Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

NANOMATERIAL AND APPLICATIONS 9 Hours
Inorganic nanoscale systems for biosystems-nanostructure materials – fullerenes, carbon nanotubes, quantum dots and wires - preparation, properties and applications. Nanopores – applications

NANOMOLECULES IN BIOSYSTEMS 9 Hours


APPLICATION OF NANOBIOENGINEERING 9 Hours


Case study on drug delivery of gold nanoparticles against breast cancer.
Theory: 45 Hr  

Total Hours: 45

REFERENCES:

OTHER REFERENCES:
Objective:
- To be the biggest knowledge enhancement movement in the world in the area of Clinical Trial, Research & Administration

Course Outcomes:
- **CO1**: Enhance and share knowledge in the emerging areas of Clinical Trial, Research & Administration
- **CO2**: Develop documentation / research writing expertise in the Clinical Trial, Research & Administration area.
- **CO3**: Able to spread awareness in this area by sharing their knowledge with others.
- **CO4**: Platform for interchange and exchange of knowledge in this area
- **CO5**: To conduct ethical Clinical Trial, Research & Administration leading to better opportunities and higher quality of life

Pre-requisite:
1. U14BTT603 Biopharmaceutical Technology
2. U14BTT505 Immunology

**CO/PO Mapping**
(S/M/W indicates strength of correlation)

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Course Content

**CLINICAL TRIALS**  
9 Hours
Basics of Clinical Trials & Clinical Research  
Clinical Trials Terminology  
Features of Clinical Trials  
Good Clinical Trial Practices  
Patient Recruitment  
Clinical Trial Statistics  
Bioavailability Studies  
Research Methodology  
Design of Experiments  
Clinical Trial Informatics  
Clinical Trial Team  
Clinical Trial Delivery Model  
Clinical Trial Business Environment  
Clinical Trial Regulatory Affairs  
Bioethics  
Audit of Clinical Trials  
Case Studies

**CONTRACT RESEARCH**  
9 Hours
Basics of Contract Research  
Contract Research Organization  
Academic Research Organization  
Contract Research Areas  
Contract Research Delivery Model  
Contract Research Business Environment  
Contract Research Information Sources  
IT and Contract Research  
Regulatory Affairs  
and Contract Research  
Case Studies

**CONTRACT RESEARCH AND CLINICAL TRIAL ENVIRONMENT**  
9 Hours
An introduction of contract research  
need of contract research organizations description, features and benefits of contract research.  
Contract research organizations in india complimentary and alternative medicine (cam)  
Contract research and clinical trial environment in india.  
Non-clinical safety studies for the conduct of human clinical trials for pharmaceuticals.  
Choice of control group and related issues in clinical trials purposes of clinical trials and related issues  
Detailed consideration of types of control external control (including historical control)
GUIDELINES ON BIOMEDICAL RESEARCH ON HUMAN SUBJECTS
9 Hours

SCHEDULE - Y
9 Hours

Theory:45 Hr
Total Hours :45

REFERENCES:

OTHER REFERENCES:
2 http://clinicalcenter.nih.gov/training/training.html
ENVIROMENTAL TOXICOLOGY AND OCCUPATIONAL HEALTH

Objectives:
- To learn the principles of toxicology and to evaluate the effects of occupational hazard on health.

Course Outcomes:
CO1 Learn the biochemical aspects of pollutants in environment.
CO2 Understand about biotransformation and detoxification.
CO3 To apply indices of toxicity in occupational health.
CO4 To assess epidemiological aspect of toxins.
CO5 Evaluate various testing procedures.

Pre-requisite:
1 U14GST001 Environmental Sciences and Engineering

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Signature of the BOS chairman/Biotechnology
Course Content

TOXICANTS OF ENVIRONMENT 9Hour
Toxic chemicals in the environment, Biochemical aspects of Arsenic, Cadmium, Lead, Mercury, Carbon Monoxide, Ozone and particulates.

MECHANISMS OF TOXICITY 9Hour
Mode of entry of toxic substance, biotransformation of xenobiotics, detoxification. Chemical carcinogens, mechanism of carcinogenicity.

INDICES OF TOXICITY 9Hour

FACTORS OF ENVIRONMENTAL HEALTH 9Hour
Biogeochemical factors in occupational health. Epidemiological issues-goiter, fluorosis, arsenic poisoning.

SUSTAINABLE DEVELOPMENT OF ECOSYSTEM 9Hour

Theory: 45
Total Hours : 45

Text book:
3 Maxwell N.C., Understanding Environmental Health: How We Live in the World, Jones & Bartlett Learning, USA, 2014.
Web references:
1 http://www.atsdr.cdc.gov/training/toxmanual/modules/1/lecturenotes.html
2 http://www.webpages.uidaho.edu/etox/lectures.htm
4 http://ocw.jhsph.edu/courses/publichealthtoxicology/lectureNotes.cfm
Objectives:
To equip the students in understanding various aspects of the environment and how Biotechnology could be applied in finding sustainable solutions to environmental issues.

Course Outcomes:
CO1: Identify the key concepts in ecosystems management
CO2: Summarize wastewater characteristics and treatment protocols
CO3: Construct systems for biotreatment of industrial effluents and solid wastes
CO4: Review the biodegradation pathways for xenobiotic compounds
CO5: Apply the concepts in developing environment-friendly bioproducts

Pre-requisite:
1 U14GST001 Environmental Sciences and Engineering
2 U14BTT302 Microbiology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Signature of the BOS chairman/Biotechnology
Course Content

**ECOSYSTEMS AND THEIR MANAGEMENT**  
9 Hours  
Microbial communities of air, water and soil ecosystems; ecological adaptations and interactions between microorganisms; biogeochemical role of microorganisms; soil, air and water pollution – types, causes and effects; contributions of biotechnology to environmental management; environmental monitoring and risk assessment Case study: environmental impact assessment (EIA)

**WASTEWATER TREATMENT**  
9 Hours  
Physical, chemical and biological characteristics of wastewater; wastewater treatment – overview of physical and chemical methods; biological methods - suspended growth and biofilm processes; design of activated sludge process; ponds and lagoons; trickling filters; anaerobic reactors for wastewater treatment; sludge digestion - design of anaerobic sludge digesters; tertiary treatment - nitrogen and phosphorus removal

**INDUSTRIAL AND SOLID WASTE MANAGEMENT**  
9 Hours  
Leather, pulp, pharmaceutical, dairy and textile industries – production process, origin and characteristics of waste, waste minimization and treatment options; solid waste management – segregation, collection, transportation, characterization, disposal methods – sanitary landfill, incineration, composting and vermicomposting, recovery of energy from solid waste; hazardous waste management – biomedical waste case study: solid waste management in Indian cities

**BIODEGRADATION AND BIOREMEDIATION**  
9 Hours  
Xenobiotics - factors causing molecular recalcitrance; microbial pathways for biodegradation of petroleum hydrocarbons – aliphatic, alicyclic, single-ringed and polycyclic aromatics, chlorinated hydrocarbons; biodegradation of pesticides and synthetic detergents, bioremediation – types and applications, use of genetically engineered microorganisms in bioremediation; role of biosurfactants in bioremediation

**APPLICATIONS OF ENVIRONMENTAL BIOTECHNOLOGY**  
9 Hours  
Biocatalysts for environmental applications; biocontrol agents – biofertilizers and biopesticides; biopolymers; bioleaching; biofuels; biodiversity – values and threats faced, biodiversity conservation and role of biotechnology in it; intellectual property rights and patenting
Theory: 45Hrs

REFERENCES:

OTHER REFERENCES:
U14BTE305  THERMOCHEMICAL
CONVERSION OF BIOMASS

Objective:
To make the students to develop basic understanding of
thermochemical conversion technologies

Course Outcomes:
CO1 To understand the Biomass resources, types of biofuels and
the bio-refinery concept
CO2 To understand the concept of pyrolysis
CO3 To understand the concept of gasification
CO4 To understand the concept of gasifier
CO5 To understand the concept of torrefaction

Pre-requisite:
1 U14BTT304 Biochemical Process Calculations

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

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Signature of the BOS chairman/Biotechnology
Course Content

THERMOCHEMICAL CONVERSION TECHNOLOGIES  9 hrs
Biomass, thermochemical conversion technologies - combustion, pyrolysis, gasification, liquefaction and torrefaction

PYROLYSIS  9 hrs
Mechanism, types, products and yield, kinetics, heat transfer, pyrolysis equipments design

GASIFICATION  9 hrs
Reactions and steps, process, kinetics, models, products and applications

GASIFIERS  9 hrs
Types, fixed bed gassifiers, moving bed gassifiers, moving bed gassifiers, entrained flow gassifiers, plasma gassifiers, process design, performance and operating issues

TORREFACTION  9 hrs
Mechanism, advantages, basics of torr, torr reduction

Lectures:45  Total Hours : 45

REFERENCES:

OTHER REFERENCES:
1 www.jie.or.jp/biomass/AsiaBiomassHandbook/English/Part-4_E.pdf
2 www.nrel.gov/docs/gen/fy04/36831e.pdf
U14BTE401  BIOMATERIALS

Objectives:
- To learn the basic concepts of the structures of various biomaterials
- To understand the mechanical properties, degradation and processing of biomaterials
- To understand the fundamentals of surface engineering and cell-biomaterial interactions
- To know the applications of biomaterials

Course Outcomes:
CO1 : Know and understand the structures of various biomaterials
CO2 : Demonstrate the mechanical properties of the biomaterials
CO3 : Explain the various methods of the improvement of mechanical properties of different biomaterials
CO4 : Remember the basics of surface engineering and protein-biomaterial interactions
CO5 : Apply the biomaterials in the healthcare sectors

Pre-requisite:
1  U14CHT101 Engineering Chemistry
2  U14PHT206 Applied Physics
3  U14BTT302 Microbiology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Course Content

**INTRODUCTION AND STRUCTURE OF BIOMATERIALS**  
9 Hours

Introduction and definition of a biomaterial; types and applications of biomaterials; Biological response to biomaterials; Crystal structure of metals; Crystal structure of ceramics; Carbon based materials; General structure of polymers; Synthesis of polymers.

**MECHANICAL PROPERTIES OF BIOMATERIALS**  
9 Hours

Tensile and shear properties – molecular causes of elastic and plastic deformation, stress-strain curves of elastic and plastic deformation; Bending properties; Time dependent properties – creep properties of polymers; Influence of porosity and the degradation of mechanical properties; Introduction to fatigue.

**BIOMATERIAL DEGRADATION AND PROCESSING**  
9 Hours

Fundamental of corrosion – redox reactions; Pourbaix diagram; Introduction to crevice and pitting corrosion; Degradation of polymers – hydrolysis and oxidation; Introduction to biodegradable polymers; Process to improve the mechanical strength of biomaterials – metals, ceramics and polymers; Processing of polymers to form desired shapes. Processing to improve biocompatibility.

**SURFACE ENGINEERING AND CELL & PROTEIN INTERACTIONS WITH BIOMATERIALS**  
9 Hours

Surface modification of biomaterials – plasma treatment, radiation grafting, self assembled monolayers (SAMs), Langmuir – Blogett films and covalent biological coatings; Protein properties that affect biomaterial
surface interaction; biomaterial surface interaction that affect interactions with proteins; Protein adsorption kinetics; DLVO model for cell adhesion; Assays to determine the effects of cell-material interactions – agar diffusion assay, adhesion assays and migration assays.

APPLICATIONS OF BIOMATERIALS  
9 Hours

In vitro assays for inflammatory response due to biomaterial implantation; Fibrous encapsulation of healing process; Ideal features of soft tissue implants; Applications of sutures; Dental implants; Eye and ear implants; Heart valves; Endovascular Stents.

**Theory: 45 Hr**  
**Total Hours : 45**

**REFERENCES:**

**OTHER REFERENCES**
1 http://nptel.ac.in/courses/113104009/
2 http://www.bioen.utah.edu/faculty/pat/Courses/biomaterials/coursenotes.html
Objectives:
- To understand structural bioinformatics and its relevance to modern biology
- Learn about structure elucidation and prediction
- Understand principles of drug discovery

Course Outcomes:
CO1: Describe the various structural databases and their data access
CO2: Describe conformational analysis of proteins
CO3: Understand the various structure prediction methods
CO4: Explain the mechanisms of drug modeling and design
CO5: Understand the principles of structure based drug design

Pre-requisite:
1 U14BTT701 Advanced Bioinformatics

CO/PO Mapping
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Course Content

STRUCTURAL DATABASES AND GENOMICS: 9 Hours
Diversity of Living Organisms: Cells and Cell theory; cell types and Structure; Cell division in prokaryotes and eukaryotes; Central dogma and information flow; Cell metabolism-Homoeostasis- Cell growth, reproduction, differentiation and stem cells.

CONFORMATIONAL ANALYSIS: 9 Hours
Proteins: Forces that determine protein structure, polypeptide chain geometries – Ramachandran Map – potential energy calculations, observed values for rotation angles – structure comparison and alignment;
Nucleic acids and carbohydrates: general characteristics of nucleic acid structure – geometries, glycosidic bond – rotational isomers and ribose puckering - forces stabilizing ordered forms – base pairing –base stacking

DETERMINATION AND PREDICTION OF STRUCTURE 9 Hours

MOLECULAR MODELING, DRUG DESIGN AND DISCOVERY 9 Hours
Communication at the cellular level - Signal transduction (insulin/epinephrine example); Communication at the organ and systems level (blood glucose regulation); Body response to the outside world (neuro-muscular coordination); Body response to the outside world (cell mechanics–chemotaxis, pheromones–one example each)

PRINCIPLES OF DRUG DISCOVERY AND DESIGN: 9 Hours

Theory: 45 Hours  Total Hours :45
REFERENCES:

OTHER REFERENCES:
4 http://www.cs.cmu.edu/~ckingsf/bioinfo-lectures/
ENVIRONMENTAL BIOTECHNOLOGY RISK AND IMPACT ASSESSMENT

Objectives:
To learn and practice environmental impact and risk assessment and to assess and evaluate the risk/impact involved in environmental biotechnology.

Course Outcomes:
CO1 Outline the concepts of environmental impact assessment.
CO2 Understand various legislation and implementation of risk assessment.
CO3 Designing of various audits and LCA
CO4 Apply the concepts for hazard identification and risk characterization.
CO5 Evaluate the risk of GMOs

Pre-requisite:
1 U14GST001 Environmental Sciences and Engineering
2 U14BTT404 Cell and Molecular Biology
3 U14BTT501 Genetic Engineering

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Course Content

CONCEPTS OF RISK ASSESSMENT  
9 Hours
Introduction to environmental impact analysis, Environmental impact statement and Environmental management plan, ISO14000. Mitigation – Matrices – Checklist.

ECOSYSTEM FUNCTIONS  
9 Hours
Impact assessment methodologies, Generalized approach to impact analysis. Rapid and Comprehensive EIA – Legislative and Environmental clearance procedures in India – Prediction tools for EIA.

ECO-TECHNOLOGIES  
9 Hours
Documentation of EIA – Environmental Management plan – Post project monitoring – Environmental Audit; Guidelines for Environmental Audit, Baseline information and prediction. Life cycle assessment – EMS - Case studies in EIA. Restoration and rehabilitation technologies.

ECOLOGICAL ENGINEERING APPLICATIONS  
9 Hours

SUSTAINABLE DEVELOPMENT OF ECOSYSTEM  
9 Hours
Environmental biotechnology risk and impact assessment matrix. Application, ethical and legal issues, on genetically modified microorganisms; risk groups; biosafety standards & measures; Expert committees (RDAC, GEAC, SBCC, DLC); environmental approval.

Theory:45  
Total Hours : 45

REFERENCES:
3 Carrol B, Turpin T, Environmental Impact Analysis Handbook, ICE

Signature of the BOS chairman/Biotechnology

OTHER REFERENCES:
3  Fulekar M.H., Environmental Biotechnology, CRC Press USA, 2011.

Web References:
1  http://www.gdrc.org/uem/eia/impactassess.html
3  http://www.ce.utexas.edu/prof/maidment/risk/risksyl.html
Objective:
- Evaluate and select appropriate software, modelling tools and techniques for performance and optimisation of biofuels processes,
- predicting the performance of biofuels processes and biomass energy conversion systems

Course Outcomes:
CO1 : Understand in depth the current theory and practice of biofuels production processes.
CO2 : Critically evaluate the current techniques and bioprocesses appropriate for the production of biofuels.
CO3 : Review and assess the technical and economic issues involved in the design and operation of biofuels plants.
CO4 : Recognise and appraise the different techniques and feedstocks use for the production of biofuels.
CO5 : Describe and appraise current research activities in selected topics in the area of biofuels from a technical, economic and environmental perspective.

Pre-requisite:
1  Nil

CO/PO Mapping
(S/M/W indicates strength of correlation)
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Course Content

CLASSIFICATION AND RESOURCES  
9 Hours
Introduction, Biofuel as a renewable energy, Classification of biofuels - First, second, third and fourth generation biofuels, Different plant sources as biofuel feedstocks, Biogases, Physical and chemical characteristics of vegetable oils - iodine number, hydroxyl, acid values, rancidity, hydrogenolysis and hydrolysis, Food vs. energy, Edible and non-edible oils as fuels - their extraction

BIODIESEL  
9 Hours
Definition, basics and chemistry of biodiesel, vegetable oils in biodiesel production, Transesterification: Chemical methods, enzymatic methods and types of catalysts, separation and purification, physical properties and characterization of biodiesel - Cloud point, pour point, cold filter plugging point, flash point, viscosity and cetane number. Purification - washing and drying options (bubble and mist washing), storage.

QUALITY BIODIESEL AND ENVIRONMENT  
9 Hours
Producing Quality Biodiesel, quality control, test methods, ASTM specifications. Oxidative and thermal stability, estimation of mono, di, triglycerides and free glycerol, engine performance test, blending of ethanol with biodiesel, blending of biodiesel with high speed diesel (HSD) and their combustion properties. Comparison of biodiesel with high speed diesel

BIOETHANOL AND BIOGASES  
9 Hours
Ethanol as a fuel, microbial and enzymatic production of ethanol from biomass – lignocellulose, sugarcane, sugar beet, corn, wheat starch, purification - wet and dry milling processes, saccharification - chemical and enzymatic .Production of biomethane and biohydrogen. Enzymes employed in the fermentation of sugars to ethanol and ethanol estimation.
BIOREFINERIES  9 Hours
Definition and types of biorefineries, co-products of biorefineries - oil cake and glycerol, purification of glycerol obtained in biodiesel plant; anaerobic and thermal gasification of biomass, economics of biorefineries, Application of biorefinerie in chemical, pharmaceutical and polymer industries

Theory:45hrs  Total Hours : 45hrs

REFERENCES:
2  Mousdale, Biofuels , CRC Press, 2008
5  Lisbeth Olsson, Biofuels (Advances in Biochemical Engineering/ Biotechnology), Springer, 2007

OTHER REFERENCES:
1  http://www.intechopen.com/books/biofuel-s-engineering-process-technology/the-challenge-of-bioenergies-an-overview
2  http://www.intechopen.com/books/biofuel-s-engineering-process-technology/bioresources-for-third-generation-biofuels
U14BTE405
ECOLOGICAL AND
ENVIRONMENTAL ENGINEERING

Objectives:

- To learn the concepts in ecology and environmental engineering, to apply these concepts in sustainable development and restoration of ecology and environment.

Course Outcomes:
CO1 Outline the concepts of ecosystem and environmental interactions
CO2 Understand the ecosystem functions
CO3 Designing and construction of eco-agri engineering systems
CO4 Apply the concepts of ecological engineering in ecosystem rehabilitations
CO5 Development of sustainable ecosystems

Pre-requisite:
1 U14GST001 Environmental Sciences and Engineering
2 U14BTT302 Microbiology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Course Content

PRINCIPLES AND CONCEPTS 9 Hours
Scope and applications of Ecological and environmental engineering – Development and evolution of ecosystems. Principles and concepts pertaining to species, populations and community.

ECOSYSTEM FUNCTIONS 9 Hours

ECO-TECHNOLOGIES 9 Hours

ECOLOGICAL ENGINEERING APPLICATIONS 9 Hours
Bio-monitoring and its role in evaluation of aquatic ecosystem; Rehabilitation of ecosystems through ecological principles – step cropping, bio-wind screens, Wetlands, ponds, Root Zone Treatment for wastewater, Reuse of treated wastewater through ecological systems.

SUSTAINABLE DEVELOPMENT OF ECOSYSTEM 9 Hours
Traditional vs. sustainable exploitation of ecosystems. Distribution of ecosystems and restoration possibilities. Case studies of integrated ecological engineering systems.

Theory:45 Total Hours : 45

REFERENCES:

OTHER REFERENCES:

OTHER REFERENCES:
1 http://ocw.mit.edu/courses/civil-and-environmental-engineering/1-020-ecology-ii-engineering-for-sustainability-spring-2008/lecture-notes/
3 http://www.aboutcivil.org/environmental-science-engineering.html
ONE CREDIT INDUSTRIAL COURSES
Objectives:
- To understand and learn about various aspects of milk.
- To learn in detail about milk processing techniques and products.

Course Outcomes:
CO1: Understand the basics of milk.
CO2: Learn about various processing techniques of milk.
CO3: Explain the different dairy products.

Prerequisite courses: Nil

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Course Content

Milk basics

Milk Processing

Signature of the BOS chairman/Biotechnology
Equipments used in dairy industry 3 Hours

Quality Control in Milk 3 Hours

Milk Products 3 Hours

Theory: 15 Hrs Total Hours :15

References

Objectives:
- To understand and learn about various edible mushrooms that are commonly cultivated and consumed.
- To learn in detail on cultivations steps and practices for edible mushrooms and their beneficial effects on human health.

Course Outcomes:
CO1: Understand biology of edible mushrooms
CO2: Cultivation techniques of button, oyster,milky and paddy straw mushrooms.
CO3: Explain the various nutritive value and their therapeutic effects

Prerequisite courses: Nil

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Course Content

Biology of Mushrooms 2 Hours
Classification fungi, life cycle of fungi, parts of a typical mushroom, properties of edible mushrooms, differentiating edible mushroom from poisonous mushrooms. Different types of Button, Oyster, Milky and Paddy straw mushrooms- General morphology.

Mushroom Cultivation techniques 8 Hours
Cultivation systems- Button mushroom, Oyster mushroom, Milky mushroom and Paddy straw mushroom. Problems and remedial measure in edible mushroom cultivation.

Nutritional statistics and beneficial effects of edible mushrooms 5 Hours
Carbohydrate, protein, essential aminoacids, fats, vitamins, polyphenols and antioxidants calorific values, of edible mushroom fruiting bodies. Antiviral,
antibacterial effect, antifungal effect, anti-tumour effect, therapeutic properties of edible mushrooms.

Theory: 15 Hr

Total Hours : 15

REFERENCES:

1 Mushroom Production and Processing Technology, Pathak Yadav Gour (2010) Published by Agrobios (India).
Objective(s):
- To learn about ancillaries of pilot-plant and industrial fermentors
- To understand the need of pilot-plant fermentors
- To learn the applications of pilot-plant fermentors

Course Outcomes:
After successful completion of this course, the students should be able to
CO1: Understand the basic components of pilot-plant fermentors
CO2: Outline the importance of pilot-plant fermentor in biotech. industries
CO3: Learn about components of industrial fermenter

Pre-requisite:
1 Principles of bioprocess engineering

CO/PO Mapping
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Course Content

PILOT-PLNT FERMENTER:
Advantages and types of pilot-plant fermenters, Design and operation of pilot-plant fermentors; Material of construction, aeration and agitation, temperature control, automatic antifoam control, automatic pH control, and facilities for air sterilization; Scale-up parameters in fermenters; Development of products using pilot-plant fermenter; Control of a fermenter by digital controllers interfaced with computers for continuous acquisition of online data and for process control;

INDUSTRIAL FERMENTER:
Temperature and pH control, aeration and agitation, Fermenter Accessories, Product recovery

Theory: 15 Hr

Total Hours: 15
REFERENCES
1  *Fermentation and Biochemical Engineering Handbook*


Objectives:
- To learn about the feedstocks, fermentation and purification of bioethanol

Course Outcomes:
After successful completion of this course, the students should be able to

CO1 : Describe the economic, social and environmental aspects of bioethanol

CO2 : Illustrate the feedstocks for bioethanol

CO3 : Demonstrate the fermentation routes for bioethanol production

CO4 : Outline the purification steps involved in bioethanol fermentation

CO5 : Understand the future prospects of bioethanol

Pre-requisite: Nil

CO/PO Mapping
S-Strong, M-Medium, W-Weak

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Signature of the BOS chairman/Biotechnology
Course Content

BIOETHANOL 5 hrs
Introduction: Economic aspects, energy balance, main drivers; Global production: statistics, international and national directives, current and emerging status. First generation (sugars and starch), second generation (lignocelluloses), third generation (algae), feedstocks with future potential, feedstock processing, alternative routes to bioethanol

FERMENTATION AND PURIFICATION 5 hrs
Ethanologenic microorganisms, theoretical and applied aspects, ethanol fermentation from sucrose, starch hydrolysate, lignocelluloses hydrolysate and algae hydrolysate. Distillation: Theoretical and applied aspects; Adsorption: Theoretical and applied aspects; Quality control: Quality parameters (process and product), alcohol specifications.

ENVIRONMENTAL ASPECTS AND FUTURE PROSPECTS 5 hrs
Environmental aspects: Sustainability and climate change, energy and water conservation, co-products: generation and utilization, effluent treatment and control; Future prospects: Global trends and issues, future challenges.

Theory: 15 Hrs

Total Hours: 15 Hrs

REFERENCES:

OTHER REFERENCES:
1 www.ethanol.net
COMMON GENERAL ELECTIVES
Objectives:
- Acquire knowledge on TQM concepts
- Acquire knowledge on quality systems
- Develop skills to use TQM tools for domain specific applications

Course Outcomes (COs)
After successful completion of this course, the students should be able to:
CO 1: Understand quality concepts and philosophies of TQM
CO 2: Apply TQM principles and concepts of continuous improvement
CO 3: Apply and analyze the quality tools, management tools and statistical fundamentals to improve quality
CO 4: Understand the TQM tools as a means to improve quality
CO 5: Remember and understand the quality systems and procedures adopted

Pre-requisite:
1. Nil

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

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INTRODUCTION

9 hrs
Definition of Quality, Dimensions of Quality, Quality costs, Top Management Commitment, Quality Council, Quality Statements, Barriers to TQM Implementation, Contributions of Deming, Juran and Crosby, Team Balancing

TQM PRINCIPLES

9 hrs
Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Continuous Process Improvement, 5S, Kaizen, Just-In-Time and TPS

STATISTICAL PROCESS CONTROL

9 hrs
The seven tools of quality, New seven Management tools, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Concept of six sigma.

TQM TOOLS

9 hrs
Quality Policy Deployment (QPD), Quality Function Deployment (QFD), Benchmarking, Taguchi Quality Loss Function, Total Productive Maintenance (TPM), FMEA

QUALITY SYSTEMS

9 hrs

TOTAL: 45 HOURS

REFERENCE BOOKS:

U14GST003  PRINCIPLES OF MANAGEMENT

Objectives:
- To study the importance and functions of management in an organization
- To study the importance of planning and also the different types of plan
- To understand the different types of organization structure in management
- To understand the basis and importance of directing and controlling in management
- To understand to the importance of corporate governance and social responsibilities.

Course Outcomes(COs)
After successful completion of this course, the students should be able to:

CO1: Understand the concepts of management, administration and the evolution of management thoughts.
CO2: Understand and apply the planning concepts
CO3: Analyze the different organizational structures and understand the staffing process.
CO4: Analyze the various motivational and leadership theories and understand the communication and controlling processes.
CO5: Understand the various international approaches to management

Pre-requisite:
1. Nil
CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

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MANAGEMENT CONTEXT
9 hrs

PLANNING
9 hrs

ORGANISING
9 hrs
Nature and Purpose of Organizing - Types of Business Organization - Formal and informal organization – Organization Chart – Structure and

DIRECTING & CONTROLLING 9 hrs
Nature & Purpose – Manager Vs. Leader - Motivation - Theories and Techniques of Motivation.
Leadership – Styles and theories of Leadership.

CONTEMPORARY ISSUES IN MANAGEMENT 9 hrs
Corporate Governance Social responsibilities – Ethics in business – Recent issues.

REFERENCES:

TOTAL HOURS: 45
Objectives:
- Apply knowledge of OR techniques to domain specific industrial situations to optimize the quality of decisions
- Conduct investigations by the use of OR techniques

Course Outcomes (COs)
After successful completion of this course, the students should be able to:

CO1: Apply linear programming model and assignment model to domain specific situations

CO2: Analyze the various methods under transportation model and apply the model for testing the closeness of their results to optimal results

CO3: Apply the concepts of PERT and CPM for decision making and optimally managing projects

CO4: Analyze the various replacement and sequencing models and apply them for arriving at optimal decisions

CO5: Analyze the inventory and queuing theories and apply them in domain specific situations.

Pre-requisite:
1. Nil

CO/PO Mapping
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Programme Outcomes (POs)

Pre-requisite:
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LINEAR MODEL 9 hrs
The phases of OR study – formation of an L.P model – graphical solution – simplex algorithm – artificial variables technique (Big M method, two phase method), duality in simplex.

TRANSPORTATION AND ASSIGNMENT MODELS 9 hrs
Assignment model – formulation – balanced and unbalanced assignment problems.

PROJECT MANAGEMENT BY PERT & CPM 9 hrs

REPLACEMENT AND SEQUENCING MODELS 9 hrs
Replacement policies - Replacement of items that deteriorate with time (value of money not changing with time) – Replacement of items that deteriorate with time (Value of money changing with time) – Replacement of items that fail suddenly (individual and group replacement policies).
Sequencing models- n job on 2 machines – n jobs on 3 machines – n jobs on m machines, Traveling salesman problem.

INVENTORY AND QUEUING THEORY 9 hrs
Variables in inventory problems, EOQ, deterministic inventory models, order quantity with price break, techniques in inventory management.
Queuing system and its structure – Kendall’s notation – Common queuing models - M/M/1: FCFS/$\infty$/∞ - M/M/1: FCFS/n/$\infty$ - M/M/C: FCFS/$\infty$/∞ - M/M/1: FCFS/n/m

TOTAL HOURS: 45

REFERENCE BOOKS:
Objectives:
- Acquire knowledge of economics to facilitate the process of economic decision making
- Acquire knowledge on basic financial management aspects
- Develop the skills to analyze financial statements

Course Outcomes (COs)
After successful completion of this course, the students should be able to:
CO1: Evaluate the economic theories, Cost concepts and pricing policies
CO2: Understand the market structures and integration concepts
CO3: Understand the measures of national income, the functions of banks and concepts of globalization
CO4: Apply the concepts of financial management for project appraisal
CO5: Understand accounting systems and analyze financial statements using ratio analysis

Pre-requisite:
1. Nil

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

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Signature of the BOS chairman/Biotechnology
Course Assessment methods:

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**ECONOMICS, COST AND PRICING CONCEPTS** 9

**CONCEPTS ON FIRMS AND MANUFACTURING PRACTICES** 9

**NATIONAL INCOME, MONEY AND BANKING, ECONOMIC ENVIRONMENT** 9

**CONCEPTS OF FINANCIAL MANAGEMENT** 9

Signature of the BOS chairman/Biotechnology
ACCOUNTING SYSTEM, STATEMENT AND FINANCIAL ANALYSIS


Total Hours: 45

REFERENCE BOOKS:
1. Prasanna Chandra, “Financial Management (Theory & Practice) TMH
2. Weston & Brigham, “Essentials of Managerial Finance”
5. Financial Management & Policy -James C. Van Horne
7. Management Accounting Principles & Practice -P. Saravanavel
Objectives:
- Acquire knowledge on the various stages of a product development process
- Develop skills for using the various tools and techniques for developing products
- Acquire knowledge on project management techniques

Course Outcomes (COs)
After successful completion of this course, the students should be able to:
CO1: Understand the process to plan and develop products
CO2: Understand the process of collecting information and developing product specifications
CO3: Understand the concept generation, selection and testing processes
CO4: Understand the concepts of product architecture, industrial design and design for manufacture
CO5: Understand the basics of prototyping, economic analysis and project planning and execution processes

Pre-requisite:
1. Nil

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

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### INTRODUCTION - DEVELOPMENT PROCESSES AND ORGANIZATIONS - PRODUCT PLANNING

Characteristics of successful product development to Design and develop products, duration and cost of product development, the challenges of product development.

A generic development process, concept development: the front-end process, adapting the generic product development process, the AMF development process, product development organizations, the AMF organization.

The product planning process, identify opportunities. Evaluate and prioritize projects, allocate resources and plan timing, complete pre project planning, reflect all the results and the process.

### IDENTIFYING CUSTOMER NEEDS - PRODUCT SPECIFICATIONS

Gathering raw data from customers, interpreting raw data in terms of customer needs, organizing the needs into a hierarchy, establishing the relative importance of the needs and reflecting on the results and the process.

Specifications, establish specifications, establishing target specifications setting the final specifications.

### CONCEPT GENERATION - CONCEPT SELECTION - CONCEPT TESTING

The activity of concept generation clarify the problem search externally, search internally, explore systematically, reflect on the results and the process.

Overview of methodology, concept screening, concept scoring, caveats.
Purpose of concept test, choosing a survey population and a survey format, communicate the concept, measuring customer response, interpreting the result, reflecting on the results and the process.

**PRODUCT ARCHITECTURE - INDUSTRIAL DESIGN - DESIGN FOR MANUFACTURING**

Meaning of product architecture, implications of the architecture, establishing the architecture, variety and supply chain considerations, platform planning, related system level design issues.

Assessing the need for industrial design, the impact of industrial design, industrial design process, managing the industrial design process, is assessing the quality of industrial design.

Definition, estimation of manufacturing cost, reducing the cost of components, assembly, supporting production, impact of DFM on other factors.

**PROTOTYPING - PRODUCT DEVELOPMENT ECONOMICS - MANAGING PROJECTS**

Prototyping basics, principles of prototyping, technologies, planning for prototypes.

Elements of economic analysis, base case financial mode,. Sensitive analysis, project trade-offs, influence of qualitative factors on project success, qualitative analysis.

Understanding and representing task, baseline project planning, accelerating projects, project execution, postmortem project evaluation.

**TOTAL: 45 HOURS**

**REFERENCE BOOKS:**

2. Product Design and Manufacturing: A C Chitale and R C Gupta, PHI
4. Product Design for Manufacture and Assembly: Geoffrey Boothroyd, Peter Dewhurst and Winston Knight.