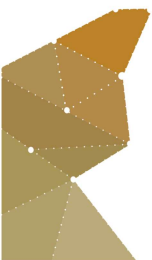




B. Tech Mechanical Engineering Curriculum

SEMESTER I



B. Tech Mechanical Engineering

Semester I

Code	Subject Name	L-T-P	Credit
ENL 101	Communicative English	3-0-0	3
ENG 111	Basic Electronics	3-0-2	4
MAT 112	Mathematics - I	3-0-0	3
BIO 101	Introduction to Biology	2-0-2	3
CSE 102	Basic Computer Science and Programming	3-0-2	4
PHY 112	Classical Mechanics	2-0-2	3
CDC 111	Soft Skills - I	1-0-0	1
		17-0-8	21



Semester I

Code	Title	Core/ Elective	L-T-P	Credits
ENL 101	Communicative English	C	3-0-0	3

UNIT I: RHETORIC AND PUBLIC SPEAKING

Rhetoric, Critical Thinking and Public Speaking; Thinking Outside the Box; How to Deliver a Speech; Fundamentals of Persuasion.

UNIT II: NONVERBAL COMMUNICATION

Nonverbal Communication; Spatial distance, eye contact and appearances; How nonverbal communication is more important than words.

UNIT III: COMMUNICATION AND THE MEDIA

Persuasion and the media; Radio, television, film, social media and the internet; How the media sells ideas, images, products and life styles; Fundamentals of Informative/Scientific Speeches and Research; The Heart of the Speech – Powerful Narratives; The Power of Narrative.

UNIT IV: SMALL GROUP COMMUNICATION

Small group communication; Leadership, conflict and persuasion in groups; The importance of small groups in business; Dr. A. Fisher's Fundamentals of Small Groups; Group Problem Solving; Learning to say no – don't say you will when you won't, don't say yes and then don't do it, be true to your word.

Books of Study:

1. Communication: Principles for a Lifetime. Beebe, Beebe and Ivy, Sixth Edition, Pearson Publishing.

References:

1. Qualitative Communication Research Methods (2011) Bryan C. Taylor and Thomas R. Lindlof. Sage Publications, New Delhi, India, 3rd Edition.
2. The Fundamentals of Small Group Communication (2008) Scott A. Myers and Carolyn M. Anderson. Sage Publications, New Delhi, India.
3. Lehninger principles of biochemistry. Lehninger, A. L., Nelson, D. L., & Cox, M. M. (2000). Worth Publishers, New York.
4. Principle and techniques of biochemistry and molecular biology, Wilson, K., Walker, J. (2005). 6th edn. Cambridge University Press, Cambridge.
5. Kuby Immunology, Ed. 5, 2006, Kindt, Goldsby and Osborn, W. H Freeman & Co (Sd).
6. Molecular Cell Biology, Ed. 8, 2016, Harvey Lodish, Arnold Berk and Chris A. Kaiser, W. H Freeman & Co (Sd).
7. Microbial Biotechnology: Principles and Applications, Ed. 1, 2006, Yuan Kun Lee, World Scientific Publishing Co Pt. Ltd.



Semester I

Code	Title	Core/ Elective	L-T-P	Credits
ENG 111	Basic Electronics	C	3-0-2	4

Unit I: ELECTRICAL QUANTITIES AND THEIR MEASUREMENT

Ohm's law, permanent magnet moving coil (PMMC) instrument, Ammeter and Voltmeter using PMMC, Measurement of resistance using Wheat Stone's Bridge and Kelvin's double bridge, measurement of capacitance using Schering's bridge and De Sautee's bridge, and measurement of inductance using Maxwell's bridge and Hay's bridge. Operation of the oscilloscope.

Unit II: SEMICONDUCTOR DEVICES

Forward and reverse bias characteristics of PN junction diode. Design of half-wave, full-wave, bridge rectifiers, clipping and clamping using PN junction diode. Bipolar junction transistors (BJTs), common-base, common-collector and common-emitter configurations using BJTs. Voltage and current gain, transistor as amplifier and buffer. Photodiode and phototransistor.

Unit III: A.C. CIRCUITS AND OPERATIONAL AMPLIFIER

Phasor analysis, impedance and reactance, resonance, tuned circuits using R-L-C components, series reactance and resistance, parallel reactance and resistance. Characteristics of an operational amplifier, inverting and non-inverting op-amps, integrator and differentiator design using op-amp. Differential operational amplifier and common-mode rejection ratio.

Unit IV: ELECTRONIC FILTERS

Low and high frequency noise in electronic circuits, basic low-pass, high-pass, band-pass and band- reject passive filters design using resistor, capacitor and inductor. Fourier transform, magnitude and phase response, bandwidth, bode plots. Design and analysis of higher order filters. Active filter design using operational amplifier, applications of electronic filters.

Unit V: DIGITAL LOGIC FUNDAMENTALS

Number systems: binary, decimal, octal and hexadecimal number systems, number system conversions. Logic gates: AND, OR, NOT, NAND, NOR, X-OR, X-NOR. Logic gates design using PN diodes. De Morgan's laws, Karnaugh maps. Basic combinational logic blocks: half adder, half subtractor, full adder, full subtractor, multiplexer and de multiplexer. Lab Work: Based on theory, some basic experiments will be conducted

Books of Study:

1. Principles of electronics by V K Mehta & Rohit Mehta, 2010 edition, S Chand and Co. Publisher, ISBN: 9788121924504.



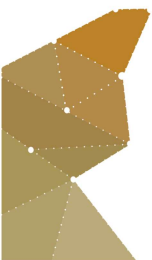
2. Electronic devices and circuits by David A. Bell, 2008 edition, Oxford University Press, ISBN: 9780195693409.
3. Introduction to digital logic design by John P. Hayes, 1993 edition, Pearson Edition, ISBN: 9780201154610.

References:

1. Electronic measurements and Instrumentation by A K Sawhney, 2015 edition, Dhanpat Rai and Co., ISBN: 9788177001006.
2. Pulse, Digital and Switching waveforms by Mill man and Taube, 2011 edition, Tata McGraw Hill, ISBN: 9780071072724.

Laboratory Experiments:

1. Verification of Kirchhoff's laws (KCL, KVL).
2. Study of I-V characteristics of PN junction diode.
3. Design of half-wave rectifier using PN junction diode with and without capacitor filter.
4. Design of positive and negative clipping circuits using PN junction diodes.
5. Study of current and voltage gain characteristics of a NPN transistor in common-emitter configuration.
6. Design of oscillator circuit using 555 timer.
7. Study of inverting and non-inverting amplifier circuits using op-amp.
8. Design of integrator and differentiator circuits using op-amp.
9. Study of low-pass and high-pass filter circuits using RC components.
10. Study of function of digital logic gates (AND, NOT, OR, NAND, NOR).



Semester I

Code	Title	Core/ Elective	L-T-P	Credits
MAT 112	Mathematics - I	C	3-0-0	3

UNIT I: DERIVATIVES AND DIFFERENTIATION

Limit, Continuity and limits of quotients, Derivatives and its geometrical Interpretation, Derivative as a function and calculating derivative, Leibnitz notation and higher derivatives, Trigonometric functions, Linear Approximations, Product and quotient rules, Chain rule, Implicit differentiation, Inverse, exponential and logarithm functions.

UNIT II: APPROXIMATIONS AND THEIR APPLICATIONS

Measurement error of linear approximation, Quadratic approximation, Newton's method, 1 and 2nd derivative test, Limits and asymptotic, Max min problems, Related application in real-life problems.

UNIT III: THE INTEGRAL AND INTEGRATION THEORY

Mean Value Theorem, Differentials and anti-derivatives, Differential equations, The definite integral, First and Second Fundamental Theorem of Calculus.

UNIT IV: DIFFERENT INTEGRATION TECHNIQUES AND APPLICATION OF CALCULUS

Areas and Volumes, Average value, Probability, Numerical Integration, Integrals of Trigonometric Power, Trigonometric substitution, Partial fractions, Integration by Parts, Arc length and Surface area.

UNIT V: POLAR CO-ORDINATE SYSTEMS AND INFINITE SERIES

Parametric curves, Polar co-ordinates, L'Hospital's rule, Improper Integrals, Infinite Series, Taylor's series.

Books of Study:

1. R. G. Bartle and D. R. Sherbert, Introduction to Real Analysis, Third edition, Wiley India , 2005.
2. S. R. Ghorpade and B. V. Limaye, An Introduction to Calculus and Real Analysis, Springer India, 2007.
3. Michael Spivak, Calculus, Third Edition, Cambridge University, 2008.

References:

1. G. B. Thomas, Jr. and R. L. Finney, Calculus and Analytic Geometry, 3rd Ed., Pearson Education India 9th Edition 1999
2. P.M. Fitzpatrick, Advanced Calculus, 2nd Edition, AMS Indian Edition, 2010.



Semester I

Code	Title	Core/ Elective	L-T-P	Credits
BIO 101	Introduction to Biology	C	2-0-2	3

UNIT I: BASIC CELL BIOLOGY AND BIOCHEMISTRY

Cells: Cell theory, prokaryotes and eukaryotes, cell structure, composition and function, cellular organelles and cytoskeleton. Biomolecules: Water, carbohydrates and lipids. Covalent and non-covalent interactions of biomolecules. Bioenergetics: Cellular energy and ATP. Cellular transport: pumps, channels and transporters.

UNIT II: PROTEIN STRUCTURE AND FUNCTION

Protein structure: Amino acids, Primary, secondary, tertiary and Quaternary structures. Protein structure and function, Protein folding, Protein modification and degradation. Introduction to Enzymes: classification, mechanism of action, and kinetics.

UNIT III: BASIC MOLECULAR BIOLOGY

Nucleic acids; DNA: structure and function, RNA: types, structure and function. Flow of genetic information: replication, transcription and translation. Post transcriptional and translational modification. Regulation of gene expression.

UNIT IV: GENOMICS AND MOLECULAR BIOLOGY TOOLS

Genes and Genome: Organization of Eukaryotic DNA. Molecular biology tools: recombinant DNA (rDNA) technology, Polymerase Chain Reaction (PCR) and DNA sequencing.

UNIT V: CELL CYCLE AND CELLULAR SIGNALING

Eukaryotic cell cycle and check points. Mitosis and Meiosis. Introduction to Cellular signaling: Signaling molecules, primary and secondary messengers, Signaling pathways.

Books of Study:

1. Thrives in Biochemistry and Molecular Biology, Edition 1, 2014, Cox, Harris, Pears, Oxford University Press.
2. Exploring Proteins, Ed. 1, 2014, Price and Nairn, Oxford University Press.
3. Thrives in Cell Biology, Ed. 1, 2013, Qiuyu Wang, Cris Smith and Davis, Oxford University Press.

References:

1. The cell: a molecular approach. Cooper, G. M., Hausman, R. E. (2009). ASM Press, Washington D. C.
2. Lehninger principles of biochemistry. Lehninger, A. L., Nelson, D. L., & Cox, M. M. (2000). Worth Publishers, New York.



3. Principle and techniques of biochemistry and molecular biology, Wilson, K., Walker, J. (2005). 6th edn. Cambridge University Press, Cambridge.
4. Molecular Cell Biology, Ed. 8, 2016, Harvey Lodish, Arnold Berk and Chris A. Kaiser, W. H Freeman & Co (Sd).

Laboratory Experiments:

1. Determination of soluble protein content by Lowry method
2. Molecular weight determination of protein by SDS-PAGE
3. Enzymatic assay: estimation of amylase by colorimetric method
4. Determination of human ABO blood type by noninvasive methods
5. Isolation of peripheral blood mononuclear cells
6. Isolation, enumeration and purification of microbes
7. Gram staining for microbial sources
8. Isolation of DNA
9. Qualitative tests for carbohydrates – distinguishing reducing from non-reducing sugars and keto from aldo sugar



Semester I

Code	Title	Core/ Elective	L-T-P	Credits
CSE 102	Basic Computer Science And Programming	C	3-0-2	4

UNIT I : INTRODUCTION TO PYTHON

Knowledge, Machines, Languages, Types, Variables Operators and Branching -- Core elements of programs: Bindings, Strings, Input/Output, IDEs, Control Flow, Iteration, Guess and Check – Simple Programs: Approximate Solutions, Bisection Search, Floats and Fractions Newton-Raphson – Functions: Decomposition and Abstraction, Functions and Scope, Keyword Arguments, Specifications, Iteration vs Recursion, Inductive Reasoning, Towers of Hanoi, Fibonacci, Recursion on non-numeric, Files

UNIT II: TUPLES AND LISTS

Tuples, Lists, List Operations, Mutation, Aliasing, Cloning – Dictionaries: Functions as Objects, Dictionaries, Example with a Dictionary, Fibonacci and Dictionaries, Global Variables – Debugging: Programming Challenges, Classes of Tests, Bugs, Debugging, Debugging Examples– Assertions and Exceptions, Assertions, Exceptions, Exception Examples

UNIT III: CLASSES AND INHERITANCE

Object Oriented Programming, Class Instances, Methods Classes Examples , Why OOP, Hierarchies, Your Own Types – An Extended Example: Building a Class, Visualizing the Hierarchy, Adding another Class, Using Inherited Methods, Gradebook Example, Generators

UNIT IV: COMPUTATIONAL COMPLEXITY

Program Efficiency, Big Oh Notation, Complexity Classes Analyzing Complexity – Searching and Sorting Algorithms: Indirection, Linear Search, Bisection Search, Bogo and Bubble Sort, Selection Sort, Merge Sort

UNIT V: OPTIMIZATION AND KNAPSACK PROBLEM

Computational models, Intro to optimization 0/1 Knapsack Problem, Greedy solutions – Decision Trees and Dynamic Programming: Decision tree solution to knapsack Dynamic programming and knapsack, Divide and conquer – Graphs: Graph problems, Shortest path, Depth first search, Breadth first search Unit VI Stochastic Thinking: Rolling a Die, Random walks – Random Walks: Drunk walk, Biased random walks, Treacherous fields – Inferential Statistics: Probabilities, Confidence intervals – Monte Carlo Simulations: Sampling, Standard error Experimental Data: Errors in Experimental Observations, Curve Fitting, Goodness of Fit , Using a Model for Predictions



UNIT VI: MACHINE LEARNING

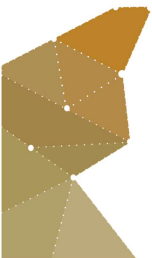
Feature Vectors, Distance Metrics, Clustering – Statistical Fallacies: Misusing Statistics, Garbage In Garbage Out, Data Enhancement - Visualization of Data: Visualizing Results, Overlapping Displays, Adding More Documentation, Changing Data Display

Books of Study:

1. Introduction to Computation and Programming using Python, by John Guttag, PHI Publisher, Revised and Expanded version (Referred by MIT)

References:

1. Python Programming using problem solving Approach by Reema Thareja, Oxford University, Higher Education Oxford University Press; First edition (10 June 2017), ISBN-10: 0199480173
2. Data Structures and Algorithms in Python by Michael T Goodrich and Roberto Tamassia, Micheal S Goldwasser, Wiley Publisher (2016)
3. Fundamentals of Python first Programmes by Kenneth A Lambert, Copyrighted material Course Technology Inc. 1st edition (6th February 2009)



Semester I

Code	Title	Core/ Elective	L-T-P	Credits
PHY112	Classical Mechanics	C	2-0-2	3

UNIT I: REVIEW OF NEWTONIAN MECHANICS

Review of Scalars, Vectors and Kinematics, Newton's Laws of Motion and applications, Contact Forces, Static Friction, worked examples, Tension and springs, Pushing Pulling and Tension, Solving Pulley Systems.

UNIT II: CIRCULAR MOTION

Polar Coordinates, Position and Velocity Vectors, Angular Velocity, Uniform Circular Motion, Direction of the Acceleration, Period and Frequency, Angular Acceleration, Newton's Second law and circular motion, worked examples.

UNIT III: MOMENTUM AND IMPULSE

Momentum and Impulse, Impulse momentum theorem, Conservation of Momentum, Momentum Diagrams, worked examples, Center of Mass and Motion of the Center of Mass, Center of Mass of 3 Objects, Center of Mass of a Continuous System, Center of Mass of a Uniform Rod and different objects, Velocity and Acceleration of the Center of Mass, Reduction of a System to a Point Particle, Center of Mass Trajectory

UNIT IV: WORK ENERGY AND COLLISION:

Kinetic Energy and Work in 1D, Work by a Constant Force, Work by a Non- Constant Force, Work-Kinetic Energy Theorem and related problems, Kinetic Energy and Work in 2D, Work-Kinetic Energy Theorem in 2D, Worked Example

Conservative and Non-conservative Forces, Path Independence - Gravity, Path Dependence – Friction, Potential Energy due to gravity and of a spring, worked examples, Principle of energy conservation and worked examples, Collision and its type. Collision in 1D and worked examples, Collision in 2D and worked examples.

Rotational Motion, Motion of a rigid body and moment of inertia, Parallel and perpendicular axis theorem, Moment of inertia of different objects, Torque and Angular momentum, worked examples.

UNIT V: GRAVITATION AND SPECIAL THEORY OF RELATIVITY

Central forces, Newton's Law of Gravitation, Principle of Superposition, Acceleration due to gravity and its variation, Gravitational Potential Energy, Kepler's Laws

Michelson-Morley experiment, Postulates of special theory of relativity, Galilean and Lorentz transformations, Length contraction and time dilation, Mass-Energy relation

Books of Study:

1. MIT-- 8.01X online course material



- University Physics with Modern Physics with Mastering Physics, (12th Edition) - Hugh D. Young, Roger A. Freedman and Lewis Ford (Publisher – Pearson Education)
- Introduction to Classical Mechanics - R. G. Takwale, P. S. Puranik (Publisher - Tata McGraw- Hill Education).

References:

- Classical Mechanics (2011) - Herbert Goldstein (Publisher – Pearson Education).
- Classical Mechanics (2014) - J. C Upadhyaya (Publisher – Himalaya Publishing House)
- Physics for Scientist and Engineers, Ninth edition (2017) - Raymond A. Serway, John W. Jewett (Publisher - Cengage India Private Limited)
- Fundamentals of Physics – Resnick and Halliday (Publisher – Wiley)

List of Experiments:

Sl. No	Experiment name	Objectives
1	Experimental data analysis	Computation methods of data analysis with MS-Excel and Python program and Graphs plotting
2	Error Analysis	Different statistical methods for Experimental data analysis
3	Revisions of Vernier caliper	a. Determination of least counts of Vernier calliper b. Determination of length, width and thickness of a metal rod and sheets
4	Revisions of Screw Gauge	a. Determination of least counts millimetre Screw Gauge instruments b. Determination of radius of a given metal wire
5	Determination of Young's modulus of the material	To calculate the Young's modulus of a given material by deflection method
6	Determination of rigidity modulus of the material - torsional pendulum	To determine the rigidity modulus of the material of the wire by torsional oscillations
7	Determine moment of inertia of a flywheel	To determine the moment of inertia of a flywheel
8	Determination of spring constant	To determine spring constant for a given spring and verify the Hooke's law
9	Compound Pendulum	a. Measure the time period for a given compound pendulum with various lengths b. Determine radius of gyration of a given pendulum
10	Determination of velocity of Sound in a medium	To determine velocity of sound in air or quantitative experiments on resonating columns



Semester I

Code	Title	Core/ Elective	L-T-P	Credits
CDC 111	Soft Skills - I	C	1-0-0	1

UNIT I: INTERPERSONAL SKILLS

Understanding the relationship between Leadership Networking & Team work, Realizing Ones Skills in Leadership, Networking & Team Work, and Assessing Interpersonal Skills Situation description of Interpersonal Skill. Team Work Necessity of Team Work Personally, Socially and Educationally

UNIT II: LEADERSHIP

Skills for a good Leader, Assessment of Leadership Skills Change Management Exploring Challenges, Risking Comfort Zone, Managing Change

UNIT III: STRESS MANAGEMENT

Causes of Stress and its impact, how to manage & distress, Understanding the circle of control, Stress Busters. Emotional Intelligence What is Emotional Intelligence, emotional quotient why Emotional Intelligence matters, Emotion Scales. Managing Emotions.

UNIT IV: CONFLICT RESOLUTION

Conflicts in Human Relations – Reasons Case Studies, Approaches to conflict resolution.

UNIT V: DECISION MAKING

Importance and necessity of Decision Making, process of Decision Making, Practical way of Decision Making, Weighing Positives & Negatives.

References:

1. Covey Sean, Seven Habit of Highly Effective Teens, New York, Fireside Publishers, 1998.
2. Carnegie Dale, How to Win Friends and Influence People, New York: Simon & Schuster, 1998.
3. Thomas A Harris, I am ok, You are ok, New York-Harper and Row, 1972
4. Daniel Coleman, Emotional Intelligence, Bantam Book, 2006

