INDIAN INSTITUTE OF INFORMATION TECHNOLOGY BHAGALPUR

Mechatronics Engineering (MEA)

B.Tech. Curricula and Syllabus

Semester-I

Course Code	Course name	L	T	P	C	Year	Semester	Semester total credit
MA101	Engineering Mathematics – I	3	1	0	4	1	1	23
PH101	Engineering Physics	3	0	0	3			
EC101	Electrical Sciences	3	0	0	3			
CS101	Computer Programming	3	0	0	3			
HS101	Professional Communication	2	0	0	2			
ME102	Engineering Graphics	2	0	3	4			
EC112	Electrical Sciences Lab	0	0	3	2			
CS110	Computer Programming Lab	0	0	3	2			

Syllabus:

Course Code	Course name	L	T	P	C	Year	Semester
MA101	Engineering Mathematics I	3	1	0	4	1st	1st
Topic	**Contents**						**No. of Lectures**
Module-I	Matrices and solving system of linear equations: Gauss elimination method, Elementary Row operations, Elementary matrices, Invertible matrices, Gauss-Jordon method for finding the inverse of a matrix; Determinants, Basic properties of determinants; Cofactors and Adjoints, the Determinant method for finding the inverse of a matrix, Cramer's Rule; Vector space, Subspace, Linear span, Linear independence and dependence, Basis, Dimension, Extension of a bas is of a subspace, Intersection, and the sum of two subspaces. The rank of a matrix, Row and column spaces, Solvability of a system of linear equations.						**09**
Module-II	Inner Product Space, Orthogonal projection, Orthogonal complement, Orthogonal basis of a Vector Space, Gram-Schmidt orthogonalization process. Least Square Method; Eigenvalue, Eigen Vectors, Matrix Diagonalization, Similarity Transformation.						**08**
Module-III	Co-ordinate of a Vector, Change of Basis; Linear transformation, Kernel, and Range of a linear map, Rank-Nullity Theorem, Matrix of a Linear Transformation; Point set Theory: Real Number system, Open and Closed Set, Intervals; Sequences of Real Numbers: Monotonicity, Convergence tests, Cauchy Criterion, Subsequences; Limits and Continuity of a real function, Boundedness of a continuous function on a closed interval, Uniform continuity.						**08**
Module-IV	Differentiability, Rolle's theorem and Mean Value theorems, Taylor's theorem, L `Hospital rule, Increasing and decreasing function, Convexity, Second derivative test for max and min, Point of Inflection; Series of real Numbers: Partial Sum Sequence, Convergence of series, Geometric and Harmonic Series, Absolute convergence, Comparison test, Ratio test, Root test, Cauchy Condensation test; Power series, Radius of convergence, Taylor Series, Maclaurin Series.						**09**
Module-V	Introduction to Riemann Integration, Integrability, The Integral existence theorem for continuous functions and monotone functions, Elementary properties of integral, Fundamental theorems of Calculus; Improper integral of the first and the second kind, Comparison test, Absolute convergence. Introduction to Beta and Gamma Function; Application of Integration to length, area, volume and surface area of revolution						**08**
						Total	**42**
Text	1. B S Grewal, J S Grewal, J K Dhanoa, *Higher Engineering Mathematics*, Khanna Publishers, 44th edition, 2017. 2. E. Kreyszig, H. Kreyszig, E. J. Norminton, *Advanced Engineering Mathematics*, 10th, Wiley India Pvt. Ltd., 2017						
Reference	1. D. Poole, *Linear Algebra*: *A Modern Introduction*, 4th edition, Brooks Cole, 2014. 2. S. R. Ghorpade and B. V. Limaye, *A Course in Calculus and Real Analysis*, 1st edition, Springer India, 2006.						

Course Code	Course name	L	T	P	C	Year	Semester
PH101	Engineering Physics	3	1	0	4	1st	1st
Topic	**Contents**						**No. of Lectures**
Module-I	Laws of thermodynamics- Statement, Discussion and Significance of Zeroth, First and Second law, Isothermal and Adiabatic change & Carnot cycle.						**08**
Module-II	Concept of Entropy- Clausius inequality and the physical significance of Entropy; Matter Waves, Wave and Group Velocities, Heisenberg Uncertainty Principle						**08**
Module-III	Wave Function, its Interpretation and Normalization, Superposition of Amplitudes, Dynamical Variables as Operators, Expectation Values, Schrodinger Equation and its Simple Applications like Particle in a Box.						**10**
Module-IV	Semiconductor materials, insulators, intrinsic and extrinsic semiconductor, Carrier transport in a semiconductor: diffusion current, drift current, mobility, and resistivity. Generation and recombination of carriers in semiconductors.						**08**
Module-V	Electrons and Holes in semiconductors: Donors and acceptors in the band model, electron effective mass, Density of states, Thermal equilibrium, Fermi-Dirac distribution function for electrons and holes, Fermi energy. Equilibrium distribution of electrons & holes.						**08**
	Total						**42**
Text	1. Dattu R Joshi, *Engineering Physics*, Tata McGraw Hill Education, 1st edition, 2015. 2. D K Bhattacharya, Poonam Tandon, *Engineering Physics*, Oxford University Press India; 2017.						
Reference	1. Arthur Beiser, Shobhit Mahajan, S Rai Choudhury, *Concepts of Modern Physics*, Tata McGraw Hill Education, 7th edition, 2017. 2. David J Griffiths, *Introduction to Quantum Mechanics*, Pearson India Education Services Pvt. Ltd, 2nd edition, 2018.						

Course Code	Course name	L	T	P	C	Year	Semester
EC101	Electrical Science	3	0	0	3	1st	1st

Course objective: The main objective of this course is to analysis of resistive circuits and solution of resistive circuits with independent sources, two terminal element relationships for inductors and capacitors and analysis of magnetic circuits, analysis of single phase AC circuits, the representation of alternating quantities and determining the power in these circuits, etc.

Topic	Contents	No. of Lectures
Module-I	Basic components and electric circuits, Ohm's law, nodes, paths, loops and branches, Kirchhoff's current law, Kirchhoff's voltage law, dependent and independent sources, voltage and current division, Basic nodal and mesh analysis; supernode, supermesh	**04**
Module-II	Network theorems: linearity and superposition, source transformations, Thevenin and Norton equivalent circuits, maximum power transfer; RL and RC circuits: source-free RL circuit, source-free RC circuit, unit-step function, driven RL circuits, natural and forced response, driven RC circuits	**10**
Module-III	RLC circuit: source-free parallel circuit, overdamped parallel RLC circuit, critical damping, underdamped parallel RLC circuit, source-free series RLC circuit, complete response of the RLC circuit	**09**
Module-IV	Sinusoidal steady-state analysis: forced response to sinusoidal functions, complex forcing function, phasor, phasor relationship for R, L and C, impedance, admittance, phasor diagrams, instantaneous power, average power, apparent power and power factor, complex power; Polyphase circuits: polyphase systems, single-phase three-wire systems, three-phase Y-Y connection, delta connection, power measurement in three-phase systems	**10**
Module-V	Magnetically coupled circuits: mutual inductance, energy considerations, Transformers, Principle of transformers and rotating machine, D. C machine: D. C. Motor and generator; Two-port networks: one-port networks, admittance parameters, impedance parameters, hybrid parameters, transmission parameters.	**09**
	Total	**42**

Text	1. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, *Engineering Circuit Analysis*, Tata-McGraw-Hill Publishing Company Limited, 8th edition,2012. 2. E. Hughes, J. Hiley, I. McKenzie-Smith, K. Brown, *Electrical And Electronic Technology*, Pearson Education India, 10th edition, 2010.
Reference	1. Bruce Carlson, *Circuits: Engineering Concepts and Analysis of Linear Electric Circuits,* Thomson Asia Pvt. Ltd., 2nd edition Reprint, 2006.

Course Code	Course name	L	T	P	C	Year	Semester
CS101	Computer Programming	3	0	0	3	1st	1st
Course objective: This course aims to teach everyone the basics of programming computers using C Programming Language. We cover the basics of how one constructs a program from a series of simple instructions in C language.							
Topic	**Contents**						**No. of Lectures**
Module-I	Introduction to Computing: Historical perspective, Early computers, the von Neumann architecture. Problems, Pseudo code, and Flowchart. Memory, Variables, Values, Instructions, Programs. Assembly language, High level language, Compiler, Assembler, Operating Systems.						**08**
Module-II	Introduction to C: The C language. Phases of developing a running computer program in C; Data Concepts in C: Constants, Variables, Expressions, Operators, and operator precedence in C. Managing input and output statements, Sequential control statements, Decision making statements (If Else constructs), Loop control statements (While construct, Do While construct, For construct).						**08**
Module-III	Data Types in C: Different basic data types and their sizes. One-dimensional Arrays: Declaration and initialization, Two-dimensional Arrays: Declaration and initialization, Multidimensional Arrays. String variables, Reading and writing strings, Arithmetic operations on characters, Putting strings together, Comparison of two strings.						**09**
Module-IV	Modular Programming and Example Programs: Functions: The prototype declaration, Function definition. Function call: Passing arguments to a function (by value, by reference). Scope of variables. Recursive function calls, Tail recursion, Tree of recursion. Sorting problems: Selection sort, Insertion sort. Sorting in arrays. Search problems: Linear search and binary search. Recursive and iterative formulations; More Data Types in C: Pointers: Declaring and dereferencing pointer variables. Pointer arithmetic. Accessing arrays. through pointers. Pointer types, Pointer and strings.						**10**
Module-V	Structures in C: Motivation, examples, declaration, and use. Operations on structures. Passing structures as function arguments. Type defining structures. Self-referential structures, Linked lists with examples. File operations in C: Input, output, and error streams. Opening, closing, and reading from files. Searching through files using functions such as fseek(), ftell(), and rewind(). Programming for command line arguments.						**07**
						Total	**42**
Text	1. Bryon Gottfried, *Programming with C*, Tata-McGraw-Hill, 3rd edition, 2015.						
Reference	1. Kernighan and Ritchie, *The C Programming Language*, PHI, 2nd edition, 2017. 2. H. M. Deitel, P. J. Deitel, *C: How to program*, Pearson Education, 7th edition, 2010.						

Course Code	Course name	L	T	P	C	Year	Semester
HS101	Professional Communication	2	0	0	2	1st	1st
Topic	**Contents**						**No. of Lectures**
Module-I	Communication Fundamentals: Using Verbal and Non- verbal Communication						**03**
Module-II	Interviewing Principles And Skills: Fundamental principles of interviewing, Success in an interview, Types of Interviews, Important Non-verbal aspects						**04**
Module-III	GROUP DISCUSSIONS: Methodology of GD, Improving Group performance						**04**
Module-IV	Professional Writing: Kinds of business letters, Job Applications and Resume Writing, Report Writing, Proposal layout and design, E-mail etiquette, Notices, Agenda and Minutes						**05**
Module-V	Delivering Professional Presentations: Elements of effective English, Effective paragraphs, The power of reading, Punctuation and Capitalization						**04**
	Total						**20**
Text	1. Business Correspondence and Report Writing - R. C. Sharma 2. Business Communication - M. Balasubramanyam 3. Essentials of Business Communication - R. Pal and Kolahalli 4. Business Communication and Report Writing - Sharma, Mohan 5. Lesikar's Basic Business Communication – Lesikar						

Course Code	Course name	L	T	P	C	Year	Semester
ME101	**Engineering Graphics**	2	0	3	4	1st	1st

Course objective:

1. To understand the drawing importance in engineering
2. To describe the 3D objects into different 2D views.
3. To understand the application of company standards and techniques applied in engineering graphics
4. To represent engineered parts by use of auxiliary or sectional views.

	Contents	**No. of Lectures**
Module 1	Introduction and importance of engineering drawing, drawing techniques: manual drawing and computer-aided drawing, Drawing instruments and their uses. Conventions of ISO and BIS, Layout of drawing sheets, Border lines, Title block, Folding of drawing sheets, Lines **Scales:** Requirements, Plane scale, Diagonal and vernier scales. **Geometrical construction and curves:** Definitions of ellipse, Parabola and hyperbola, Various methods of drawing Ellipse, parabola and hyperbola and drawing tangents and normal at any point on the conic.	**6**
Module 2		
Cycloids, Construction of cycloids, Epicycloids & hypocycloid. Involutes, Spirals and Helices and their construction. **Orthographic projection:** Introduction, Methods of projection, Orthographic projection, Projection planes and four quadrants, First and third angle projections. **Projection of points:** Introduction, A point is situated in the first, second, third and fourth quadrant. **Projection of straight lines:** Introduction, Line parallel to one or both of the planes, Line perpendicular to one of the planes, Line inclined to one and perpendicular to other, Line inclined to both of the planes, True lengths and its inclination, Traces of a line.		**6**
Module 3		
Projection of planes: Introduction, Types of planes, Traces of planes and its calculations, Projection of planes parallel to one of the reference planes, Projection of planes inclined to one reference planes and perpendicular to other, Projection of oblique planes. Projection of lines and plane by auxiliary planes. **Projection of solids**: Introduction, Types of solids, Projections of solids in simple positions, Projections of solids with axes inclined to one of the reference planes and parallel to other, Projections of solids with axes inclined to both of the planes, Projection of spheres.		**6**

Module 4	
Projection of sectioned solids: Introduction, Conventions in sectional view drawings, True shape of a section, Sections of prisms, pyramids, cylinders, cones and spheres. **Intersection of solids:** Introduction, Classification, Line of intersection, Line/generator method and section plane method, Intersection of two prisms, two cylinders, cone and cylinder, pyramid and cylinder, pyramid and prism, etc. **Development of surfaces:** Introduction, Method of development, Development of lateral surfaces of right solids, Development of transition pieces, Development of spheres.	**6**
Module 5	
Isometric: Introduction, Isometric scale, Box method, Coordinate or offset method, Four centre method, Isometric projection of arcs, Construction of isometric projection of different solids. **Perspective projection:** Introduction, Terminology and Principles of perspective projection. Methods of perspective projection of various objects.	**4**
Total	**30**
Text	1. N. D. Bhatt and V. M. Panchal, "Engineering Drawing", 53rd Ed., Charator Publishing House,2001 2. M. B. Shah and B. C. Rana, "Engineering Drawing", 2nd Ed., Pearson Education, 2009
Reference	1) T. E. French, C. J. Vierck and R. J. Foster, "Graphic Science and Design", 4th Ed., McGraw Hill, 1984. 2) W. J. Luzadder and J M Duff, "Fundamentals of Engineering Drawing", 11th Ed., PHI,1995