Department of
Materials and Metallurgical Engineering

INFORMATION BOOKLET
For Undergraduate Students

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Information Booklet
For Undergraduate Students

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Disclaimer:

The information contained in this booklet is intended to provide guidance to those who are concerned with the undergraduate studies in Materials and Metallurgical Engineering. The Department of Materials and Metallurgical Engineering (DMME) of Bangladesh University of Engineering and Technology (BUET), Dhaka reserves the right to add, alter or modify, without prior notice, the contents of this booklet. The department shall bear no responsibility for any inconvenience caused to or expenditure incurred by any person because of the information contained in this booklet.

Then his GPA for the term will be as follows:

$$\text{GPA} = \frac{3(4.00) + 3(3.00) + 3(3.75) + 2(3.25) + 1(3.50)}{3 + 3 + 3 + 2 + 1} = 3.52$$

4.11 Earned Credits

The courses in which a student has obtained 'D' or a higher grade will be counted as credits earned by him/her. Any course in which a student has obtained 'F' grade will not be counted towards his/her earned credits. A student who obtains an 'F' grade in any Core Course in any term, he/she will have to repeat the course. If a student obtains a 'F' grade in an Optional Course, he/she may choose to repeat the course or take a substitute course if available.

F grades will not be counted for GPA calculations but will stay permanently on the Grade Sheet and Transcript. When a student will repeat a course in which he/she previously obtained a 'F' grade, he/she will not be eligible to get a grade better than 'B' in such course.

If a student obtains a grade lower than 'B' in a course, he/she will be allowed to repeat the course only once for the purpose of grade improvement by forgoing his/her earlier grade, but he/she will not be eligible to get a grade better than 'B' in such a course. A student will be permitted to repeat for grade improvement purposes a maximum of four courses in the B.Sc. Engg. programme.

If a student obtains 'B' or better grade in a course, he/she will not be allowed to repeat the course for the purpose of grade improvement.

A student can sit for supplementary examination (70% marks similar to term final examination) for a previously registered single course with F grade in the next semester. The examination generally held during the mid-term recess. Attendance and class test marks of previously registered course will be evaluated.

5 Co-Curricular and Extra-Curricular Activities

Co-curricular and extra-curricular activities are the integral part of the skill development Mechanism. Directorate of students' welfare (DSW) of BUET foresees the co-curricular and extracurricular activities of students. They act as a reference point to organize sports, entertainment Programs and cultural activities on a regular basis involving students.

Department of MME organise each year a number of co-curricular and extra-curricular activities of Students. The department has a students' association of

materials and metallurgical engineering (SAMME) who is responsible for organising different co-curricular and extra-curricular activities At the department. The head of the department is the president of SAMME and two faculties of the Department acts as advisor and treasurer of the committee, respectively. The types of activities usually arranged include:

- MME day/festival
- job fair
- annual picnic
- freshers' reception
- farewell ceremony
- cultural programmes
- materials competitions (materials Olympiad)
- materials exhibition, and
- poster presentation.

6 Undergraduate Course Structure

Students registered for the Department of Materials and Metallurgical Engineering for the session 1997-98 onwards follow a newly approved (269th Academic Council Meeting, Resolution no. 980816, date 19 November 1997) four-year programme of undergraduate study.

The present format of the undergraduate degree is changed to accommodate the present need. Apart from the general basic science, humanities and management subjects, there are core courses and optional courses specific to the discipline of materials and metallurgical engineering.

In the present programme, the courses are rearranged into six modules (Table 2) and some of them are divided further into sub-modules. The idea behind this rearrangement was that a student must have a knowledge about basic science and engineering courses in the earlier part of his study to have a firm grip on the subjects so that he can expand his learning in the later part of his study by going through more applied and technology oriented subjects. In the course format, the basic science and core courses are grouped into level one and two, while the technology-oriented courses are placed in level three and four.

Student registered for Materials and Metallurgical Engineering has to complete a total of 160 credits in the four-year undergraduate programme. The summary of credit hours requirements is shown in Table 3.

Table 2 Grouping of courses into modules and sub-modules

Module 1: Basic Science and Engineering Courses (Minimum 47.50 Credits)

Math 171 Calculus and Differential Equation (3.00 Credits)
Math 173 Vector Analysis and Matrices (3.00 Credits)
Math 271 Numerical Analysis, Statistics & Partial Differential Eqn. (4.00 Credits)
Chem 107 Inorganic and Physical Chemistry (3.00 Credits)
Chem 114 Inorganic Quantitative Analysis (1.50 Credits)
Chem 121 Organic Chemistry (3.00 Credits)
Chem 122 Organic Chemistry Sessional (1.50 Credits)
Phy 102 Physics Sessional - I (1.50 Credits)
Phy 103 Optics, Waves and Oscillation (3.00 Credits)
Phy 157 Prop. of Matter, Electricity & Mag. & Modern Physics (3.00 Credits)
EEE 155 Electrical Engineering Fundamentals (3.00 Credits)
EEE 156 Electrical Engineering Fundamentals Sessional (1.50 Credits)
EEE 267 Electrical and Electronic Technology (3.00 Credits)
IPE 491 Engineering Management (3.00 Credits)
IPE 483 Production Planning and Control (3.00 Credits)
ME 141 Engineering Mechanics (3.00 Credits)
ME 160 Mechanical Engineering Drawing - I (1.50 Credits)
ME 221 Elements of Fluid Mechanics and Machinery (3.00 Credits)
ME 243 Mechanics of Solids (3.00 Credits)
ME 260 Mechanical Engineering Drawing - II (1.50 Credits)

Module 2: Core Courses (39.00 Credits)

Sub-module 2.1: Structure (X1X)
MME 211 Crystallography and Structure of Materials (2.00 Credits)
MME 212 Crystallography and Structure Sessional (0.75 Credits)
MME 213 Phase Diagrams and Transformation (4.0 Credits)
MME 214 Metallography (1.50 Credits)
MME 411 Principles of Materials Characterisation (3.00 Credits)

Sub-module 2.2: Properties (X2X)
MME 222 Materials Testing Sessional (1.50 Credits)
MME 321 Crystal Defects, Deformation and Fracture (3.00 Credits)
MME 323 Physical Properties of Materials (3.00 Credits)
MME 325 Corrosion and Degradation of Materials (3.00 Credits)

Sub-module 2.3: Engineering Principles (X3X)
MME 131 Introduction to Metallurgy and Materials (3.00 Credits)

MME 138 Introduction to Computing (1.50 Credits)
MME 230 Materials and Metallurgical Analysis (1.50 Credits)
MME 231 Materials Thermodynamics (3.00 Credits)
MME 233 Mechanical Behaviour of Materials (3.00 Credits)
MME 235 Heat and Mass Transfer (3.00 Credits)
MME 238 Computer Application to Metallurgy and Materials (1.50 Credits)
MME 338 Application of CAD to Materials Processing (0.75 Credits)

Module 3: Technology Oriented Courses (Minimum 56.00 Credits)

Sub-module 3.1: Compulsory Courses (X4X)
MME 241 Fuels and Combustion (3.00 Credits)
MME 242 Fuels and Combustion Sessional (1.50 Credits)
MME 340 Communication Techniques (0.75 Credits)
MME 341 Refractories and Furnaces (3.00 Credits)
MME 342 Refractories and Furnaces Sessional (1.50 Credits)
MME 343 Surface Engineering of Materials (3.00 Credits)
MME 344 Surface Engineering of Materials Sessional (0.75 Credits)
MME 345 Foundry Engineering (4.00 Credits)
MME 346 Foundry Engineering Sessional (1.50 Credits)
MME 347 Metal Joining Technology (3.00 Credits)
MME 348 Metal Joining Technology Sessional (1.50 Credits)
MME 440 Materials Processing and Plant Design (0.75 Credits)
MME 442 Failure of Materials and Artefacts Study (1.50 Credits)
MME 443 Physical Metallurgy of Steel and Heat Treatment (3.00 Credits)
MME 444 Heat Treatment and Microstructure Sessional (1.50 Credits)
MME 445 Metallic Alloys and Materials Selection (3.00 Credits)
MME 447 Industrial Metal Working Processes (3.00 Credits)
MME 449 Ferrous Production Metallurgy (4.00 Credits)

Sub-module 3.2: Elective - Metallurgy (X5X)
MME 351 Principles of Ore Dressing and Extractive Metallurgy (3.00 Credits)
MME 354 Chemical Metallurgy Sessional (1.50 Credit)
MME 453 Special Casting Processes (3.00 Credits)
MME 455 Mineralogy and Economic Minerals of Bangladesh (3.00 Credits)
MME 457 Powder Metallurgy (2.00 Credits)
MME 458 Metal Forming Sessional (0.75 Credits)

Sub-modules 3.3: Elective - Materials (X6X and X7X)
MME 361 Ceramic Raw Materials and Processing (3.00 Credits)
MME 362 Ceramic Processing Sessional (1.50 Credits)
MME 363 Glass Science and Engineering (3.00 Credits)

MME 364 Glass Science and Engineering Sessional (0.75 Credits)
MME 365 Ceramics and Glass Engineering (3.00 Credits)
MME 366 Ceramics & Glass Engineering Sessional (0.75 Credits)
MME 467 Ceramics for Advanced Applications (3.00 Credits)
MME 471 Polymer Science and Engineering (3.00 Credits)
MME 472 Polymer Science and Engineering Sessional (0.75 Credits)
MME 473 Composite Materials (2.00 Credits)
MME 474 Composite Materials Sessional (0.75 Credits)
MME 475 Polymers and Composites (3.00 Credits)
MME 476 Polymers and Composite Sessional (0.75 Credits)

Sub-modules 3.4: Elective - Metallurgy and Materials (X8X)
MME 481 Industrial Metallurgy (3.00 Credits)
MME 483 Industrial Pollution Control and Safety (3.00 Credits)

Module 4: Management Sciences (6.00 Credits)
IPE 483 Production Planning and Control (3.00 Credits)
IPE 491 Engineering Management (3.00 Credits)

Module 5: Humanities Courses (Minimum 8.00 Credits)
Hum 101 English (3.00 Credits)
Hum 103 Economics (3.00 Credits)
Hum 207 Advanced English (2.00 Credits)
Hum 211 Sociology (2.00 Credits)
Hum 303 Principles of Accounting (3.00 Credits)
Hum 305 Economics of Development and Planning (2.00 Credits)
Hum 401 Business Law (3.00 Credits)

Module 6: Workshop Practices (1.50 Credits)
Shop 182 Machine Shop, Sheet Metal and Carpentry (1.50 Credits)

Table 3 Summary of credit hours for Materials and Metallurgical Engineering Programme

Level	Term	Theory Subjects	Sessional Subjects	Total Credits
One	One	15.00	4.50	19.50
	Two	15.00	6.00	21.00
Two	One	15.00	5.25	20.25
	Two	16.00	4.50	20.50
Three	One	16.00	4.50	20.50
	Two	15.00	4.50	19.50

Level	Term	Theory Subjects	Sessional Subjects	Total Credits
Four	One	15.00	4.50	19.50
	Two	14.00	5.25	19.25
Total Credits		**121.00**	**39.00**	**160.00**

The details of the courses to be taken in each level and term with credit hours and prerequisite courses, if any, are shown in Appendix F.

6.1 Details of Courses for MME Students

MME 131 Introduction to Metallurgy and Materials
3.00 Credits
Geological and archaeometallurgical understanding of the development and uses of materials. Classification of materials and their characteristics. Selection of materials in view of service and fabrication requirements, and economics. Physical, mechanical and chemical properties of materials. Factors influencing properties. Materials processing and inspection.

MME 138 Introduction to Computing
1.50 Credits
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.

MME 211 Crystallography and Structure of Materials
2.00 Credits
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 amorphic materials. Stereographic projection, representation of the 32 point groups on a stereographic projection.

MME 212 Crystallography and Structure Sessional
0.75 Credits
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.

MME 213 Phase Diagrams and Transformation
4.00 Credits

Factors affecting the formation of alloys. Types of binary phase diagrams. The phase rule. 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.

MME 214 Metallography
1.50 Credits

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 222 Materials Testing Sessional
1.50 Credits

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

MME 230 Materials and Metallurgical Analysis
1.50 Credits

Principles of volumetric and gravimetric analysis. Analysis of various non-ferrous and ferrous alloys. Analysis of refractories and ceramic materials. Analysis of glass, composites and polymers. Instrumental methods of analysis.

MME 231 Materials Thermodynamics
3.00 Credits

Reviews of the laws of thermodynamics. Thermodynamic variables and relations. Equilibrium in thermodynamic systems. Statistical thermodynamics. Unary heterogeneous systems. Multicomponent, homogeneous nonreacting 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 233 Mechanical Behaviour of Materials
3.00 Credits Prereq. Math 171

Mechanical properties of metallic alloys. Fundamental concepts of stress and strain. Stresses on planes of axially loaded members. Stresses in thin-walled cylinders, spheres, fabricated joints etc. Design of beams: shearing force, bending moment, slope and deflection of beams. Torsion of shafts and springs. Columns: Euler's formula and formulae for intermediate column. Curved beam, pressure column etc.

MME 235 Heat and Mass Transfer
3.00 Credits Prereq. Math 271

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 238 Computer Application to Metallurgy and Materials
1.50 Credits Prereq. MME 138

FORTRAN language. File processing. Solution of algebraic and transcendental equations. Matrices. Solution of systems of linear equations. Finite difference method. Numerical solution of ordinary and partial differential equations. Solution of materials and metallurgy related problems.

MME 241 Fuels and Combustion
3.00 Credits

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

MME 242 Fuels and Combustion Sessional
1.50 Credits

Physical properties of fuels. Proximate analysis of coal/coke. Determination of calorific values of coal/coke. Heat balance and combustion problems relating to

various iron and steel-making, glass melting and ceramics firing processes.

MME 321 Crystal defects, deformation and fracture
3.00 Credits

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.

MME 323 Physical Properties of Materials
3.00 credits

Electron theory: free electron theory and band theory. Metals, semiconductors and insulators. Properties of metals: electrical conductivity, thermal conductivity, specific heat etc. Properties of semiconductors: conductivity, optical properties etc. Properties of insulators: dielectric properties, ionic conductivity etc. Magnetic Properties: dia-, para- and ferromagnetism etc.; magnetic domains; magnetostriction and magnetostatic energy; soft and hard magnetic materials. Superconductivity and superconducting materials.

MME 325 Corrosion and Degradation of Materials
3.00 credits

Economic aspects of corrosion. Electrochemical principles of corrosion: Thermodynamics of electrochemical cells, electrode kinetics, Butler-Volmer kinetics, anodic polarization behaviour, mixed potential theory and Pourbaix diagrams. Metallurgical factors in corrosion. Forms of corrosion. Corrosion tests. High temperature oxidation: oxide defect structure, kinetics, effect of alloying etc. Corrosion control and corrosion resistant materials. Degradation of polymeric materials and paints.

MME 338 Application of CAD to Materials Processing
0.75 credits Prereq. MME 138

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.

MME 340 Communication Techniques
0.75 Credits

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 341 Refractories and Furnaces
3.00 Credits

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. Control of furnace atmosphere and pyrometry.

MME 342 Refractories and Furnaces Sessional
1.50 Credits

Measurement of true and apparent density and percentage porosity of refractory bricks. Estimation of cold crushing strength, thermal conductivity, spalling and slagging resistance of some common refractories. Design of recuperators and regenerators. Design of iron and steel making furnaces, heat treating furnaces, ceramic kiln and glass melting furnaces.

MME 343 Surface Engineering of Materials
3.00 Credits

Scope of surface engineering. Surface characteristics, texture and preparation methods. Classification of surface coatings/modification techniques. Electro- and electroless- plating: mechanisms, bath characteristics and electrochemical parameters. Conversion coatings: Anodizing, chromating, phosphating etc. Spray coating processes, hot dipping and weld coating methods. Vapour deposition and other advanced methods including PVD, CVD, laser surface modification. Testing and quality control of coatings. Selection of coating materials and methods. Basic types of wear: Abrasive, adhesive and delamination wear. Frictional processes and friction coefficient. Influence of materials properties on wear resistance. Wear tests. Wear resistant materials and coatings.

MME 344 Surface Engineering of Materials Sessional
0.75 Credits

Electrodeposition processes: copper, nickel and chromium plating, effect of deposition parameters on coating properties, effect of additives. Conversion coating processes including anodizing. Hot dip galvanising. Diffusion coating processes: chromising, aluminising etc. Wear and frictional behaviour of

materials.

MME 345 Foundry Engineering
4.00 Credits

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. Solidification of pure metals and alloys, control of solidified structure. Segregation and gas porosity. Principles of feeding and solidification shrinkage. 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. Inspection and quality control. Salvage of casting. Casting design.

MME 346 Foundry Engineering Sessional
1.50 Credits

Routine testing on foundry sand. Preparation of moulding sand mixtures. Melting and casting of ferrous and non-ferrous materials. Properties of cast metals. Effect of foundry variables on structure and properties of castings obtained by different casting processes. Study of casting defects.

MME 347 Metal Joining Technology
3.00 Credits

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 non-ferrous metals and alloys. Welding defects, design and symbols. Inspection and quality control. Weld failure analysis. Thermal cutting of metals.

MME 348 Metal Joining Technology Sessional
0.75 Credits

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

MME 351 Principles of Ore Dressing and Extractive Metallurgy
3.00 Credits

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 354 Chemical Metallurgy Sessional
1.5 Credits

Pyrometallurgy: reduction of ores. Hydrometallury: leaching of metallic ores, concentrates and mattes; effect of variables on dissolution kinetics. Corrosion tests: anodic polarization measurements, exposure to different environments, effects of aeration, stress corrosion tests etc. Electro-metallurgy: electro-winning, electro-forming and electroplating.

MME 361 Ceramics Raw Materials and Processing
3.00 Credits

Nature of clays and other ceramic raw materials. Crystal structure of silicates. Non-silicate ceramic materials. Properties of clays. Physical and chemical changes in clay materials. Powder characteristics and production. Raw material sources. Flocculants, binders, deflocculants and coagulants. Plasticizers and lubricants. Pressing, extrusion and injection moulding. Slip and tape casting. Thermodynamics and kinetics of drying. Firing of white wares, biscuit firing. Solid state and liquid phase sintering. Glazing and decoration. Raw materials and manufacture of cements including high-alumina, magnesia-phosphate and polymer modified cements.

MME 362 Ceramics Processing Sessional
1.50 Credits

Preparation of ceramic powders. Powder characterisation. Ceramic production processes: dry pressing, slip casting, extrusion. Evaluation of drying, firing, and cooling schedules for product performance. Finishing processes. Microstructure, defects and their effect on properties.

MME 363 Glass Science and Engineering
3.00 Credits

Definition and types of glass. Structure of glass and its effect on properties. Energy requirements for melting and kinetics of glass melting reactions. The effect of glass composition, temperature and oxygen partial pressure on glass melt. Physical and chemical processes affecting elimination of bubbles. Importance of conditions in the atmosphere above the melt. Oxidation-reduction processes in oxide glass melts. The homogenizing of glass melts. Manufacture of sheet glass, containers, rods, tubes and fibres, optical glass. Crystallisation, glass ceramics and special glasses. Annealing and toughening of glass. Surface treatment and modification.

MME 364 Glass Science and Engineering Sessional
0.75 Credits

Melting of glass: effect of composition, temperature, viscosity. Annealing of

glass: effect of thermal stress and its removal by annealing. Properties of glass: effect of composition, thermal stress, environment. Colour glass: removal of common colour bearing materials to produce colourless glass.

MME 365 Ceramics and Glass Engineering
3.00 Credits

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. Crystallisation and glass ceramics. Annealing and toughening of glass. Surface treatment and modification.

MME 366 Ceramics and Glass Engineering Sessional
0.75 Credits

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

MME 400 Project and Thesis
4.50 credits

Design and construction of equipment and devices of materials and metallurgical interests. Studies on mode of manufacture of items comprising of several parts and investigation on possible lines of their improvement. Studies on processes of materials and metallurgical interest including steel making, casting and fabrication, heat treatment, corrosion, industrial metal finishing, ceramics, polymers and composites processing, etc. Studies on structure and properties of metals and materials.

MME 411 Principles of Materials Characterization
3.00 credits Prereq. MME 211 and MME 323

Principles of spectroscopy: UV-visible, infra-red, 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, TEM and other related techniques. Non-destructive testing: radiography, ultrasonic, eddy current, magnetic particles and dye penetration. Thermal analysis: DTA, DSC, TGA etc.

MME 440 Materials Processing Plant Design
0.75 Credits

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

and safety considerations.

MME 442 Failure Analysis and Artefact Study
1.50 Credits

Different mechanisms by which materials fail in service will be reviewed with special industrial reference. A number of 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 443 Physical Metallurgy of Steels and Heat Treatment
3.00 Credits Prereq. MME 213

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, normalising, hardening and tempering; TTT and CCT diagrams; austempering and martempering; hardenability and rulling 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 444 Heat Treatment and Microstructure Sessional
1.50 Credits Prereq. MME 214

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 445 Metallic Alloys and Materials Selection
3.00 Credits Prereq. MME 443

The 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 447 Industrial Metal Working Processes
3.00 Credits
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.

MME 449 Ferrous Production Metallurgy
4.00 Credits
Production of pig iron. Modern trends in blast furnace practice. Alternative routes of iron production. Kinetics of iron oxide reduction. Evaluation of activation energy for various reaction mechanisms. Production of plain carbon and alloy steels by various steel making processes. Physical chemistry of steel making. Degassing and secondary steel making. Solidification of steel ingots and continuous casting of steel products. Production of ferroalloys.

MME 453 Special Casting Processes
3 Credits Prereq. MME 345
Purpose and classification of special casting processes. Die casting: Gravity die and pressure die casting processes; theories of die casting; die design, metal-mould reaction and die lubrication, modes of die failure; die casting machines; requirements and types of die casting alloys; design of die cast products; defects and remedies. Precision casting: Lost wax process, moulding materials and preparation of moulds, precision cast alloys. Centrifugal casting: Types of centrifugal casting processes, forces involved in centrifugal casting, flow of metals, processes variables and casting quality, centrifugally cast products.

MME 455 Mineralogy and Economic Minerals of Bangladesh
3.00 Credits
Introduction. Earth's crust and genesis of minerals. Mineral forming environment. Occurrence, texture, structure, composition and classification of rocks. Optical mineralogy: polarizing microscopy, optical properties of common minerals and their identification. Economic minerals of Bangladesh: occurrence, distribution and reserve of glass sand, white clay, placer deposits, building materials, coal and hydrocarbon. National mineral policy of Bangladesh. Sampling, assaying and evaluation of ore deposits.

MME 457 Powder Metallurgy
2.00 Credits
Significance and importance. Production, characterisation and testing of metal

powders. Binders. Conditioning, compaction, pre-sintering, and sintering of metal 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. Finishing operations and heat treatment prospects for future development.

MME 458 Metal Forming Sessional
0.75 Credits
Application rolling theory to calculate rolling schedules. Work hardening of plain carbon steels, aluminium, etc. Recovery and recrystallisation of work hardened materials. Mechanical properties of cast and wrought products.

MME 467 Ceramics for Advanced Applications
3.00 Credits
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 471 Polymer Science and Engineering
3.00 Credits
Classification. Polymerization reactions. Molecular weight and its distribution. Characterization of polymers in solution and in solid state. Glassy and crystalline polymers. Mechanical properties. Concepts in polymer viscoelasticity. Creep, stress relaxation and dynamic behaviour. Rubber elasticity. Structure-property relationship: effect of degree of cross linking and temperature. Polymer processing: Formulation and compounding, melting and softening, rheology, Newtonian and non-Newtonian flow. Aspects of shaping of polymers. Considerations of die design for polymers.

MME 472 Polymer Science and Engineering Sessional
0.75 Credits
Microstructure and mechanical properties of polymers. XRD investigation of polyethylene. Environmental stress cracking in strained thermoplastics. Determination of degree of cross-linking in cross-linked ethylene plastics. Properties of polymeric melts. Selection of polymeric materials in practical applications.

MME 473 Composite Materials
2.00 Credits
Classification of composites. Types of fibres and matrices, fibre-matrix interface, theories of adhesion and measurement of bond strength. Elastic properties of unidirectional and random fibre composites, stress and strain distribution at fibres ends. Strength and toughness of composite. Production technology for reinforcements; whiskers, fibres and particulates. Production metal, ceramic and polymer matrix composites. Relationship between structure and properties.

MME 474 Composite Materials Sessional
0.75 Credits
Microstudy of different types of composite materials. Study of geometrical characteristics of composite materials. Anisotropic properties of composite materials. Thermal conductivity and thermal expansion of composite materials.

MME 475 Polymers and Composites
3.00 Credits
Classification of polymeric materials. Polymerisation reactions. Structure and properties of polymers. Processing and applications of polymers. Classification of composites. Types of fibres and matrices. Elastic properties of unidirectional and random fibre composites, stress and strain distribution at fibres ends. Production metal, ceramic and polymer matrix composites.

MME 476 Polymers and Composites Laboratory
0.75 Credits
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 481 Industrial Metallurgy
3.00 Credits
Role of production technology and its influence. Material selection, Domino effect, absolutes etc. Product liability. Materials Handling. Activities, functions, merits and demerits. Product development and methods. Designing for durability and economy. Optimum production with available facilities. Application of ergonomics and human resources for achieving productivity.

MME 483 Industrial Pollution, Control and Safety
3.00 Credits
Status of environmental quality in industries. Causes of industrial pollution. Sources and characteristics of industrial wastes. Solid wastes, raw-waste

constituents, air pollutants etc. Pollution control in various industries. Industrial waste management. Scope of industrial safety, safety in operating systems, personal safety and equipment, setting standard for safety. The role of government in industrial safety. Management responsibilities for safety and health. Legal aspects of safety.

6.2 Courses for MME Students Offered by Other Departments

Chem 107 Inorganic and Physical Chemistry
3.00 Credits
Atomic structure, periodic table. Properties and uses of noble gases. Different types of chemical bonds and their properties. Different types of solutions and their compositions. Properties of dilute solutions. Thermochemistry, chemical kinetics, chemical equilibria. Electrolytic conductance, emf. Electrochemical cells. Corrosion reactions.

Chem 114 Inorganic Quantitative Analysis
1.50 Credits
Volumetric analysis: acid-base titration, oxidation-reduction titrations, determination of Fe, Cu, and Ca volumetrically.

Chem 121 Organic Chemistry
3.00 Credits
The hybridisation of carbon atom and covalent bonding. A comprehensive study of aliphatic hydrocarbons with special reference to nomenclatures, method of preparation, properties and important uses. Types of reactions of aliphatic hydrocarbons and their industrial applications. Structure, nomenclature, preparation, properties, reactions and industrial applications of aliphatic hydrocarbon homologues. Aromatic compounds and aromaticity; preparation, properties, reactions and industrial applications of benzene and its derivatives. Heterocyclic compounds and their applications.

Chem 122 Organic Chemistry Sessional
1.50 Credits
Detection of elements in organic compounds. Identification of functional groups. Preparation of different organic compounds. Separation, purification and characterisation of organic compounds.

EEE 155 Electrical Engineering Fundamentals
3.00 Credit
Electrical units and standards. Electrical networks and circuits theorems, introduction to measuring instruments. Alternating current, RLC series, parallel

circuits, magnetic concepts and magnetic circuits.

EEE 156 Electrical Engineering Fundamentals Sessional
1.5 Credit

Laboratory experiments based on EEE 155.

EEE 267 Electrical and Electronic Technology
3.00 Credit

Balanced three-phase circuits. Introduction to single-phase and three-phase transformers. Principles of construction, operation and applications of DC generator, DC motor, synchronous generator, synchronous motor and induction motors. Semiconductor diode, transistors, operational amplifiers (OPAMs), silicon controlled rectifiers (SOR's): principles of operation and applications. Oscilloscope. Transducers: temperature, pressure, flow-rate, speed and torque measurements.

Hum 101 English
3.00 Credit

English phonetics: the places and manners of articulation of the English sounds. Vocabulary. English grammar: construction of sentences; some grammatical problems. Comprehension. Paragraph writing. Precis writing. Amplification. Report writing. Commercial correspondence and tenders. Short stories written by some well-known classic writers.

HUM 103 Economics
3.00 Credit

Definition of Economics. Economics and Engineering Principles of Economics. Micro-economics: The theory of demand and supply and their elasticities. Price determination. Nature of an economic theory, applicability of economic theories to the problems of developing countries. Indifference curve technique. Marginal analysis. Production, production function, types of productivity. Rational region of production of an engineering firm. Concepts of market and market structure. Cost analysis and cost function. Small scale production and large-scale production. Optimization. Theory of distribution. Macro-economics: savings, investment, employment. National income analysis. Inflation. Monetary policy, Fiscal policy and trade policy with reference to Bangladesh. Economics of development and planning.

Hum 207 Advanced English
2.00 Credit Prereq. Hum 101

Antonyms and synonyms. Words which often confuse us. Advanced grammar. Comprehension. Composition. Dialogue writing. Selected short stories or novels

written by some well-known classic writers. Selected poems written by the romantic poets: Wordsworth, Coleridge, Shelley, Keats and Byron. Writing research paper.

Hum 211 Sociology
2.00 Credit

Scope of sociology: Micro and Macro Sociology. Some fundamental concepts. Society: From savagery to civilization (Table). Social evolution and techniques of production: Social structure of Bangladesh. Oriental and occidental societies: Feudalism. Industrial revolution: The growth of capitalism, features, social consequences. Socialism. Fascism. Social control: need, means, future of social control. Leadership: types, functions, techniques, social power. Society and population: social determinants of fertility and mortality, human migration, demographic transition, density, the standard of living, population pyramid, population and world resources; Malthusian, optimum and socialistic population theory. Population Problem of Bangladesh. Social pathology: crime, juvenile delinquency, slum. Nature of social change: factors of social change-biological, physical, economic, cultural, technological factor: change in production technology, means of communication, transportation. Derivative social effects of converging material inventions. Effects of technology on major social institutions. Social inventions. Urbanization and industrialisation in Bangladesh.

Sociology of development: process of development, social planning. Planing as a factor of social change, social change in Bangladesh-nature and trend. Urban Ecology: city, pre-industrial and industrial: growth and nature of cities in Bangladesh. Rural sociology: features of village community in Bangladesh, social mobility, urban rural contrast. Social structure of the tribal people of Bangladesh.

Hum 302 Principles of Accounting
3.00 Credit

Accounting elements: the accounting equation, accounts, transactions, the double entry mechanism. Accounting procedure: the financial statements. Cost in general: objectives and classifications. Overhead costs: allocation and apportionment product costing: cost sheet under job costing, operating costing and process costing. Costing of by-products and joint products. Marginal costing: tools and techniques, cost-volume-profit analysis. Designing the optimal product-mix. Relevant costing: analysis profitability within the firm. Guidelines for decision making: short run decisions. Long-run planning and control: capital budgeting. The master budget, flexible budget and standard cost. Variance analysis.

Hum 305 Economics of Development and Planning

2.00 Credit Prereq. Hum 103 or Hum 113

Concept of development and underdevelopment, causes of underdevelopment. Characteristics of less developed countries. Theories of development: Lewis 2-Sectoral growth model. Hirshman's unbalanced growth and Rostow's stages of growth theory. Alternative strategies for development: balanced versus unbalanced growth. Investment criteria. Issues of economic development: poverty, inequality and unemployment in relation to development. Development problems related to agriculture, industry and population of Bangladesh. Industrialisation, trade, foreign aid and foreign private investment. Planning and its types: physical, financial project, sectoral and national planning. Stages of planning. Financing economic development: domestic resources for investment: savings, taxation. borrowing: internal and external. Role of taxation and borrowing in financing of economic plan. Deficit financing. Role of government in economic development. Project preparation, project appraisal and project evaluation. Cost-benefit analysis.

HUM 401 Business Law

3.00 Credit

Principles of law of contract, agency, partnership, sale of goods, negotiable instruments, insurance-insolvency. Company law: the companies act with special reference to the amendments and ordinances applicable to Bangladesh. Law regarding formation. Incorporation. Management and winding up of companies. Labour Law: the scope and sources of labour law. Law in relation to wages hours, health. Safety and other condition to work. The legislation effecting employment in factories. The trade union legislation arbitration, the policy of the state in relation to labour. Elementary principles of labour law-Factory Act (1965). Law of compensation (1965).

IPE 483 Production Planning and Control

3.00 Credit

Element of production planning and control, Types of production systems. Forecasting; methods and their application; aggregation planning; master production scheduling, MRP, coding and standardisation; capacity planning, inventory management. ABC analysis. Production scheduling techniques, CPM and PERT, line balancing, capacity planning. Plant location and layout, work study and method study, plant performance measurement. Introduction to product development and design. Computers in production planning and control and MRPII, JIT.

IPE 491 Engineering Management

3.00 Credit

Introduction: evolution and various thoughts of management, management principles and functions, organisation and environment. Organisation, theory and structure, co-ordination, span of control, authority delegation, groups, committee and task force, manpower planning. Personnel management: need, hierarchy, motivation, leadership, performance appraisal, wages and incentives, informal groups, organisation change and conflict.

Operational management: types of production, forecasting, inventory control, scheduling, maintenance management using conventional and analytical techniques. Safety management, quality management. Measures of performance, work measurement. Management information system. Location and layout of plant and facilities. Cost and financial management: elements of costs of products, depreciation, break-even analysis, investment analysis, budgetary control, benefit-cost ratio. Marketing management: concepts, sales and marketing strategies, patents laws. Technology management: management of innovation and changes, technology life cycle, Hi-tech management. Case studies.

Math 171 Calculus and Differential Equation

3.00 credit

Calculus: Limit, continuity and differentiability of a function, differentiation. Leibnitz theorem. Partial differentiation. Euler's theorem. Tangent and normal. Maxima and minima.

Integration by the method of substitutions. Standard integrals. Integration by parts. Definite integral and its properties. Area under plane curves in Cartesian and polar co-ordinates. Surface, area and volume of revolution.

Differential Equations: Definition. Formation of differential equations. Solution of first order differential equations by various methods. Solution of differential equation of first order and higher degrees. Solution of general linear equations of second and higher orders with constant coefficient. Solution of Euler's homogeneous linear equations.

Math 173 Vector Analysis and Matrices

3.00 credit

Vector Analysis: Scalars and vectors, equality of vectors. Addition and subtraction of vectors. Multiplication of vectors by Scalars. Position vector of a point. Resolution of vectors. Scalar and vector product of two vectors and their geometrical interpretation. Triple products and multiple products.

Application to geometry and mechanics. Linear dependence and independence of vectors. Differentiation and integration of vectors together with elementary applications. Definition of line, surface and volume integrals. Gradient,

divergence and curl of point functions. Various formulae. Gauss's theorem, Stoke's theorem, Green's theorem and their applications.

Matrices: Definition of matrix. Different types of Matrices. Algebra of matrices. Adjoining and inverse of a matrix. Rank and elementary transformations of matrices. Normal and canonical forms, Solution of linear equations. Quadratic forms. Matrix polynomials. Caley-Hamilton theorem. Eigenvalues and eigenvectors.

Math 271 Numerical Analysis, Statistics and Partial Diff. Equations

4.00 credit

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 Largange'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.

Statistics: Frequency distribution. Mean, median, mode and other measures of central tendency. Standard deviation and other measures of dispersion, Moments, skewness and kurtosis. Elementary probability theory and discontinuous probability distributions, e.g. binomial, Poison and negative binomial. Continuous probability distributions, e.g. normal and exponential. Characteristics of distributions. Elementary sampling theory. Estimation. Hypothesis testing and regression analysis.

Partial differential equation: Introduction. Equations of the linear and non-linear first order. Standard forms. Linear equations of higher order. Equations of the second order with variable co-efficient.

ME 141 Engineering Mechanics

3.00 Credit Prereq. Math 161 or equivalent course

Basic concepts of mechanics, statics of particles and rigid bodies, centroids of lines, areas and volumes. Forces in trusses and frames. Friction. Moments of inertia of areas and masses. Relative motion. Kinematics of particles- Newton's

Second law of motion. Principles of work and energy. System of particles. Kinematics of rigid bodies, kinematics of plane motion of rigid bodies-forces and acceleration.

ME 160 Mechanical Engineering Drawing-I

1.50 Credit

Introduction, instruments and their uses, first and third angle projections, orthographic drawing, isometric views. missing lines and views, sectional views and conventional practices, auxiliary views.

ME 221 Elements of Fluid Mechanics and Machinery

3.00 Credit Prereq. Math 161, Math 163, Math 263 or equivalent courses

Fluid properties. Fluid statics: manometry, forces on submerged planes and curved surfaces, buoyancy and floatation. One dimensional flow of fluid, equation of continuity. Euler's equation. Flow of fluid in pipes, Bernoulli's equation, flow through venturimete, head losses. Open channel flow: flow through weirs and notches. Impulse and momentum principles, fans and blowers. Study of centrifugal compressor and reciprocating pumps.

ME 243 Mechanics of Solids

3.00 credit Prereq. Math 161

Stress analysis: statically indeterminate axially loaded member, thermal and centrifugal stresses. Stresses in thin and thick walled cylinders and spheres, Beams, shear forces and bending moment diagrams. Various types of stresses in beams. Flexure formula. Deflection of beams: integration and area moments methods. Introduction to reinforced concrete beams and slabs. Torsion formula, angle of twist, modulus of rupture, helical springs. Combined stresses: principal stress, Mohr's circle. Columns. Eulers formula, intermediate column formulas, the secants formula. Flexure formula of curved beams. Introduction to experimental stress analysis techniques. Strain energy, failure theories.

ME 260 Mechanical Engineering Drawing-II

1.50 Credit Prereq. ME 160

Review of orthographic projections. Fasteners, gears, keys and springs. Sectional views and convectional practices, auxiliary views. Specifications for manufacture. Working drawings. Plans and elevation of buildings. Computer graphics.

Phy 103 Optics, Waves and Oscillation

3.00 Credit

Geometrical Optics. Combination of lenses: equivalent lens and equivalent focal length, cardinal points of a lens, power of a lens. Defects of images: spherical

aberration, astigmatism, coma, distortion, curvature, chromatic aberration. Optical instruments: compound microscope, polarising microscope, resolving power of a microscope, camera and photographic techniques.

Physical Optics. Theories of light: Huygen's principle and construction. Interference of light: Young's double slit experiment, Fresnel bi-prism, Newton's rings, interferometers. Diffraction of light: Fresnel and Fraunhoffer diffraction, diffraction by single slit, diffraction by double slit, diffraction gratings. Polarisation, production and analysis of polarised light, optical activity, optics of crystals.

Waves and Oscillations. Simple harmonic motion, damped simple harmonic oscillations, forced oscillations, resonance, vibrations of membranes and columns, combination and composition of simple harmonic motions, Lissajous' figures. Transverse and longitudinal nature of waves, travelling and standing waves, intensity of a wave, energy calculation of progressive and stationary waves, phase velocity, group velocity; velocity of longitudinal wave in a gaseous medium. Doppler effect. Architectural acoustics: Sabine's formula, requisites of a good auditorium.

Phy 102 Physics Sessional - I
1.50 Credit

Sessionals based on Phy 103.

Phy 157 Prop. of Matter, Electricity & Magnetism and Modern Physics
3.00 credit

Properties of Matter. Surface tension, surface tension as a molecular phenomenon, surface tension and surface energy, capillarity and angle of contact, pressure on a curved membrane, surface tension and temperature. Hydrodynamics: streamline and turbulent motion, equation of continuity, Bernoulli's equation and its applications: venturimeter, pilot tube, Torricelli's theorem. Viscosity: coefficient of viscosity, Poisouilles equation and its limitations, Stoke's law.

Electricity and Magnetism: electric charge, Coulomb's law. The electric field: calculation of the electric field strength, E; a dipole in an electric field. Electric flux and Gauss's law, some application of Gauss's law: electric potential V, relation between E and V, electric potential energy. Capacitors: capacitance, dielectrics: an atomic view, dielectrics and Gauss's law: current and resistance: current and current density, Ohm's law, resistivity: an atomic view, Ampere's law, Faraday's law, Lenz's law, self-Inductance and mutual Inductance. Magnetic properties of matter: magnetomotive force, magnetic field intensity; permeability, susceptibility, classifications of magnetic materials, magnetisation curves.

Modern Physics: Michelson Morley's experiment, Galilean transformation, special theory of relativity, Lorentz transformation, relative velocity, length contraction, time dilation, mass-energy relation. Photo-electric effect, Compton effect, de-Broglie wave, Bohr's atom model. Radioactive decay, half-life, mean life, isotopes, nuclear binding energy, alpha, beta gamma decay.

Shop 182 Carpentry Sheet metal and Machine Shop
1.50 credit

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.

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.

6.3 Courses Offered by DMME to Students of Other Departments

MME 195 Engineering Materials - I
3.00 Credits For IPE students (Level 1 Term 2)

Properties of metals, ceramics and polymers; processing of materials from liquid, solid and paste; choosing materials for products. Atomic, molecular, crystalline and amorphous structures for metals, ceramics and polymers. Elastic and plastic behaviour of materials. Behaviour of ceramic materials, glasses and polymeric materials. The behaviour of materials in service: fracture, ductile-brittle transition, fatigue, creep, oxidation and degradation, corrosion and corrosion protection. Materials as mixtures of elements: mixtures near and far from equilibrium, phase diagrams, phase changes. Non-ferrous metals: production and uses. Iron and steel production: production and uses; types of cast iron, effects of impurities. Plain carbon steel: the iron-iron carbide phase diagram, constituents and structures of plain carbon steels; Heat treatment of steels. Alloy steels: principles and effects of alloying, different alloy steels and their uses.

MME 291 Metallic Materials
3.00 credits For ME students (Level 2 Term 2)

Concept of malleability, ductility, toughness, fatigue resistance and other properties. Mechanical and non-destructive tests of metals. Pig iron: production

and uses. Cast iron: production, types, uses and effects of impurities. Steels: Bessemar and open-hearth steels, production and uses. Plain carbon and different types of alloy steels. Bearing metals, light alloys, common metals and their alloys. The Fe-Fe_3C equilibrium diagram. Types of heat-treatment. Case carburizing and nitriding.

MME 292 Metallic Materials Sessional
1.50 credits For ME students (Level 2 Term 2)
Experiments based on MME 291.

MME 293 Shipbuilding Materials
3.00 credits For NAME students (Level 2 Term 1)
Metals as materials of construction. Industrially significant properties of metallic materials. Production, properties and uses of pig iron, cast iron and carbon steels. Nonferrous alloys. Protective coatings. Ferrous alloys: plain carbon, alloy, tool, stainless, heat-resisting and creep-resisting steels etc. The Fe-Fe_3C equilibrium, different types of heat-treatment operations. Case hardening of steels. Cement, ferro-cement, timber, rubber, glass and plastics.

MME 294 Shipbuilding Materials Sessional
0.75 credits For NAME students (Level 2 Term 1)
Experiments based on MME 293.

MME 295 Engineering Materials - II
2.00 Credits For IPE students (Level 2 Term 1)
Ceramics: Ceramic raw materials, preparation, characterisation and processing; principles and mechanisms of ceramic drying and firing processes; defects and properties of ceramics; glazing and decoration; conventional and engineering ceramics; newer industrial ceramics. Glasses: Kinetics of crystallisation and phase separation of glass, glass transition; viscosity, chemical durability and thermal, electrical, optical, and mechanical properties of commercial glasses; relation of physical properties to glass structure and composition; tests of glass. Polymers: Structure and properties of polymers and copolymers; thermoplastics and thermosets; product design; commercial processing of polymers; properties and testing of polymers; polymers and the environment. Composites: Theory of composites; fabrication, structure and uses of different types of composites; properties of composites.

MME 296 Engineering Materials Sessional
1.50 Credits For IPE students (Level 2 Term 1)
Metallographic sample preparation. Microstudy of ferrous and nonferrous materials. Microstudy of clay-based ceramic materials and semi-crystalline

polymers. Study of the manufacturing processes of ceramics and glasses. Anisotropic properties of composite materials.

MME 391 Fundamentals of Metallurgy
3.00 credits For ChE students
History of the development of metallurgy. Production of pig iron and steel. Extraction of copper and aluminium. Mechanical and physical properties of metals. Crystalline structure of metals. Metallography. Phase diagram of the Fe-C system. Heat treatment of steel. Metals and metallic alloys such as cast iron, plain carbon steels, low alloy steels, stainless steels, copper and copper alloys, aluminium, lead, nickel and nickel alloys, titanium and titanium alloys. Numerical designation of alloy steels. High temperature alloys. Metal forming, non-destructive testing.

Appendix F

Level and Term-Wise Course Curriculum for the Department of Materials and Metallurgical Engineering, BUET, Dhaka

LEVEL ONE / TERM ONE

Course Number	Course Name	Credit Hour	Pre-requisite Course(s)
Chem 107	Inorganic and Physical Chemistry	3.00	
Chem 114	Inorganic Quantitative Analysis	1.50	
EEE 155	Electrical Engineering Fundamentals	3.00	
EEE 156	Electrical Engineering Fundamentals Sessional	1.50	
Math 171	Calculus and Differential Equation	3.00	
MME 131	Introduction to Metallurgy and Materials	3.00	
Phy 102	Physics Sessional – I	1.50	
Phy 103	Optics, Waves and Oscillation	3.00	
	Total Credits	**19.50**	

Appendix F: (Contd...)

Level and Term-Wise Course Curriculum for the Department of Materials and Metallurgical Engineering, BUET, Dhaka

LEVEL ONE / TERM TWO

Course Number	Course Name	Credit Hour	Pre-requisite Course(s)
Chem 121	Organic Chemistry	3.00	
Chem 122	Organic Chemistry Sessional	1.50	
Hum 101	English	3.00	
Math 173	Vector Analysis and Matrices	3.00	
ME 141	Engineering Mechanics	3.00	Math 171
ME 160	Mechanical Engineering Drawing – I	1.50	
MME 138	Introduction to Computing	1.50	
Phy 157	Properties of Matter, Electricity and Magnetism and Modern Physics	3.00	
Shop 182	Machine Shop, Sheet Metal and Carpentry	1.50	
	Total Credits	**21.00**	

Appendix F: (Contd...)

Level and Term-Wise Course Curriculum for the Department of Materials and Metallurgical Engineering, BUET, Dhaka

LEVEL TWO / TERM ONE

Course Number	Course Name	Credit Hour	Pre-requisite Course(s)
Math 271	Numerical Analysis, Statistics and Partial Differential Equations	4.00	
ME 260	Mechanical Engineering Drawing – II	1.50	ME 160
MME 211	Crystallography and Structure of Materials	2.00	
MME 212	Crystallography and Structure Sessional	0.75	
MME 222	Materials Testing Sessional	1.50	
MME 231	Materials Thermodynamics	3.00	
MME 241	Fuels and Combustion	3.00	
MME 242	Fuels and Combustion Sessional	1.50	
OPTION – I			
ME 243	Mechanics of Solids	3.00	Math 171
MME 233	Mechanical Behaviour of Materials	3.00	
	Total Credits	**20.25**	

Appendix F: (Contd...)

Level and Term-Wise Course Curriculum for the Department of Materials and Metallurgical Engineering, BUET, Dhaka

LEVEL TWO / TERM TWO

Course Number	Course Name	Credit Hour	Pre-requisite Course(s)
EEE 267	Electrical and Electronic Technology	3.00	
ME 221	Elements of Fluid Mechanics and Machinery	3.00	Math 171, Math 173
MME 213	Phase Diagrams and Transformations	4.00	
MME 214	Metallography	1.50	
MME 230	Materials and Metallurgical Analysis	1.50	
MME 235	Heat and Mass Transfer	3.00	Math 271
MME 238	Computer Applications to Metallurgy and Materials	1.50	MME 138
OPTION – II			
Hum 103	Economics	3.00	
Hum 303	Principles of Accounting	3.00	
Hum 401	Business Law	3.00	
	Total Credits	**20.50**	

Appendix F: (Contd...)

Level and Term-Wise Course Curriculum for the Department of Materials and Metallurgical Engineering, BUET, Dhaka

LEVEL THREE / TERM ONE

Course Number	Course Name	Credit Hour	Pre-requisite Course(s)
MME 321	Crystal Defects, Deformation and Fracture	3.00	
MME 325	Corrosion and Degradation of Materials	3.00	
MME 338	Application of CAD to Materials Processing	0.75	MME 138
MME 340	Communication Techniques	0.75	
MME 341	Refractories and Furnaces	3.00	
MME 342	Refractories and Furnaces Sessional	1.50	
OPTION – III			
MME 351	Principles of Ore Dressing and Extractive Metallurgy	3.00	
MME 361	Ceramic Raw Materials and Processing	3.00	
OPTION – IV			
MME 354	Chemical Metallurgy Sessional	1.50	
MME 362	Ceramic Processing Sessional	1.50	
MME 449	Ferrous Production Metallurgy	4.00	
	Total Credits	**20.50**	

Appendix F: (Contd...)

Level and Term-Wise Course Curriculum for the Department of Materials and Metallurgical Engineering, BUET, Dhaka

LEVEL THREE / TERM TWO

Course Number	Course Name	Credit Hour	Pre-requisite Course(s)
MME 300	Industrial Training	0.00	
MME 343	Surface Engineering of Materials	3.00	
MME 344	Surface Engineering of Materials Sessional	0.75	
MME 345	Foundry Engineering	4.00	
MME 346	Foundry Engineering Sessional	1.50	
MME 347	Metal Joining Technology	3.00	
MME 348	Metal Joining Technology Sessional	1.50	
OPTION–V			
MME 363	Glass Science and Engineering	3.00	
MME 365	Ceramics and Glass Engineering	3.00	
OPTION–VI			
Hum 207	Advanced English	2.00	Hum 101
Hum 211	Sociology	2.00	
Hum 305	Economics of Development and Planning	2.00	Hum 103
OPTION–VII			
MME 364	Glass Science and Engineering Sessional	0.75	
MME 366	Ceramics and Glass Engineering Sessional	0.75	
	Total Credits	**19.50**	

Appendix F: (Contd…)

Level and Term-Wise Course Curriculum for the Department of Materials and Metallurgical Engineering, BUET, Dhaka

LEVEL FOUR / TERM ONE

Course Number	Course Name	Credit Hour	Pre-requisite Course(s)
IPE 491	Engineering Management	3.00	
MME 400	Project and Thesis	1.50	
MME 411	Principles of Materials Characterisation	3.00	MME 211, MME 323
MME 440	Materials Processing Plant Design	0.75	
MME 443	Physical Metallurgy of Steel and Heat Treatment	3.00	MME 213
MME 444	Heat Treatment and Microstructure Sessional	1.50	
OPTION-VIII			
MME 471	Polymer Science and Engineering	3.00	
MME 475	Polymers and Composites	3.00	
MME 323	Physical Properties of Materials	3.00	
OPTION-X			
MME 472	Polymer Science and Engineering Sessional	0.75	
MME 476	Polymers and Composites Sessional	0.75	
	Total Credits	**19.50**	

Appendix F: (Contd …)

Level and Term-Wise Course Curriculum for the Department of Materials and Metallurgical Engineering, BUET, Dhaka

LEVEL FOUR / TERM TWO

Course Number	Course Name	Credit Hour	Pre-requisite Course(s)
MME 400	Project and Thesis	3.00	
MME 442	Failure of Materials and Artefact Study	1.50	
MME 445	Metallic Alloys and Materials Selection	3.00	MME 443
MME 447	Industrial Metal Working Processes	3.00	ME 243, or MME 233
OPTION-XI			
MME 457	Powder Metallurgy	2.00	
MME 473	Composite Materials	2.00	
OPTION-IX			
MME 467	Ceramics for Advanced Applications	3.00	
MME 453	Special Casting Processes	3.00	MME 345
MME 455	Mineralogy and Economic Minerals of Bangladesh	3.00	
OPTION-XII			
IPE 483	Production Planning and Control	3.00	
MME 481	Industrial Metallurgy	3.00	
MME 483	Industrial Pollution Control and Safety	3.00	
OPTION-XIII			
MME 458	Metal Forming Sessional	0.75	
MME 474	Composite Materials Sessional	0.75	
	Total Credits	**19.25**	