

B.Sc. in Materials and Metallurgical Engineering

(Effective from the session:2019 -2020)

Summary of Course Plan

Sl. No.	Year/ Semester	Theory		Sessional		Contact Hour/Week	Total Credits
		No. of Course	Credits	No. of Course	Credits		
1.	1st/1st	4	12	3	3.00	18.00	15.00
2.	1st/2nd	5	16	4	3.75	23.50	19.7
3.	2nd/1st	5	16	4	3.00	22.00	19.00
4.	2nd/2nd	5	16	4	5.25	26.50	21.25
5.	3rd/1st	5	16	5	5.25	26.50	21.25
6.	3rd/2nd	5	17	5	6.00	29.00	23.00
7.	4th/1st	5	15	4	5.25	22.50	20.25
8.	4th/2nd	5	15	3	6.00	24.00	21.00

Categories of courses	Courses	Credit hours	Percentage	Reference Value
Mathematics, Basic sciences with experimental experiences	Math 1901, Math 2901, Math 2903, Math 3901, Phy 2901, Phy 2902, Phy 2903, Phy 2904, Ch 2901, Ch 2902, Ch 3901, Ch 3902	31.00	19.31	20-25%
Engineering topics appropriate to the program	MME 1101, MME 1103, MME 1105, MME 1106, MME 2101, MME 2301, MME 2002, MME 2105, MME 2004, MME 3301, MME 3302, MME 3101, MME 3002, MME 3103, MME 3004, MME 3105, MME 3106, MME 3107, MME 3108, MME 3109, MME 3110, MME 3111, MME 3112, MME 3113, MME 4101, MME 4103, MME 4104, MME 4105, MME 4106, MME 4002, MME 4115, MME 4004, MME 4000, MME 4006	78.50	48.91	50-60%
Technical Elective	MME 4107/ MME 4109/MME 4111, MME 4113, MME 4117, MME 4119/ MME 4121 / MME 4123	12.00	7.48	10-15%
Interdisciplinary	ME 1901, ME 1902, ME1002, EEE 1901, EEE 1902, ME 1903, ME 1008, ME 1006, ME 2901, ME 2902, MME 1002, MME 2006, MME 3008	21.75	13.55	10-15%
Humanities, Economics/Accounting, and management	HSS 1901, HSS 1903, HSS 2002, HSS 2901, MME 3006, ME 4901, HSS 4901	17.25	10.75	10-15%
Total		160.50	100.00	

1. LANGUAGE AND GENERAL EDUCATION [10-15% TOTAL CREDIT-HOURS]

Category	Year/Semester	Course	Credit
Language	1/2	HSS 1903: English	3.00
	2/1	HSS 2002: English Language practice	0.75
Art and Humanities	3/1	MME 3006: Professional Ethics and Practices	1.50
	4/2	HSS 4901: Government and Bangladesh Studies	3.00
Business	1/1	HSS 1901: Business organization and Communication	3.00
	2/2	HSS 2901: Economics and Accounting	3.00
	4/2	ME 4901: Industrial Management	3.00
		Total	17.25

2. BASIC SCIENCES AND MATHEMATICS [20- 25% OF TOTAL CREDIT HOURS]

Category	Year/Semester	Course	Credit
Physics	2/1	Phy 2901: Properties of matter, Waves, Electricity and Magnetism	3.00
	2/1	Phy 2902: Properties of matter, Waves, Electricity and Magnetism Sessional	0.75
	2/2	Phy 2903: Optics and Modern Physics	3.00
	2/2	Phy 2904: Optics and Modern Physics Sessional	0.75
Chemistry	2/1	Ch 2901: Inorganic and Physical Chemistry	3.00
	2/1	Ch 2902: Inorganic and Physical Chemistry Sessional	0.75
	3/1	Ch 3901: Organic Chemistry	3.00
	3/2	Ch 3902: Organic Chemistry Sessional	0.75
Mathematics	1/2	Math 1901: Differential and Integral Calculus	4.00
	2/1	Math 2901: Coordinate Geometry, Matrices and Vector Analysis	4.00
	2/2	Math 2903: Complex Variables and Ordinary Differential Equations	4.00
	3/1	Math 3901: Numerical Analysis, Mathematical Methods and PDE	4.00
		Total	31.00

3. OTHER ENGINEERING [10- 15% OF TOTAL CREDIT HOURS]

Category	Year/Semester	Course	Credit
Computer Science and Engineering	1/1	MME 1002: Introduction to Computing	1.50
	2/2	MME 2006: Computer Programming	1.50
	3/2	MME 3008: Application of CAD to Materials Processing	0.75
Electrical Engineering	1/2	EEE 1901: Basic Electrical Engineering	3.00
	1/2	EEE 1902: Basic Electrical Engineering Sessional	0.75
Mechanical Engineering	1/1	ME 1901: Fundamentals of Mechanical Engineering	3.00
	1/1	ME 1902: Fundamentals of Mechanical Engineering Sessional	0.75
	1/1	ME 1002: Workshop Practice	1.50
	1/2	ME 1903: Engineering Mechanics	3.00
	1/2	ME 1008: Mechanical Engineering Drawing	1.50
	1/2	ME 1006: Machine Shop Practice	0.75
	2/1	ME 2901: Mechanics of Solids	3.00
	2/1	ME 2902: Mechanics of Solids Sessional	0.75
		Total	21.75

4. TECHNICAL ELECTIVES [10 - 15% OF TOTAL CREDIT HOURS]

Category	Year/Semester	Course	Credit
Technical Electives	4/1	MME 4113: Ceramics for Advanced Applications	3.00
	4/1	MME 4107: Design and Application of Biomaterials (Optional) MME 4109: Smart Materials and Structures (Optional) MME 4111: Nanostructured Materials and Thin Films (Optional)	3.00
	4/2	MME 4117: Industrial Metal Working Processes	3.00
	4/2	MME 4119: Powder Metallurgy (Optional) MME 4121: Composite Materials (Optional) MME 4123: Fuel, Refractory and Furnace (Optional)	3.00
		Total	12.00

5. PROGRAM COURSES [50 - 60% OF TOTAL CREDIT HOURS]

Category	Year/Semester	Course	Credit
Materials Science and Metallurgy	1/1	MME 1101: Fundamentals of Engineering Materials	3.00
	1/1	MME 1103: Introduction to Metallurgy	3.00
	1/2	MME 1105: Crystallography and Structure of Materials	3.00
	1/2	MME 1106: Crystallography and Structure of Materials Sessional	0.75
	2/1	MME 2101: Crystal Defects, Deformation and Fracture	3.00
	2/2	MME 2002: Materials Testing Sessional	1.50
	2/2	MME 2004: Metallography Sessional	1.50
	2/2	MME 2105: Phase Diagram and Transformations	3.00
	3/1	MME 3101: Steel Production and Quality Control	3.00
	3/1	MME 3002: Materials and Metallurgical Analysis	0.75
	3/1	MME 3103: Electronic, Magnetic and Optical Materials	3.00
	3/1	MME 3004: Technical Communication	1.50
	3/2	MME 3105: Materials Processing and Design	4.00
	3/2	MME 3106: Materials Processing and Design Lab	1.50
	3/2	MME 3107: Corrosion and Surface Engineering of Materials	4.00
	3/2	MME 3108: Corrosion and Surface Engineering of Materials Sessional	1.50
	3/2	MME 3109: Physical Metallurgy of Steel and Heat Treatment	3.00
	3/2	MME 3110: Physical Metallurgy of Steel and Heat Treatment Sessional	1.50
	3/2	MME 3111: Glass and Ceramics Engineering	3.00
	3/2	MME 3112: Glass and Ceramics Engineering Sessional	0.75
3/2	MME 3113: Materials Characterization	3.00	

Category	Year/Semester	Course	Credit
	4/1	MME 4101: Ore Dressing and Extractive Metallurgy	3.00
	4/1	MME 4103: Polymers and Composites	3.00
	4/1	MME 4104: Polymers and Composites Sessional	0.75
	4/1	MME 4105: Metal Joining Technology	3.00
	4/1	MME 4106: Metal Joining Technology Sessional	0.75
	4/1	MME 4002: Materials Processing Plant Design	0.75
	4/2	MME 4115: Metallic Alloys and Materials Selection	3.00
	4/2	MME 4004: Failure of Materials and Artefact Study	1.50
Thermal	2/2	MME 2301: Materials Thermodynamics	3.00
	3/1	MME 3301: Heat and Mass Transfer	3.00
	3/1	MME 3302: Heat and Mass Transfer Sessional	0.75
Project/Thesis	4/1 and 4/2	MME 4000: Thesis / Capstone Design	6.00
Industrial Attachment and Technical Seminar	4/2	MME 4006: Industrial Training and Technical Seminar	1.50
		Total	78.50

Syllabus effective from the session 2019-2020

1st year 1st semester courses are exempted because of the candidates 4 years Diploma in Engineering background after 10 years of schooling.

Course designation and numbering system:

For Department of Materials and Metallurgical Engineering:

Considering an example, let,

MME 1101: Introduction to Metallurgy and Materials where,

MME: Department identification code

1: First digit signifies year number

1: Second digit is reserved for departmental use to indicate the major branches

01: Third and fourth digits signify course designation of which the fourth digit will be odd for theoretical courses and even for sessional courses

Introduction to Metallurgy and Materials indicates course title.

Major branches:

1 – Materials Science and Metallurgy; 2 – Management; 3 – Thermal; 4 – Computation

For all allied courses other than Department of Materials and Metallurgical Engineering:

Considering an example, let,
EEE 1901: Basic Electrical Engineering

1: First digit signifies year number

9: Second digit '9' is reserved for any course from other departments.

01: Third and fourth digits signify course designation of which the fourth digit will be odd for theoretical courses and even for sessional courses

Basic Electrical Engineering indicates course title

1st Year 1st Semester (Exempted)

Sl. No.	Course No.	Course Title	Contact hours/week	Credits
1	HSS 1901	Business Organization and Communication	3.00	3.00
2	ME 1901	Fundamentals of Mechanical Engineering	3.00	3.00
3	ME 1902	Fundamentals of Mechanical Engineering Sessional	1.50	0.75
4	MME 1101	Fundamentals of Engineering Materials	3.00	3.00
5	MME 1103	Introduction to Metallurgy	3.00	3.00
6	MME 1002	Introduction to Computing	1.50	0.75
7	ME 1002	Workshop Practice	3.00	1.50
Sub Total:			18.00	15.00

1st Year 2nd Semester

Sl. No.	Course No.	Course Title	Contact hours/week	Credits
1	EEE 1901	Basic Electrical Engineering	3.00	3.00
2	EEE 1902	Basic Electrical Engineering Sessional	1.50	0.75
3	HSS 1903	English	3.00	3.00
4	Math 1901	Differential and Integral Calculus	4.00	4.00
5	ME 1903	Engineering Mechanics	3.00	3.00
6	MME 1105	Crystallography and Structure of Materials	3.00	3.00
7	MME 1106	Crystallography and Structure of Materials Sessional	1.50	0.75
8	ME 1008	Mechanical Engineering Drawing	3.00	1.50
9	ME 1006	Machine Shop Practice	1.50	0.75
Sub Total:			23.50	19.75

2nd Year 1st Semester

Sl. No.	Course No.	Course Title	Contact hrs/week	Credits
1	Ch 2901	Inorganic and Physical Chemistry	3.00	3.00
2	Ch 2902	Inorganic and Physical Chemistry Sessional	1.50	0.75
3	ME 2901	Mechanics of Solids	3.00	3.00
4	ME 2902	Mechanics of Solids Sessional	1.50	0.75
5	MME 2101	Crystal Defects, Deformation and Fracture	3.00	3.00
6	Math 2901	Coordinate Geometry, Matrices and Vector Analysis	4.00	4.00
7	Phy 2901	Properties of Matter, Waves, Electricity and Magnetism	3.00	3.00
8	Phy 2902	Properties of Matter, Waves, Electricity and Magnetism Sessional	1.50	0.75
9	HSS 2002	English Language Practice	1.50	0.75
Sub Total:			22.00	19.00

2nd Year 2nd Semester

Sl. No.	Course No.	Course Title	Contact hours/week	Credits
1	HSS 2901	Economics and Accounting	3.00	3.00
2	Math 2903	Complex Variables and Ordinary Differential Equations	4.00	4.00
3	MME 2105	Phase Diagram and Transformations	3.00	3.00
4	MME 2301	Materials Thermodynamics	3.00	3.00
5	MME 2006	Computer Programming	3.00	1.50
6	Phy 2903	Optics and Modern Physics	3.00	3.00
7	Phy 2904	Optics and Modern Physics Sessional	1.50	0.75
8	MME 2002	Materials Testing Sessional	3.00	1.50
9	MME 2004	Metallography Sessional	3.00	1.50
Sub Total:			26.50	21.25

3rd Year 1st Semester

Sl. No.	Course No.	Course Title	Contact hours/week	Credits
1	Ch 3901	Organic Chemistry	3.00	3.00
2	Ch 3902	Organic Chemistry Sessional	1.50	0.75
3	Math 3901	Numerical Analysis, Mathematical Methods and PDE	4.00	4.00
4	MME 3101	Steel Production and Quality Control	3.00	3.00
5	MME 3103	Electronic, Magnetic and Optical Materials	3.00	3.00
6	MME 3301	Heat and Mass Transfer	3.00	3.00
7	MME 3302	Heat and Mass Transfer Sessional	1.50	0.75
8	MME 3002	Materials and Metallurgical Analysis	1.50	0.75
9	MME 3004	Technical Communication	3.00	1.50
10	MME 3006	Professional Ethics and Practices	3.00	1.50
Sub Total:			26.50	21.25

3rd Year 2nd Semester

Sl. No.	Course No.	Course Title	Contact hours/week	Credits
1	MME 3105	Materials Processing and Design	4.00	4.00
2	MME 3106	Materials Processing and Design Lab	3.00	1.50
3	MME 3107	Corrosion and Surface Engineering of Materials	4.00	4.00
4	MME 3108	Corrosion and Surface Engineering of Materials Sessional	3.00	1.50
5	MME 3109	Physical Metallurgy of Steel and Heat Treatment	3.00	3.00
6	MME 3110	Physical Metallurgy of Steel and Heat Treatment Sessional	1.50	0.75
7	MME 3111	Glass and Ceramics Engineering	3.00	3.00
8	MME 3112	Glass and Ceramics Engineering Sessional	1.50	0.75
9	MME 3113	Materials Characterization	3.00	3.00
10	MME 3008	Application of CAD to Materials Processing	1.50	0.75
Sub Total:			29.00	23.00

4th Year 1st Semester

Sl. No.	Course No.	Course Title	Contact hours/week	Credit
1	MME 4101	Ore Dressing and Extractive Metallurgy	3.00	3.00
2	MME 4103	Polymers and Composites	3.00	3.00
3	MME 4104	Polymers and Composites Sessional	1.50	0.75
4	MME 4105	Metal Joining Technology	3.00	3.00
5	MME 4106	Metal Joining Technology Sessional	1.50	0.75
6	MME 4107	Design and Application of Biomaterials (Optional)	3.00	3.00
	MME 4109	Smart Materials and Structures (Optional)		
	MME 4111	Nanostructured Materials and Thin Films (Optional)		
7	MME 4113	Ceramics for Advanced Applications	3.00	3.00
8	MME 4000	Thesis / Capstone Design	3.00	3.00
9	MME 4002	Materials Processing Plant Design	1.50	0.75
Sub Total:			22.50	20.25

4th Year 2nd Semester

Sl. No.	Course No	Course Title	Contact Hours/week	Credit
1	HSS 4901	Government and Bangladesh Studies	3.00	3.00
2	ME 4901	Industrial Management	3.00	3.00
3	MME 4115	Metallic Alloys and Materials Selection	3.00	3.00
4	MME 4117	Industrial Metal Working Processes	3.00	3.00
5	MME 4119	Powder Metallurgy (Optional)	3.00	3.00
	MME 4121	Composite Materials (Optional)		
	MME 4123	Fuel, Refractory and Furnace (Optional)		
6	MME 4000	Thesis / Capstone Design	3.00	3.00
7	MME 4004	Failure of Materials and Artefact Study	3.00	1.50
8	MME 4006	Industrial Training and Technical Seminar	3.00	1.50
Sub Total			24.00	21.00

1st Year 1st Semester (Exempted)

Sl. No.	Course No.	Course Title	Contact hours/week	Credits
1	HSS 1901	Business organization and Communication	3.00	3.00
2	ME 1901	Fundamentals of Mechanical Engineering	3.00	3.00
3	ME 1902	Fundamentals of Mechanical Engineering Sessional	1.50	0.75
4	MME 1101	Fundamentals of Engineering Materials	3.00	3.00
5	MME 1103	Introduction to Metallurgy	3.00	3.00
6	MME 1002	Introduction to Computing	1.50	0.75
7	ME 1002	Workshop Practice	3.00	1.50
Sub Total:			18.00	15.00

HSS 1901 Business organization and Communication 3.00

Principles and objects of business organization; Formation of business organization; Banking system and its operation; Negotiable instrument; Home trade and foreign trade. Basic concepts of communication model and feedback; Types of communication; Methods of communication; Formal and informal communication; Essentials of communication; Report writing, Office management; Communication through correspondence; Official and semi- official letters.

ME 1901 Fundamentals of Mechanical Engineering 3.00

Stress and Strain; Mechanical Properties of Materials; Deformation of materials; Shear forces and bending moment diagrams; Torsion.

ME 1902 Fundamentals of Mechanical Engineering Sessional 0.75

Experiments based on ME 1901.

MME 1101 Fundamentals of Engineering Materials 3.00

Aspects of engineering materials; Ferrous metals and alloys; Non-ferrous metals; Fundamental concept of aluminum; Bricks; Sand; Cement; Sound absorbing and heat insulating materials; Glass and ceramics, Paints and varnishes, Fire and water proofing materials; Plastic materials, Conducting magnetic materials and optical fiber.

MME 1103 Introduction to Metallurgy 3.00

Furnaces and refractories; Ferrous and Nonferrous metals and alloys characteristics; Iron and Iron Carbide diagram; Heat treatment of Steel.

MME 1002 Introduction to Computing 0.75

Introduction to digital computers; Basic components of computers; Fundamentals of computer architecture; Number representation in binary, octal and hexadecimal systems; Character codes; Use of microcomputers; Introduction to DOS, common software packages and computer graphics; Introduction to high level programming languages; Algorithm development.

ME 1002 Workshop Practice 1.50

Carpentry: Wood working tools and machines; Types of sawing: common cuts in wood works; Types of joint; Defects of timber; Seasoning; Preservation; Shop practice; Practical job with particular emphasis on pattern making.

Sheet metal: Sheet metal working tools, machinery, and materials; Patterns and uses; Punching, drilling, and riveting; Folding edges; Soldering, types of solders, fluxes ,and practice.

1st Year 2nd Semester

Sl. No.	Course No.	Course Title	Contact hours/ week	Credits
1	EEE 1901	Basic Electrical Engineering	3.00	3.00
2	EEE 1902	Basic Electrical Engineering Sessional	1.50	0.75
3	HSS 1903	English	3.00	3.00
4	Math 1901	Differential and Integral Calculus	4.00	4.00
5	ME 1903	Engineering Mechanics	3.00	3.00
6	MME 1105	Crystallography and Structure of Materials	3.00	3.00
7	MME 1106	Crystallography and Structure of Materials Sessional	1.50	0.75
8	ME 1008	Mechanical Engineering Drawing	3.00	1.50
9	ME 1006	Machine Shop Practice	1.50	0.75
Sub Total:			23.50	19.75

EEE 1901 Basic Electrical Engineering 3.00

Laws of electric circuit: Ohm's law, Kirchoff's voltage and current laws, delta-wye transformation.

A.C. Circuits: Introduction to AC Circuits, Instantaneous current and power, R-L, R-C and RLC- circuits. Effective current and voltage, average values, form factor, crest factor, power-real and reactive. Impedances in polar and Cartesian forms. Sinusoidal single phase circuit analysis. Impedance in series, parallel branches, series-parallel circuits. Network Analysis: Network analysis methods of branch and loop currents, method of node-pair voltages, Norton's theorem, Thevenin's theorem and Superposition theorem. Electromagnetic forces and torque: Forces upon a current-carrying conductor and charged particle moving in a magnetic field. Electric motor. Electromagnetic induction and emf, Lenz's law, Blv rule, A.C. generator. Balanced polyphase circuits: Three-phase three-wire systems, Three-phase four wire system of generated emfs, balanced wye loads, balanced delta loads, power in balanced systems, power factor. Measuring Instruments: Ammeter, Voltmeter, Wattmeter etc.

EEE 1902 Basic Electrical Engineering Sessional 0.75

Experiments based on EEE 1901.

HSS 1903 English 3.00

Parts of speech, Appropriate preposition, Word formation, Affixation and conversion of words, Phrases and clauses, Joining Sentences, Transformation of Sentences (Assertive to integrative and simple to complex and vice-versa), WH Questions, Right form of verbs, (subject verb agreement, conditionals), Fragments and run-ons, Steps and processes of writing, Paragraph writing (Topic sentences, Supporting details, Linking words), Amplification, Cohesion and coherence (Supplying words, rearranging sentences in paragraph), Information Transfer, e-tender notice, Technical report writing (Features and methodologies), Error correction (Right forms of verbs, subject verb agreement, preposition, punctuation and capitalization), Usage of Tenses in real life contexts, Voice Change, (Active to Passive, Passive to Active), Business correspondence: i) CV and Cover letter ii) E-mail writing, Business letters: i) Placing order ii) complaint letter iii) Adjustment letter, Basic vocabulary for engineering students.

Math 1901 Differential and Integral Calculus 4.00

Differential Calculus: Limit, Function, Continuity and differentiability, differentiation of explicit and implicit function, significance of derivatives, differential coefficient, Successive differentiation of various types of functions, Leibnitz's theorem, Rolle's theorem, Mean value theorems, Taylor's theorem, Maclaurin's theorem, Lagrange's remainder theorem, Partial differentiation, Euler's theorem on homogeneous function, maxima and minima, Tangent and normal, Curvature, Asymptotes, Curve tracing, Indeterminate forms, L'Hospital's rule.

Integral Calculus: Definitions of integration, Integration by method of substitution, integration by parts, Standard integrals, Integration by the method of successive reduction, Definite integrals, Beta and Gamma functions, Jacobian, Length of curves, Area of bounded by plane curves volume and surface area of solid of revolution, Multiple integration, and application.

ME 1903 Engineering Mechanics 3.00

Basic concepts of mechanics; Statics of particles and rigid bodies; Centroids of lines, areas and volumes; Forces in truss and frames; Friction; Moments of inertia of areas and masses. Kinematics of particles: Kinetics of particles: Newton's second law, energy and momentum method; Kinematics of rigid bodies; Plane motion of rigid bodies: Forces and acceleration, Energy and momentum methods.

MME 1105 Crystallography and Structure of Materials 3.00

Classification of crystals by symmetry. Crystal structure of elements and alloys. Ordered and disordered solid solutions. Simple oxide, ionic and covalent crystal structures. Structure of polymers and amorphous materials. Stereographic projection, representation of the 32-point groups on a stereographic projection.

MME 1106 Crystallography and Structure of Materials Sessional 0.75

Analysis of natural crystals and models. Identification of coordinate axes and description of atomic planes of crystals. Analysis of symmetry of planar patterns and identification of unit cell and coordinate axes. Stereographic projection: graphical representation of 3-D crystal data in two dimensions. Qualitative analysis by X-ray diffraction. Identification of common industrially important polymer, metal, and ceramic structures.

ME 1006 Machine Shop Practice 0.75

Machine shop: Kinds of tools - common bench and hand tools; marking and layout tools; measuring tools; cutting tools; machine tools; bench work with job. Types of drilling machine, shaper machine, lathe, milling machine and their practice.

ME 1008 Mechanical Engineering Drawing 1.50

Introduction, instruments, and their uses; Review of first and third angle projections; Orthographic drawings; Isometric views; Missing lines and views, Sectional views, and conventional practices; Auxiliary views. Fasteners and gears, working drawing of machine elements with sectional views; detail drawing; sub-assembly drawing, assembly drawing.

2nd Year 1st Semester

Sl. No.	Course No.	Course Title	Contact hrs./week	Credits
1	Ch 2901	Inorganic and Physical Chemistry	3.00	3.00
2	Ch 2902	Inorganic and Physical Chemistry Sessional	1.50	0.75
3	Math 2901	Coordinate Geometry, Matrices and Vector Analysis	4.00	4.00
4	ME 2901	Mechanics of Solids	3.00	3.00
5	ME 2902	Mechanics of Solids Sessional	1.50	0.75
6	MME 2101	Crystal Defects, Deformation and Fracture	3.00	3.00
7	Phy 2901	Properties of matter, Waves, Electricity and Magnetism	3.00	3.00
8	Phy 2902	Properties of matter, Waves, Electricity and Magnetism Sessional	1.50	0.75
9	HSS 2002	English Language Practice	1.50	0.75
Sub Total:			22.00	19.00

Ch 2901 Inorganic and Physical Chemistry 3.00

Inorganic Chemistry: Quantum numbers, different rules/principles dealing with distribution of electrons in atom, chemical bond; strong and weak bonds, their formation, conditions and properties, Fagan's rules, modern concept of covalent bond, hybridization, valence shell electron-pair repulsion (VSEPR) model and molecular shape, noble gases; their isolation, compound formation, properties and uses, heavy water; manufacture, properties and uses, oxidation-reduction reaction.

Physical Chemistry: Chemical equilibrium; characteristics, law of mass action, Le Chatelier's principle and applications, thermo-chemistry; enthalpies of formation, reaction, combustion, neutralization, laws of thermo-chemistry, distribution law; its statement, derivation, modification and applications, Henry's law, properties of dilute solution; lowering of vapor pressure (Raoult's law), elevation of boiling point, depression of freezing point and osmotic pressure, Colloids: definition, classification and preparation, chemical kinetics; rate, order and molecularity of reaction, factors affecting rate and rate expressions, phase rule.

Ch 2902 Inorganic and Physical Chemistry Sessional 0.75

Experiments based on Ch 2901.

Math 2901 Coordinate Geometry, Matrices and Vector Analysis 4.00

Two-dimensional Coordinate geometry: Transformation of coordinates, Pair of straight lines, Circle, System of circles, General equation of second-degree parabola, ellipse, hyperbola in cartesian and polar coordinates.

Three-dimensional Coordinate geometry: System of coordinates, Distance between two points, Section formulae, Projection, Direction cosines, Equations of planes and straight lines.

Matrices: Definition of matrices, Matrix Algebra, Transpose, Inverse and ranks of matrices, Solution of simultaneous equation by matrix method.

Vector Analysis: Definition of scalar and vectors, Vector Algebra, Cross product, Triple product and multiple products, Differentiation and integration of vectors together with elementary applications, Definitions of line, surface and volume integrals, Gradient of a scalar function, Divergence and curl of a vector functions, various formulae, Green's theorem, Stoke's theorem and Gauss's theorem.

ME 2901 Mechanics of Solids 3.00

Introduction and analysis of axially loaded members, Indeterminate members; Principle of superposition and its applications, Thermal stress and centrifugal stress, Stresses in thin-walled cylinder; Stresses in composite members, Helical springs. Torsion: Shear stress and torque, angle of twist, Strain energy, Combined stress: combined axial and flexural stresses, variation of stresses with inclination, stress analysis, principal stress and planes, Mohr's circle,

Shear force and bending moment: their equations, diagrams and relation, Stresses in beams; Deflection in beams: double integration method, area moment method, conjugate- Beam method and method of superposition for finding slopes & deflections, Curved beams, Columns: types of column failures; Euler's equation; Column Secant's formula, Failure Theories; Joints: Riveted and welded joints.

ME 2902 Mechanics of Solids Sessional 0.75

Experiments of based on ME 2901.

MME 2101 Crystal Defects, Deformation and Fracture 3.00

Defects in crystals. Types, movement, and properties of dislocation; dislocation multiplication. Strengthening mechanisms. Basic features of catastrophic fracture. Fracture criterion. Modes of fracture and ductile to brittle transition. The influence of microstructure on fracture. Application of fracture mechanics to practical problems. Environmental effects on fracture. Mechanisms of crack initiation and propagation. Quantitative analysis of fatigue fracture. Fatigue resistant materials. Creep deformation, grain boundary rotation and sliding, void formation and rupture mechanisms. Creep resistant materials.

Phy 2901 Properties of matter, Waves, Electricity and Magnetism 3.00

Thermal Physics: Kinetic theory of gases, Kinetic calculation of pressure, temperature and energy, Ratio of specific heats; Mean free path, Equation of state, Van der Waal's equation of state; Thermal conductivity; The zeroth law and first law of thermodynamics and their applications, Isothermal, Adiabatic, Isochoric and Isobaric processes, Work done by expanding gases, Adiabatic gas equation, Reversible and irreversible processes, Second law of thermodynamics, The Carnot cycle, Entropy.

Properties of Matter: Gravitation, Kepler's Laws of motion, Gravitational potential and field, Escape velocity, Velocity of satellite; Elasticity, Elastic constants, Relation between elastic constants; Surface tension, Surface energy, Capillarity, Determination of surface tension of water by capillary tube method; Fluid dynamics, Equation of continuity, Bernoulli's equation, Viscosity, Poiseuille's equation, Determination of coefficient of viscosity by capillary flow method.

Oscillations and Waves: Oscillations, The simple harmonic wave equation and its solution, Composition of simple harmonic motion- Lissajous's figure, Damped harmonic motion and its solution, Forced oscillation and resonance; Wave motion, Types of wave motion, Expression for plane progressive wave, Energy calculation of stationary and progressive wave; Interference of sound wave, Beats, Doppler effect.

Electricity and Magnetism: The electric force and Coulomb's law, Gauss' law and its applications, The electric field and potential due to continuous charge distribution, electric dipole and quadrupole; The magnetic field and flux, Magnetic force on a current carrying conductor, Hall effect, Biot-Savart law and Amperes law and their applications; Faraday's law, Lenz law, Self-induction and mutual induction; Different types of magnetism.

Phy 2902 Properties of matter, Waves, Electricity and Magnetism Sessional 0.75

Experiments based on Phy 2901.

HSS 2002 English Language Practice 0.75

Listening skill and note taking: Listening to recorded texts and class lectures and learning to take useful notes based on listening.

Developing speaking skill: Oral skills including communicative expressions for personal identification, life at home, giving advice and opinion, instruction and directions, requests, complains, apologies, describing people and places, narrating events.

2nd Year 2nd Semester

Sl. No.	Course No.	Course Title	Contact hrs./week	Credits
1	HSS 2901	Economics and Accounting	3.00	3.00
2	Math 2903	Complex Variables and Ordinary Differential Equations	4.00	4.00
3	MME 2105	Phase Diagram and Transformations	3.00	3.00
4	MME 2301	Materials Thermodynamics	3.00	3.00
5	Phy 2903	Optics and Modern Physics	3.00	3.00
6	Phy 2904	Optics and Modern Physics Sessional	1.50	0.75
7	MME 2002	Materials Testing Sessional	3.00	1.50
8	MME 2004	Metallography Sessional	3.00	1.50
9	MME 2006	Computer Programming	3.00	1.50
Sub Total:			26.50	21.25

HSS 2901 Economics and Accounting 3.00

Economics:

Definition and scope of economics; its utility importance to engineering definition of engineering economics; basic concepts of economics; utility of goods; wealth; value; price and want; theory of utility and demand the law of diminishing marginal and its measurement; consumer's surplus; production; factors of production; division of labor; localization of industries; specialization; small and large scale production; distribution the marginal productivity theory; economics of development and planning basic concepts of saving; investment; GNP; per capita income; growth rate; policy instruments of developments fiscal policy; momentary policy their relative applicability in Bangladesh; some planning tools capital output ratio; input-output analysis; planning in Bangladesh five year plan. development problems related to agriculture; industry and population of Bangladesh; role of state and engineers in economic development; natural resources in Bangladesh; trade and commerce; banking system.

Accounting:

Accounting and its uses in business decisions.

Financial Accounting: Recording processes of accounts; The Journal, The Ledger, Financial statement. Depreciation techniques.

Financial Management: Financial statement analysis; Ratio analysis, liquidity ratio, leverage ratio, profitability ratio, activity ratio; capital budgeting; Discounted cash flow, NPV, IRR, ARR, payback period method: working capital management; Definition, nature of WC, sources of finance.

Cost Accounting: Definition, Need for cost accounting, scope, definition of cost and cost center. Classification of costs; direct and indirect raw material, direct and indirect labor, overhead costs, preparation of cost sheet.

Math 2903 Complex Variables and Ordinary Differential Equations 4.00

Complex Variable: Complex number system, general functions of complex variables, Limit and continuity of a function of complex variable and related theorems, Complex differentiation and the Cauchy-Riemann equations, Cauchy's integral theorem, Cauchy's integral formula, line integral of a complex function, Taylor's series, Laurent's series, residues, Cauchy's residue theorem, singular points, bilinear transformation, evaluation of residues, contour integration.

Infinite Series: Sequence and series, Convergence of series, Uniform convergence, Absolute convergence and divergence.

Ordinary Differential Equations: Formation of differential equation, Differential equation, where variables are separable, First order homogeneous equation, Equation reducible to homogeneous form, First order linear equation, Clairaut's form; one variable absent; Exact differential equation, General linear equation of second and higher order with constant coefficients, Solution of homogeneous linear equations; applications, Differential equations with variable coefficients in which either dependent or independent variables are absent. Factorizing the operator, Euler's equation.

MME 2301 Materials Thermodynamics 3.00

Reviews of the laws of thermodynamics. Thermodynamic variables and relations. Equilibrium in thermodynamic systems. Statistical thermodynamics. Unary heterogeneous systems. Multicomponent, homogeneous non reacting systems -solutions. Multicomponent heterogeneous systems. Thermodynamics of phase diagrams. Multicomponent, multiphase reacting systems. Thermodynamics of interfaces. Equilibrium in continuous systems. The thermodynamics of electrolysis. Application of thermodynamic principles to materials processing.

MME 2105 Phase Diagram and Transformations 3.00

Factors affecting the formation of alloys. Types of binary phase diagrams. The phase rules. Industrially important binary diagrams of metallic and ceramic systems including details of iron - iron carbide diagram. Diffusional, martensitic, and mixed transformations. Nucleation and growth theory. Precipitation hardening. Types, mechanism, and factors influencing diffusion, measurement of diffusion coefficients. Ternary phase diagrams: Composition triangles and space models, isothermal, and vertical sections of isomorphous and other systems. Equilibrium and nonequilibrium freezing of typical ternary alloys.

Phy 2903 Optics and Modern Physics 3.00

Theory of Relativity: Postulates of special theory of relativity, Lorentz transformation equations, Length contraction, Time dilation, Twin paradox, Variation of mass with velocity, Einstein's mass energy relation.

Optics: Huygens's principle, Young's experiment, Coherent sources and its production methods, Analytical treatment of interference, Interference from thin films, Newton's rings; Diffraction of light, Fresnel and Fraunhofer diffraction, Fraunhofer diffraction by single and double slit, Resolving and dispersive power of a grating; Polarization, Polarization by reflection, refraction, double refraction, Brewster's law and Malus law, Elliptical and circular polarization of light.

Modern Physics: Quantum theory of light, Photoelectric effect, Compton effect, Pair production; Concept of de-Broglie wave, Phase velocity and group velocity, Heisenberg's uncertainty principle and its applications; Atomic structure, Atom models, Electron orbits, Energy levels and spectral series of hydrogen atom, Crystalline and amorphous solids, Miller indices and crystal plane; Different types of crystal structure, Simple cubic, body centered cubic and face centered cubic crystal structure, Packing fraction, Different types of bonding in crystal, Nuclear compositions, mass defect, Binding energy, Radioactive decay, Laws of radioactive decay, Half-life and mean life, Radioactive series, Nuclear fission and fusion.

Phy 2904 Optics and Modern Physics Sessional 0.75

Experiments based on Phy 2903.

MME 2002 Materials Testing Sessional 1.50

Statistical analysis of data. Tensile, static bending and impact tests on metallic and nonmetallic materials. Determination of hardness by Rockwell, Brinell and microhardness testing machines. Determination of wear and creep damage on common metals and alloys. Fatigue testing of metals. Non-destructive testing.

MME 2004 Metallography Sessional 1.50

Construction of binary phase diagram from cooling curves. Selection and preparation of micro, and macro- specimens. Microstudy of common non-ferrous metals and alloys. Microstudy of plain carbon steels and cast irons. Quantitative metallography: grain size, volume fraction, aspect ratio, particle size distribution, etc.

MME 2006 Computer Programming 1.50

Introduction to computer programming with Fortran/C language; calculation, selective execution or branch, loop, array, functions, application to solve engineering problems.

3rd Year 1st Semester

Sl. No.	Course No.	Course Title	Contact hours/week	Credits
1	Ch 3901	Organic Chemistry	3.00	3.00
2	Ch 3902	Organic Chemistry Sessional	1.50	0.75
3	Math 3901	Numerical Analysis, Mathematical Methods and PDE	4.00	4.00
4	MME 3101	Steel Production and Quality Control	3.00	3.00
5	MME 3103	Electronic, Magnetic and Optical Materials	3.00	3.00
6	MME 3301	Heat and Mass Transfer	3.00	3.00
7	MME 3302	Heat and Mass Transfer Sessional	1.50	0.75
8	MME 3002	Materials and Metallurgical Analysis	1.50	0.75
9	MME 3004	Technical Communication	3.00	1.50
10	MME 3006	Professional Ethics and Practices	3.00	1.50
Sub Total:			26.50	21.25

Ch 3901 Organic Chemistry 3.00

Bonding of Carbon: Valance bond theory and Hybridization in Organic Chemistry.

Isomerism: Structural Isomerism: Chain isomerism, Position isomerism, Functional isomerism, Metamerism, Tautomerism. Stereoisomerism: Geometrical isomerism and Optical isomerism.

Derivatives of Aliphatic Hydrocarbons: General methods of preparation and important reactions of Alkyl halides; Mono, Di and Trihydric alcohols; Aldehydes; Ketones; Amines; Monocarboxylic acids and their halides; esters; anhydrides and amides.

Aromatic Hydrocarbons: Kekule's structure of benzene; Orbital theory; Isomers and nomenclature; Orientation in benzene derivatives; Aromaticity; Electrophilic Aryl substitution reaction and Effect of substituents on reactivity.

Derivatives of Aromatic Hydrocarbons: General methods of preparation and important reactions of Aromatic Nitro, Amino, Diazo and Halogen derivatives; Aromatic Sulphonic acids; Aldehydes and ketones; Carboxylic acids, Amino acids, and Phenols.

Ch 3902 Organic Chemistry Sessional 0.75

Experiments based on Ch 3901.

Math 3901 Numerical Analysis, Mathematical Methods and PDE 4.00

Numerical Analysis: Interpolation: Simple difference, Newton's formulae for forward and backward interpolation. Divided differences. Tables of divided differences. Relation between divided differences and simple differences. Newton's general interpolation formula. Lagrange's interpolation formula. Inverse interpolation by Lagrange's formula and by successive approximations. Numerical differentiation of Newton's forward and backward formulae. Numerical integration. General quadrature formula for equidistant ordinates. Trapezoidal rule, Simpson's rule, Waddle rule. Calculation of errors. Relative study of three rules. Gauss's quadrature formula. Legendre polynomials. Newton's-cotes formula. Principle of least squares. Curve fitting. Solution of algebraic and transcendental equations by graphical method. Regula-Falsi method. Newton-Raphson method, geometrical significance. Convergence of iteration and Newton-Raphson methods. Newton-Raphson method and iteration method for the solution of simultaneous equations. Solution of ordinary first order differential equations by Picard's and Euler's method. Range-Kutta's methods for solving differential equations.

Mathematical Methods: Fourier series and its properties, applications to solve the engineering problems, Parseval's theorem; Fourier integral; finite and infinite Fourier transformation and their uses in solving boundary value problems. Laplace transformation of elementary functions, properties of Laplace transform. Inverse Laplace transform and its properties. Convolution theorem. Applications of Laplace transform to solve differential equations and partial differential equations.

Partial Differential Equations (PDE): Particular solution with boundary and initial conditions, linear and non-linear first order, standard forms of partial differential equations equation, Charpit's methods etc.

MME 3101 Steel Production and Quality Control 3.00

History and Fundamentals of Iron and Steelmaking. Physico-Chemical Principles- Thermodynamics and Kinetics of Steelmaking Processes. Production of pig iron using blast furnace. Alternative processes of liquid iron production. Kinetics of iron oxide reduction. Principles of steel making. Production of plain carbon and alloy steels by various steel making processes. EOF (Energy Optimizing Furnace) Process, CONARC Process. Introduction to ladle metallurgy; deoxidation and refining of steel. Gases in steels and common degassing techniques. Solidification of steel by ingot and continuous casting processes. Common defects and their remedies in steel. Production of sponge iron and ferroalloys. Steelmaking in Bangladesh.

MME 3103 Electronic, Magnetic and Optical Materials 3.00

Application of solid-state phenomena in engineering structures such as microelectronic, magnetic, and optical devices. Basic quantum mechanics and the Schrodinger equation. Microelectronic, magnetic, and optical properties of devices, fabrication, and process methods. Conduction process in metals and semiconductors. Epitaxial growth. Semiconductors: intrinsic and extrinsic, Semiconductor junctions and transistors. Semiconductor device manufacturing: ion implantation, thermal oxidation, and metallization, patterning, etching, lithography methods as well as front-end technology and packaging. Very large-scale integration (VLSI). Vacuum System in Semiconductor Industries. Optical properties: atomistic and quantum mechanical considerations. Magnetic materials: properties, microstructure, and processes, permanent magnets and transformers. Recording and memory devices. Materials issues in packaging.

MME 3301 Heat and Mass Transfer 3.00

Thermal properties of materials. Basic modes of heat transfer. Steady and unsteady state conduction. Numerical solutions of conduction equations. Blackbody radiation. Radiation from real surfaces, view factors. Radiation exchange. Mechanism of convective heat transfer, estimation of convective heat transfer coefficient, heat transfer from liquid metals. Heat transfer with phase change. Mechanism of mass transfer. Application of heat transfer in materials and

metallurgical processes.

MME 3302 Heat and Mass Transfer Sessional 0.75

Experiments based on MME 3301.

MME 3002 Materials and Metallurgical Analysis 0.75

Principles of volumetric and gravimetric analysis. Analysis of various non-ferrous and ferrous alloys. Analysis of polymer, composite, refractory, and ceramic materials. Instrumental methods of analysis.

MME 3004 Technical Communication 1.50

Mode of communication: Verbal and written communication, business communication. Development of communication skills through presentation and discussion of selected topics. Essential features of thesis and report writing. Case studies.

MME 3006 Professional Ethics and Practices 1.50

Meaning of ethics and the need for ethical reasoning in engineering profession. Classical moral theory as applied to science and engineering. Evaluating ethical judgement and preserve communications, Obligations to clients, employers, public, and environments. Ethics in the global engineering profession. Engineering code of ethics. Intellectual property rights/software patent issues, issues on fraud, corruption, mismanagement, poor product design, deliberate design faults or /and harms from relevant engineering projects/products.

3rd Year 2nd Semester

Sl. No.	Course No.	Course Title	Contact hours/week	Credits
1	MME 3105	Materials Processing and Design	4.00	4.00
2	MME 3106	Materials Processing and Design Lab	3.00	1.50
3	MME 3107	Corrosion and Surface Engineering of Materials	4.00	4.00
4	MME 3108	Corrosion and Surface Engineering of Materials Sessional	3.00	1.50
5	MME 3109	Physical Metallurgy of Steel and Heat Treatment	3.00	3.00
6	MME 3110	Physical Metallurgy of Steel and Heat Treatment Sessional	3.00	1.50
7	MME 3111	Glass and Ceramics Engineering	3.00	3.00
8	MME 3112	Glass and Ceramics Engineering Sessional	1.50	0.75
9	MME 3113	Materials Characterization	3.00	3.00
10	MME 3008	Application of CAD to Materials Processing	1.50	0.75
Sub Total:			29.00	23.00

MME 3105 Materials Processing and Design 4.00

Introduction: Classification of manufacturing processes. Review of material and process selection. Coupled problems in design and manufacturing: the interaction between material, process, and design parameters.

Foundry establishment. General methods of moulding and casting. Pattern and pattern allowances, core boxes. Principles of gating design. Melting furnaces and practice. Melt reaction and fluid dynamics. Purpose and types of special casting processes. Metals cast in foundry. Families of cast irons. Ferrous and non-ferrous foundry practices. Fettling and finishing operations. Casting defects and design of shaped castings. Inspection and quality control. Salvage of casting. Casting design.

Revision of phase diagrams and transformations applied to solidification: segregation, constitutional super cooling, casting alloys and microstructures.

Design against Failure: Processing as the origin of defects and failures (microstructure, damage, residual stress). Environmental factors in failure of materials. Analysis and case studies of failures.

MME 3106 Materials Processing and Design Sessional 1.50

Experiments based on MME 3105

MME 3107 Corrosion and Surface Engineering of Materials 4.00

Importance of Corrosion; Electrochemical Mechanisms of Corrosion: Dry cell analogy, Types of cells; Corrosion Theory and Electrode Potentials: Free energy change, Nernst equation, Hydrogen electrode, EMF and Galvanic series; Eight Forms of Corrosion: Uniform attack, Galvanic corrosion, Crevice corrosion, Pitting, Intergranular corrosion, Selective leaching, Erosion corrosion, Stress corrosion, Hydrogen damage; High Temperature Corrosion: Pilling-Bedworth ratio, Electrochemical and morphological aspects of oxidation, Oxide defect structure, Oxidation kinetics; Modern Theory-Principles and Applications of Corrosion; Exchange current density, Polarization, Mixed potential theory and Pourbaix diagrams, Mixed electrodes, Passivity, Effect of oxidizers, Electrolyte velocity effects, Galvanic coupling; Corrosion Prevention: Materials selection, Alteration of environment, Design, Cathodic and anodic protection.

Scope of Surface Engineering: Surface Chemistry, Texture; Classification of Surface Coating Techniques: Electro- and electroless plating, Anodizing, Spray coating, Hot dipping, PVD, CVD, LASER surface modification, Beam irradiation method; Electrochemistry Applied to Electroplating: Fundamentals, Decorative and protective plating, Ingredients of a plating bath, Epitaxial growth, Wetting agents, Conducting salts and buffers, Throwing power and leveling; Electrodeposition of Alloys: Principles, Plating Variables, Types of Alloy Plating Systems; Testing and Selection of Coating: Metallurgical and Chemical Tests, Coating Selection Factors, Coating Protection Examples; Friction: Laws and Mechanisms of Sliding Friction, Friction Transitions during Sliding, Factors Affecting Friction; Wear: Types of Wear Mechanisms, Adhesive Wear, Abrasive Wear, Fatigue Wear, Erosion, Chemical Wear.

MME 3108 Corrosion and Surface Engineering of Materials Sessional 1.50

Electrodeposition processes: copper, nickel and chromium plating, effect of deposition parameters and additives on coating properties. Anodizing. Hot dip galvanizing. Wear and frictional behavior of materials.

MME 3109 Physical Metallurgy of Steel and Heat Treatment 3.00

Structural constituents of steel. Structure-property relationship in plain carbon, austenitic, martensitic, duplex, and ferritic stainless steels. Influence of alloying elements on the iron-iron carbide diagram. Strengthening mechanisms in steels. Heat treatment of steels: annealing, normalizing, hardening and tempering; TTT and CCT diagrams; austempering and martempering; hardenability and ruling sections; secondary hardening. Case hardening and surface hardening procedures. Special techniques in heat treatment. Defects in heat treatment. Thermo-mechanical treatment of steels. Heat treatment of complex-shaped components. Heat treatment of cast irons.

MME 3110 Physical Metallurgy of Steel and Heat Treatment Sessional 1.50

Microstudy of heat-treated carbon and alloy steels, special cast irons and tool steels. Microstudy of heat-treated nonferrous metals and alloys. Case hardened steels. Defects in heat treatment and remedies. Welded and bonded microstructure. Macro and micro-photographic studies of materials.

MME 3111 Glass and Ceramics Engineering 3.00

Introduction to ceramic materials, their classification and uses. Forming by casting, powder pressing and plastic techniques. Drying and firing processes. Vitrification. Glazing and decorating. Raw materials and manufacture of cements. Scope, processing, and properties of high-performance ceramics. Type, structure, and properties of glass. Glass fabrication. Crystallization and glass ceramics. Annealing and toughening of glass. Surface treatment and modification.

MME 3112 Glass and Ceramics Engineering Sessional 0.75

Preparation of ceramic powders. Powder characterization. Ceramic production processes. Melting, annealing and properties of various glasses.

MME 3113 Materials Characterization 3.00

Principles of spectroscopy: UV-visible, infra-red, Fourier transform, X-ray photoelectron, Raman, atomic emission spectroscopy etc. Beam-solid interaction: elastic and inelastic interactions. Theories of diffraction: Bragg's law, reciprocal space and Ewald sphere representation. X-ray techniques. Electron analytical techniques: SEM, EDX, TEM and other related techniques. Non-destructive testing: radiography, ultrasonic, eddy current, magnetic particles and dye penetration. Thermal analysis: DTA, DSC, TGA etc. Vibrating-sample magnetometer analysis.

MME 3008 Application of CAD to Materials Processing 0.75

Introduction to computer aided design (CAD). Common CAD software: AutoCAD. Drawing of engineering components using AutoCAD. Application of CAD in casting: calculation of section modulus, design for directional solidification etc.

4th Year 1st Semester

Sl. No.	Course No.	Course Title	Contact hours/week	Credit
1	MME 4101	Ore Dressing and Extractive Metallurgy	3.00	3.00
2	MME 4103	Polymers and Composites	3.00	3.00
3	MME 4104	Polymers and Composites Sessional	1.50	0.75
4	MME 4105	Metal Joining Technology	3.00	3.00
5	MME 4106	Metal Joining Technology Sessional	1.50	0.75
6	MME 4002	Materials Processing Plant Design	1.50	0.75
7	MME 4107	Design and Application of Biomaterials (Optional)	3.00	3.00
	MME 4109	Smart Materials and Structures (Optional)		
	MME 4111	Nanostructured Materials and Thin Films (Optional)		
8	MME 4113	Ceramics for Advanced Applications	3.00	3.00
9	MME 4000*	Thesis / Capstone Design	3.00	3.00
Sub Total:			22.50	20.25

MME 4101 Ore Dressing and Extractive Metallurgy 3.00

Purposes of ore dressing. Comminution, screening, classification, concentration, and dewatering. General principles of extraction of metals. Pyrometallurgy: drying, calcining, roasting, sintering, and smelting. Hydrometallurgy: leaching and separation techniques. Electrometallurgy: voltage of electrolytic cell, aqueous and fused salt bath electrolytic extraction. Principles of refining of non-ferrous metals. Secondary metal production.

MME 4103 Polymers and Composites 3.00

Classification of polymeric materials. Polymerization reactions. Structure and properties of polymers. Processing and applications of polymers. Classification of composites. Types of fibers and matrices. Elastic properties of unidirectional and random fiber composites, stress and strain distribution at fibers ends. Production of metal, ceramic, and polymer matrix composites.

MME 4104 Polymers and Composites Sessional 0.75

Microstructure and mechanical properties of polymeric and composite materials. XRD investigations on polymers. Geometrical characteristics and anisotropic properties of composite materials. Selection of polymeric and composite materials in practical applications.

MME 4105 Metal Joining Technology 3.00

Types and metallurgy of metal joining: fusion and solid-state welding, adhesive bonding. Various welding processes and equipment. Metallurgical aspects of welding for different ferrous and nonferrous metals and alloys. Welding defects, design, and symbols. Inspection and quality control. Weld failure analysis. Thermal cutting of metals.

MME 4106 Metal Joining Technology Sessional 0.75

Various types of welding of ferrous and nonferrous metals and alloys. Testing of welds. Study of structure, properties, and defects of weld joints.

MME 4002 Materials Processing Plant Design 0.75

Problems relating to design, erection, operation and maintenance of materials processing plants and equipment from engineering, economics, environment, and safety considerations.

MME 4107 Design and Application of Biomaterials (Optional) 3.00

Bulk properties and surface properties. Materials used in biomedical applications. Biological interactions with materials: Proteins, cells, and tissues. Biological responses: Inflammation, immunity, toxicity, coagulation, tumorigenesis. Biofilms, Pathological calcification, Biocompatibility. Applications of biomaterials: drug delivery, tissue engineering, cardiovascular, orthopedic, dental, functional tissues, etc.

MME 4109 Smart Materials and Structures (Optional) 3.00

Overview of smart materials. Piezoelectric Ceramics, Piezo-polymers, Magneto strictive Materials, Electroactive Polymers, Shape Memory Alloys, Electro and Magneto Rheological Fluids. Modelling of smart materials. Introduction to composite smart materials. Mechanics of smart composite materials. Smart sensors based on high bandwidth low strain smart materials, low-bandwidth high strain smart actuators. Micro-electromechanical Smart Systems. Intelligent devices based on smart materials. Applications of Smart Actuators: Active and Hybrid Vibration Control. Active Shape Control. Distributed Sensing and Control of Smart Beams.

MME 4111 Nanostructured Materials and Thin Films 3.00

Nanotechnology in nanomaterials synthesis and fabrication, novel property at the nanoscale, a variety of nanostructures including nanocrystal, nanowire, carbon nanotube, graphene, nanoporous material, block copolymer, and self-assembled monolayer; nanofabrication techniques, electronic and optical property, applications in solar cells, batteries, biosensors, and electronics. Mechanical behavior and fracture in nanomaterials.

Crystal structures of thin films. Defects in thin films. Nanocrystalline, polycrystalline and epitaxial thin films. Thin film nucleation. Thin film growth techniques (Molecular beam Epitaxy (MBE), Laser MBE, Pulsed Laser Deposition (PLD), E-beam Evaporation, Plasma Enhanced CVD (PECVD) and Metal Organic CVD (MOCVD)). Thin film deposition and property measurements. Special topics in thin films for electrical and optical devices (LED, Solid Oxide Fuel Cells, Solar Cells, and other applications).

MME 4113 Ceramics for Advanced Applications 3.00

Engineering Ceramics: Definition and scope of engineering ceramics. Structure and bonding, phase diagrams. Processing of high-performance ceramics. Mechanical and thermal properties of engineering ceramics. Toughening mechanisms. Industrial applications of engineering ceramics as tool materials, surface barrier coatings, bio-ceramics, dental ceramics, etc. Electronic ceramics: Crystal chemistry of ceramics. Effects of crystal defects and impurities on electronic properties of ceramics. Processing, structure, and properties of ceramic insulators. Ceramic materials for piezoelectric, ferroelectric, and magnetic applications. Ceramic sensors.

MME 4000* Thesis / Capstone Design 3.00

Experimental and theoretical investigation of various topics in Materials and Metallurgical Engineering. The topic should provide an opportunity for the student to develop initiative creative ability and Engineering judgment. The work may be done individually or in a group (Preferably not more than two in a group). Towards the end of the final semester, the students will have to submit thesis to the department.

4th Year 2nd Semester

Sl. No.	Course No	Course Title	Contact Hours/week	Credits
1	HSS 4901	Government and Bangladesh Studies	3.00	3.00
2	ME 4901	Industrial Management	3.00	3.00
3	MME 4115	Metallic Alloys and Materials Selection	3.00	3.00
4	MME 4117	Industrial Metal Working Processes	3.00	3.00
5	MME 4004	Failure of Materials and Artefact Study	3.00	1.50
6	MME 4119	Powder Metallurgy (Optional)	3.00	3.00
	MME 4121	Composite Materials (Optional)		
	MME 4123	Fuel, Refractory and Furnace (Optional)		
7	MME 4000	Thesis / Capstone Design	3.00	3.00
8	MME 4006	Industrial Training and Technical Seminar	3.00	1.50
Sub Total			24.00	21.00

HSS 4901 Government and Bangladesh Studies 3.00

Government: Basic concepts of government and politics: form and structure of government, organs of government-legislature, executive, judiciary, theory of democracy; socialism, bureaucracy State, government, nation, and nationality etc. Political views on government structure, cabinet form and presidential form of government, unitary form and federal form of government, main organs of government, characteristics and functions of Government and good governance, Public Administration in Bangladesh, E-government; Government and Politics of Bangladesh. Constitution and laws for Government, local government, NGOs, public law, principal, rule and policies for Administration and Government, managing development project, constitutional bodies. Local Self – Government, Central Government, Public Opinion and foreign policy of Bangladesh, Major Administrative Systems of Developed Counties.

Bangladesh Studies: Introduction to Bangladesh, Geo-political and socio-economic history of Ancient Bengal, Origin, and development of Bengal Civilization from early and medieval periods to pre-Bangladesh period, Important places and sculptures, Socioeconomic and political contexts in the period of Liberation War and backgrounds of her Independence: six points demands, Agartala Conspiracy, General Election 1970, Operation searchlight.

Economic development and its transformation, Economic and social inequality, Social and cultural transformation, Industrial development from the first industrial to the fourth industrial revolution.

Bangladesh and its Vision 2021 and Vision 2041, Fifth year economic plan, Progress to the Sustainable Development Goals (SDGs), Bangladesh Delta Plan 2100 (BDP 2100).

ME 4901 Industrial Management 3.00

Management and Organization: Management functions; principles of management; organization fundamentals; organization structures; span of control. Business: Single proprietorship; partnership; joint stock company; corporation; private and public sector; share, bond, loan; share market, mortgage, bankruptcy, liquidation. Financial Planning: Elements and costs, cost patterns, cost control, classification of capital, capital procurement, budgetary control. Depreciation, depreciation calculation. Personnel Management: Definition and functions of personnel management, manpower planning, recruitment, and development. Wage and Salary Administration: Job evaluations, techniques of job evaluation, merit rating, salary and wages, wage incentive plans, fringe benefits, working conditions, safety and health measure. Purchases and sales: Organization and means of market promotion, markets and marketing related to sales and purchases, purchasing procedures. Performance: Measure of performance, measurement and analytical problems of productivity, costs of management. Research and development: Technological change, process of innovation, importance of R and D, patent and royalty, product life cycle analysis; development of a product creativity. Industrial Psychology: Perception and forming impression on other; Motivation theories, motives and goals; stress, frustrations, anxiety and conflict, leadership.

MME 4115 Metallic Alloys and Materials Selection 3.00

Copper, Aluminium, Nickel, Magnesium, Titanium base alloys. Bearing metals and joining alloys. Thermocouple alloys. High temperature alloys. Oxidation and heat resistant alloys. Magnetic alloys, high and low expansion alloys. Super alloys. Low alloy steels. High strength low alloy steels. High alloy steels. Stainless steels and maraging steels. Tool steels, Die steels and related materials. Principles of selection: material, processing route, interrelationship between material factors and mechanical design. Sources of information. Specifications. Practical materials selection for components used in machineries in different industries including ship building, automotive, chemical industries, cement factories, power plants etc.

MME 4117 Industrial Metal Working Processes 3.00

Concepts of theory of elasticity and plasticity. Forming Processes: Classification of forming processes, hot working, and cold working. Mechanics of metal working. Details of industrial metal working processes like rolling, forging, extrusion, wire, rod and tube drawing, sheet metal forming, etc. Deformation mechanisms at elevated temperatures, dynamic recovery, and recrystallization. Superplastic forming and diffusion bonding. Wrought alloy processing and microstructure evolution. Simple modelling of plastic forming processes (stress analysis, and upper bound method). Machining of metals and case studies.

MME 4004 Failure of Materials and Artefact Study 1.50

Different mechanisms by which materials fail in service will be reviewed with special industrial reference. Several case studies will be introduced, and practical sessions will involve the examination of failures and the preparation of the failure examination reports. Artefact study: Dismantling and identification of materials of engineering components.

MME 4119 Powder Metallurgy (Optional) 3.00

Significance and importance. Production, characterization, and testing of metal and ceramic powders. Binders. Conditioning, compaction, pre-sintering, and sintering of powders. Mechanism of sintering, sintering practice. Effects of variables on sintering. Furnaces and atmospheres. Production of porous bearings, cemented carbides, ferrites, cermets etc. Mechanical alloying and additive manufacturing processes of materials. Finishing operations and heat treatment prospects for future development.

MME 4121 Composite Materials (Optional) 3.00

Properties and microstructure of high-strength fiber materials (glass, carbon, polymer, ceramic fibers) and matrix materials (polymer, metal, ceramic, and carbon matrices). Specific strength and stiffness of high-performance composites. Rule of mixtures. Stress, strain transformations. Elastic properties of a single orthotropic ply. Laminated plate theory. Failure criteria. Design of composite structures and components. Manufacturing processes.

MME 4123 Fuel, Refractory and Furnace (Optional) 3.00

Classification of fuels. Properties and characteristics of fuels. Origin, types and petrographic constituents of coal. Carbonization of coal. Origin of liquid fuels and natural gases. Distillation of crude oil and reforming of petroleum products. Fundamental physico-chemical laws of combustion processes. Design of combustion devices.

Classification and application of refractory materials. Raw materials, preliminary treatments, and manufacturing processes of various types of refractories. Properties of refractories, their tests and uses. Heat transfer in industrial furnaces. Classification of furnaces and theories of furnaces design.

MME 4000* Thesis / Capstone Design 3.00

Experimental and theoretical investigation of various topics in Materials and Metallurgical Engineering. The topic should provide an opportunity for the student to develop initiative creative ability and Engineering judgment. The work may be done individually or in a group (Preferably not more than two in a group). Towards the end of the final semester, the students will have to submit thesis to the department.

MME 4006 Industrial Attachment and Technical Seminar 1.50

Three weeks (40 hours per week) industrial engagement of the students at different or private organizations for problem identification, formulate the solution of that problem, reporting to the authority of the industry as well as the department and presentation of the entire attachment programme in front of the board.

Each student enrolled in the course is to participate in the seminars organized by the Materials and Metallurgical Engineering Department. Every topics of the seminars are to be approved by the Materials and Metallurgical Engineering Department.