JHARKHAND Rai University

B. Tech Sem III C E

B.TECH CE 2018-2022													
SEMESTER III													
S.No.	CATEGORY	CODE	COURSE TITLE	Periods			Evaluation Scheme				Subject Total	Credit
				L	T	P	Assignment	TA	Total	ESE		
1	Basic Science Course	5ABSC201	Mathematics- III	2	0	0	20	10	30	70	100	2
2	Basic Science Course	5ABSC203	Life Science	2	0	0	20	10	30	70	100	2
3	Basic Science Course	BSC 202	Biology for Engineers	3	0	0	20	10	30	70	100	3
4	Engineering Science Courses	5AESC202	Basic Electronics	1	0	0	20	10	30	70	100	1
5	Engineering Science Courses	5AESC203	Computer Aided Civil Engineering Drawing	1	0	0	20	10	30	70	100	1
6	Engineering Science Courses	5AESC201	Engineering Mechanics	3	1	0	20	10	30	70	100	4
7	Engineering Science Courses	5A ESC212	Energy science and Engineering	1	1	0	20	10	30	70	100	2
8	Humanities and Social Sciences including Management courses	HSMC201	Effective Technical Communication	3	0	0	20	10	30	70	100	3
9	Humanities and Social Sciences including Management courses	HSMC251	Introduction to Civil Engineering	2	0	0	20	10	30	70	100	2
PRACTICAL /SESSIONAL												
1	Basic Science Course	5ABSC203P	Life Science	0	0	2			30	20	50	1
2	Engineering Science Courses	5AESC202P	Basic Electronics	0	0	2			30	20	50	1
3	Engineering Science Courses	5AESC203P	Computer Aided Civil Engineering Drawing	0	0	2			30	20	50	1
									TOTAL		**1100**	**23**

**** NOTE: Qualifying Non Credit Course**

Program: B.Tech
Semester: Three
Course: Mathematics III
Course Code: 5ABSC201

L	T	P	C
3	0	0	3

Course Objective:

- The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions. Students will be able to solve problems related to engineering applications by using these techniques.
- To find the velocity and acceleration of a particle moving along a space curve.
- Apply the principles of Differential Calculus to solve a variety of practical problems in Engineering and Applied Science.
- Apply the principles of Partial Differentiation, Directional Derivatives, and Double integral.

Module 1: Transform Calculus

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace Transform method. Fourier transforms.

Module 2: Sets, Relations and Functions

Basic operations on sets, Cartesian products, disjoint union (sum), and power sets. Different types of relations, their compositions and inverses. Different types of functions, their compositions and inverses.

Module 3: Introduction to Counting Technique and graph:

Basic counting techniques– inclusion and exclusion, pigeon-hole principle, permutation, combination, summations. Introduction to recurrence relation and generating functions. Introduction to Graphs and their basic properties – degree, path, cycle, sub graph, isomorphism, Eulerian and Hamiltonian walk.

Module 4: Algebraic Structures

Algebraic structures with one binary operation – semi group, monoid and group. Cosets, Lagrange's theorem, normal subgroup, homomorphic subgroup. Congruence relation and quotient structures. Error correcting code. Algebraic structures with two binary operations ring, integral domain, and field. Boolean algebra and boolean ring (Definitions and simple examples only).

Suggested Reading:

1. *Higher Engineering Mathematics, B.S. Grewa*
2. *N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.*
3. *P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).*
4. *S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.*
5. *J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and It's Application to Computer Science",TMG Edition, TataMcgraw-Hill*
6. *Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press. Schaum's Outlines Series,Seymour Lipschutz, Marc Lipson.*

Program: B.Tech

Semester: Third

Course: Engineering Mechanics

Course Code: 5AESC201

L	T	P	C
3	1	0	4

Course Objective:

- To Confidently tackle equilibrium equations, moments and inertia problems
- To Master calculator/computing basic skills to use to advantage in solving mechanics problems.
- To Gain a firm foundation in Engineering Mechanics for furthering the career in Engineering.

Module 1*: Introduction to Engineering Mechanics covering*, Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy.

Module 2*: Friction covering*, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack;

Module 3*: Basic Structural Analysis covering*, Equilibrium in three dimensions; Method ofSections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines;

Module 4*: Centroid and Centre of Gravity covering*, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

Module 5*: Virtual Work and Energy Method*-Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.

Module 6*: Review of particle dynamics*-Rectilinear motion; Plane curvilinear motion(rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work -kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

Module 7:*Introduction to Kinetics of Rigid Bodies covering*, Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation;

Module 8:*Mechanical Vibrations covering*, Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums;

Suggested Reading:

1. *Shanes and Rao (2006), Engineering Mechanics,Pearson Education.*
2. *Hibler and Gupta (2010),Engineering Mechanics (Statics,Dynamics) by Pearson Education.*
3. *Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer"s Engineering Mechanics.*
4. *Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications.*
5. *Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.*

Program: B.Tech

Semester: Third

Course: Basic Electronics

Course Code: 5AESC202

L	T	P	C
1	0	0	1

Course Objective:

- To Identify the unique vocabulary associated with electronics and explain the basic concepts of Semiconductor diodes such as pn junction diode, characteristics and ammeters, DC load line, Zener diode.
- To apply the basics of diode to describe the working of rectifier circuits such as Full and half wave rectifiers. To solve examples on rectifiers for parameters such as Capacitance, load and source effect, line and load regulations, and circuit current.
- To Draw and explain the structure of bipolar junction transistor. Explain the operation of each device in terms of junction bias voltage and charge carrier movement. Identify and explain the various current components in a transistor.

Module1:*Diodes and Applications* covering, Semiconductor Diode - Ideal versus Practical, Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode and Applications; Silicon Controlled Rectifier (SCR) – Operation, Construction, Characteristics, Ratings, Applications;

Module2*: Transistor Characteristics* covering, Bipolar Junction Transistor (BJT)–Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Voltage Divider Bias Configuration; Field Effect Transistor (FET) – Construction, Characteristics of Junction FET, Depletion and Enhancement type Metal Oxide Semiconductor (MOS) FETs, Introduction to CMOS circuits;

Module 3*: Transistor Amplifiers and Oscillators* covering, Classification, Small Signal Amplifiers – Basic Features, Common Emitter Amplifier, Coupling and Bypass Capacitors, Distortion, AC Equivalent Circuit; Feedback Amplifiers – Principle, Advantages of Negative Feedback, Topologies, Current Series and Voltage Series Feedback Amplifiers; Oscillators – Classification, RC Phase Shift, Wien Bridge, High Frequency LC and Non-Sinusoidal type Oscillators;

Module 4: *Operational Amplifiers and Applications covering,* Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal Op Amp, Concept of Virtual Ground; inter ICs;

Reading Suggested

1. *David. A. Bell (2003), Laboratory Manual for Electronic Devices and Circuits, Prentice Hall, India.*
2. *Santiram Kal (2002), Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India.*
3. *Thomas L. Floyd and R. P. Jain (2009), Digital Fundamentals by Pearson Education.*

4.Paul B. Zbar, A.P. Malvino and M.A. Miller (2009), Basic Electronics–A Text-Lab.Manual, TMH.

5.R. T. Paynter (2009), Introductory Electronic Devices & Circuits, Conventional FlowVersion, Pearson.

Program: B.Tech

Semester: Third

Course: Basic Electronics

Course Code: 5AESC202P

L	T	P	C
0	0	2	1

Practicals:

Module 1: Laboratory Sessions covering, Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Switches (SPDT, DPDT and DIP), Bread Boards and Printed Circuit Boards (PCBs); Identification, Specifications, Testing of Active Devices – Diodes, BJTs, JFETs, MOSFETs, Power Transistors, SCRs and LEDs;

Module 2: Study and Operation of Digital Multi Meter, Function / Signal Generator, Regulated Power Supply (RPS), Cathode Ray Oscilloscopes; Amplitude, Phase and Frequency of Sinusoidal Signals using Lissajous Patterns on CRO; (CRO);

Module 3: Experimental Verification of PN Junction Diode Characteristics in A) Forward Bias B) Reverse Bias, Zener Diode Characteristics and Zener Diode as Voltage Regulator, Input and Output Characteristics of BJT in Common Emitter (CE) Configuration, Drain and Transfer Characteristics of JFET in Common Source (CS) Configuration;

Module 4: Study of Half Wave and Full Wave Rectification, Regulation with Filters, Gain And Bandwidth of BJT Common Emitter (CE) Amplifier, Gain and Bandwidth of JFET Common Source (CS) Amplifier, Gain and Bandwidth of BJT Current Series and Voltage Series Feedback Amplifiers, Oscillation Frequency of BJT based RC Phase Shift, Hartley and Colpitts Oscillators; Module 5: Op-Amp Applications – Adder, Subtractor, Voltage Follower and Comparator; Op-Amp Applications – Differentiator and Integrator, Square Wave and Triangular Wave Generation, Applications of 555 Timer – Astable and Monostable Multivibrators;

Module 5: Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR Integrated Circuits (ICs); Truth Tables and Functionality of Flip-Flops – SR, JK and D Flip-Flop ICs; Serial-In-Serial-Out and Serial-In-Parallel-Out Shift operations Using 4-bit/8-bit Shift Register ICs; Functionality of Up-Down / Decade Counter ICs; (15 Sessions)

Program: B.Tech

Semester: Third

Course: Computer Aided Civil Engineering

Course Code: 5AESC203

L	T	P	C
1	0	1	1

Course Objective:

- To Develop Parametric design and the conventions of formal engineering drawing.
- To Produce and interpret 2D & 3D drawings.
- To communicate a design idea/concept graphically/ visually.
- To Examine a design critically and with understanding of CAD - The student learn to
- To interpret drawings, and to produce designs using a combination of 2D and 3D software.
- To Get a Detailed study of an engineering artifact

Module 1: INTRODUCTION**;** Introduction to concept of drawings, Interpretation of typical drawings, Planning drawings to show information concisely and comprehensively; optimal layout of drawings and Scales; Introduction to computer aided drawing, co-ordinate systems, reference planes. Commands: Initial settings, Drawing aids, Drawing basic entities, Modify commands, Layers, Text and Dimensioning, Blocks. Drawing presentation norms and standards.

Module 2: SYMBOLS AND SIGN CONVENTIONS: Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards

Module 3: MASONRY BONDS: English Bond and Flemish Bond–Corner wall and Crosswalls - One brick wall and one and half brick wall.

Module 4: BUILDING DRAWING: Terms, Elements of planning building drawing, Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings. Foundation plan. Roof drainage plans. Depicting joinery, standard fittings & fixtures, finishes. Use of Notes to improve clarity.

Module 5: PICTORIAL VIEW: Principles of isometrics and perspective drawing. Perspective view of building. Fundamentals of Building Information Modeling.

Suggested Reading

1.Subhash C Sharma & Gurucharan Singh (2005), " Civil Engineering Drawing" , Standard Publishers

2.Ajeet Singh (2002), " Working with AUTOCAD 2000 with updates on AUTOCAD 200I", Tata-Mc Graw-Hill

Company Limited, New Delhi

3.Sham Tickoo Swapna D (2009), " AUTOCAD for Engineers and Designers" , Pearson Education,

4.Venugopal (2007), "Engineering Drawing and Graphics + AUTOCAD" , New Age International Pvt.Ltd.

Program: B.Tech
Semester: Third
Course: Computer Aided Civil Engineering
Course Code: 5AESC203P

L	T	P	C
0	0	2	1

List of Drawing Experiments:

1. Buildings with load bearing walls including details of doors and windows.
2. Taking standard drawings of a typical two storeyed building including all MEP, joinery, rebars, finishing and other details and writing out a description of the Facility in about 700 words
3. RCC framed structures
4. Reinforcement drawings for typical slabs, beams, columns and spread footings.
5. Industrial buildings - North light roof structures - Trusses
6. Perspective view of one and two storey buildings

Program: B.Tech
Semester: Third
Course: Effective Technical Communications
Course Code: HSMC201

L	T	P	C
3	0	0	3

Course Objective:

- To explain the key elements of technical writing.
- To explain the role that communication plays within an organization.
- To explain the importance of good communication skills.
- To identify the foundations of technical writing.
- To identify the qualities of good technical writing.

Module 1: Information Design and Development- Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.

Module 2: Technical Writing, Grammar and Editing- Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Hunan factors, Managing technical communication projects, time estimation, Single sourcing, Localization.

Module 3: Self Development and Assessment- Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, Taking notes; Complex problem solving; Creativity

Module 4: Communication and Technical Writing- Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

Module 5: Ethics- Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity.

Suggested Readings

1. *David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004.*

2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)

3. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.

Program: B.Tech
Semester: Third
Course: Introduction to Civil Engineering
Course Code: HSMC251

L	T	P	C
2	0	0	2

Course Objective:

- To give an understanding to the students of the vast breadth and numerous areas of engagement available in the overall field of Civil Engineering.
- To motivate the student to pursue a career in one of the many areas of Civil Engineering with deep interest and keenness.
- To expose the students to the various avenues available for doing creative and innovative work in this field by showcasing the many monuments and inspiring projects of public utility.

Modules

1. **Basic Understanding**: What is Civil Engineering/ Infrastructure? Basics of Engineering and Civil Engineering; Broad disciplines of Civil Engineering; Importance of Civil Engineering, Possible scopes for a career

2. **History of Civil engineering**: Early constructions and developments over time; Ancient monuments & Modern marvels; Development of various materials of construction and methods of construction; Works of Eminent civil engineers.

3. **Overview of National Planning for Construction and Infrastructure Development**; Position of construction industry vis-à-vis other industries, five year plan outlays for construction; current budgets for infrastructure works;

4. **Fundamentals of Architecture & Town Planning**: Aesthetics in Civil Engineering, Examples of great architecture, fundamentals of architectural design & town planning; Building Systems (HVAC, Acoustics, Lighting, etc.); LEED ratings; Development of Smart cities

5. **Fundamentals of Building Materials**: Stones, bricks, mortars, Plain, Reinforced & Prestressed Concrete, Construction Chemicals; Structural Steel, High Tensile Steel, Carbon Composites; Plastics in Construction; 3D printing; Recycling of Construction & Demolition wastes

6. **Basics of Construction Management & Contracts Management**: Temporary Structures in Construction; Construction Methods for various types of Structures; Major Construction equipment; Automation & Robotics in Construction; Modern Project management Systems; Advent of Lean Construction; Importance of Contracts Management.

7. **Environmental Engineering & Sustainability**: Water treatment systems; Effluent treatment systems; Solid waste management; Sustainability in Construction;

8. **Geotechnical Engineering**: Basics of soil mechanics, rock mechanics and geology; various types of foundations; basics of rock mechanics & tunneling

9. **Hydraulics, Hydrology &Water Resources Engineering**: Fundamentals of fluid flow, basics of water supply systems; Underground Structures; Underground Structures Multi-purpose reservoir projects

10. **Ocean Engineering**: Basics of Wave and Current Systems; Sediment transport systems; Ports & Harbours and other marine structures

11. **Power Plant Structures**: Chimneys, Natural & Induced Draught Colling towers, coal handling systems, ash handling systems; nuclear containment structures; hydro power projects

12. **Structural Engineering**: Types of buildings; tall structures; various types of bridges;Water retaining structures; Other structural systems; Experimental Stress Analysis; Wind tunnel studies;

13. **Surveying & Geomatics**: Traditional surveying techniques, Total Stations, Development of Digital Terrain Models; GPS, LIDAR;

14. **Traffic &Transportation Engineering**: Investments in transport infrastructure development in India for different modes of transport; Developments and challenges in integrated transport development in India: road, rail, port and harbour and airport sector; PPP in transport sector; Intelligent Transport Systems; Urban Public and Freight Transportation; Road Safety under heterogeneous traffic; Sustainable and resilient pavement materials, design, construction and management; Case studies and examples.

Repairs & Rehabilitation of Structures: Basics of corrosion phenomena and other structural distress mechanisms; some simple systems of rehabilitation of structures; Non-Destructive testing systems; Use of carbon fibre wrapping and carbon composites in repairs.

Computational Methods, IT, IoT in Civil Engineering: Typical software used in Civil Engineering-Finite Element Method, Computational Fluid Dynamics; Computational Geotechnical Methods; highway design (MX), Building Information Modeling; Highlighting typical available software systems.

Suggested Reading:

1.Patil, B.S.(1974), Legal Aspects of Building and Engineering Contract
2.The National Building Code, BIS, (2017)RERA Act, (2017)
3.Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset4. Chandiramani, Neelima (2000), The Law of Contract: An Outline, 2nd Edn. Avinash Publications Mumbai 5.Avtarsingh (2002), Law of Contract, Eastern Book Co.
6.Dutt (1994), Indian Contract Act, Eastern Law House
7.Anson W.R.(1979), Law of Contract, Oxford University Press
8.Kwatra G.K.(2005), The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration, Indian Council of Arbitration
6.Avtarsingh (2005), Law of Arbitration and Conciliation, Eastern Book Co.
7.Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.
8.P. S. Narayan (2000), Intellectual Property Rights, Gogia Law Agency
9.T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House
10.Bare text (2005), Right to Information Act
11.O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers
12.K.M. Desai(1946), The Industrial Employment (Standing Orders) Act

Program: B.Tech
Semester: Third
Course: Biology (Biology for Engineers)
Course Code: 5ABSC202

L	T	P	C
2	1	0	3

Course Objective:

- To Convey that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological.
- To highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring.
- To convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine.

Module 1*.(2 hours)- Introduction*

Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18^{th} Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.

Module 2*.(3 hours)- Classification*

Purpose: To convey that classification*per se*is not what biology is all about. Theunderlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity-Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization - Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata-acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus

Module 3*.(4 hours)-Genetics*

Purpose: To convey that " Genetics is to biology what Newton's laws are to PhysicalSciences"Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of

genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.

Module 4.*(4 hours)-Biomolecules*
Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.

Module 5.*(4 Hours). Enzymes*

Purpose: To convey that without catalysis life would not have existed on earth
Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyze reactions. Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.

Module 6.*(4 hours)- Information Transfer*
Purpose: The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.

Module 7.*(5 hours). Macromolecular analysis*
Purpose: How to analyses biological processes at the reductionistic level Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.

Module 8.*(4 hours)- Metabolism*
Purpose: The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of K_{eq} and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO_2 + H_2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge

Module 9.*(3 hours)- Microbiology* Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.

Suggested Reading:

1.Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd

2.Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons

3.Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company

4.Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher

5.Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publisher

Program: B.Tech
Semester: Third
Course: **Life Science**
Course Code: 5ABSC 203

L	T	P	C
2	0	0	2

Course Objective:

Module 1A: *Plant Physiology* covering, Transpiration; Mineral nutrition**.**

Module 1B:*Ecology*covering, Ecosystems- Components, types, flow of matter and energy in an ecosystem; Community ecology- Characteristics, frequency, life forms, and biological spectrum; Ecosystem structure- Biotic and a-biotic factors, food chain, food web, ecological pyramids.

Module 2A: *Population Dynamics* covering, Population ecology- Population characteristics, ecotypes; Population genetics- Concept of gene pool and genetic diversity in populations, polymorphism and heterogeneity.

Module 2B*: Environmental Management* covering, Principles: Perspectives, concerns and management strategies; Policies and legal aspects- Environment Protection Acts and modification, International Treaties; Environmental Impact Assessment- Case studies (International Airport, thermal power plant).

Module 3A*:* *Molecular Genetics* covering, Structures of DNA and RNA; Concept of Gene, Gene regulation, e.g., Oberon concept.
Module 3B*: Biotechnology* covering, Basic concepts: Tot potency and Cell manipulation; Plant & Animal tissue culture- Methods and uses in agriculture, medicine and health; Recombinant DNA Technology-Techniques and applications.
Module 4A: *Biostatistics* covering, Introduction to Biostatistics:-Terms used, types of data; Measures of Central Tendencies- Mean, Median, Mode, Normal and Skewed distributions; Analysis of Data-Hypothesis testing and ANNOVA (single factor).

Suggested Readings

1.Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd.
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons.
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company.
4.Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher.
5. *Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers.*

Program: B.Tech
Semester: Three
Course: **Life Science**
Course Code: 5ABSC 203

L	T	P	C
0	0	2	1

Laboratory & Field work Sessions

- Comparison of stomatal index in different plants
- Study of mineral crystals in plants; Determination of diversity indices in plant communities
- To construct ecological pyramids of population sizes in an ecosystem
- Determination of Importance Value Index of a species in a plant community
- Seminar (with PPTs) on EIA of a Mega-Project (e.g., Airport, Thermal/Nuclear Power Plant/ Oil spill scenario)
- Preparation and extraction of genomic DNA and determination of yield by UV absorbance
- Isolation of Plasmid DNA and its separation by Gel Electrophoresis
- Data analysis using Bio-statistical tools

Program: B.Tech

Semester: Third

Course: Energy Science & Engineering

Course Code: 5AESC 212

L	T	P	C
3	0	0	3

Course Objective:

- To List and generally explain the main sources of energy and their primary applications nationally and internationally.
- To have basic understanding of the energy sources and scientific concepts/principles behind them.
- To understand effect of using these sources on the environment and climate.
- To describe the challenges and problems associated with the use of various energy sources, including fossil fuels, with regard to future supply and the impact on the environment.

Module 1: *Introduction to Energy Science:* Scientific principles and historical interpretation to *place energy* use in the context of pressing societal, environmental and climate issues; Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment.

Module 2: *Energy Sources:* Overview of energy systems, sources, transformations, efficiency, and storage. Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal and hydrogen; Sustainability and environmental trade-offs of different energy systems; possibilities for energy storage or regeneration (Ex. Pumped storage hydro power projects, superconductor-based energy storages, high efficiency batteries).

Module 3: *Energy & Environment:* Energy efficiency and conservation; introduction to clean energy technologies and its importance in sustainable development; Carbon footprint, energy consumption and sustainability; introduction to the economics of energy; How the economic system determines production and consumption; linkages between economic and environmental outcomes; How future energy use can be influenced by economic, environmental, trade, and research policy.

Module 4:*Civil Engineering Projects connected with the Energy Sources:* Coal mining technologies, Oil exploration offshore platforms, Underground and under-sea oil pipelines, solar chimney project, wave energy caissons, coastal installations for tidal power, wind mill towers; hydro power stations above-ground and underground along with associated dams, tunnels, penstocks, etc.; Nuclear reactor containment buildings and associated buildings, design and construction constraints and testing procedures for reactor containment buildings; Spent Nuclear fuel storage and disposal systems.

Module 5: *Engineering for Energy conservation:* Concept of Green Building and Green Architecture; Green building concepts (Green building encompasses everything from the choice of building materials to where a building is located, how it is designed and operated); *LEED ratings;* Identification of energy related enterprises that represent the breath of the industry and prioritizing these as candidates; Embodied energy analysis and use as a tool for measuring sustainability. Energy Audit of Facilities and optimization of energy consumption

Suggested Reading:

1. *Boyle, Godfrey (2004), Renewable Energy (2nd edition). Oxford University Press*
2. *Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.) (2004), Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press*
3. *Schaeffer, John (2007), Real Goods Solar Living Sourcebook: The Complete Guide to Renewable Energy Technologies and Sustainable Living, Gaiam*
4. *Jean-Philippe; Zaccour, Georges (Eds.), (2005), Energy and Environment Set: Mathematics of Decision Making, Loulou, Richard; Waaub, XVIII,*
5. *Ristinen, Robert A. Kraushaar, Jack J. AKraushaar, Jack P. Ristinen, Robert A. (2006) Energy and the Environment, 2nd Edition, John Wiley*
6. *UNDP (2000), Energy and the Challenge of Sustainability, World Energy assessment*
7. *E H Thorndike (1976), Energy & Environment: A Primer for Scientists and Engineers, Addison-Wesley Publishing Companny.*

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