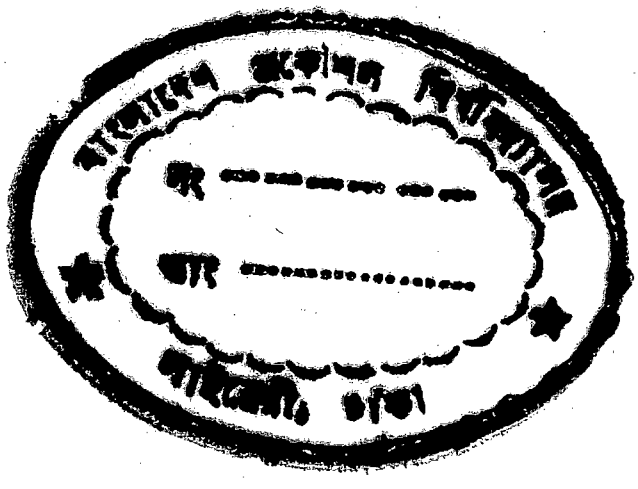
DEPARTMENT OF
MATERIALS AND METALLURGICAL ENGINEERING

INFORMATION BOOKLET
FOR THE UNDERGRADUATE STUDENTS



BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY
DHAKA, BANGLADESH

October 1999

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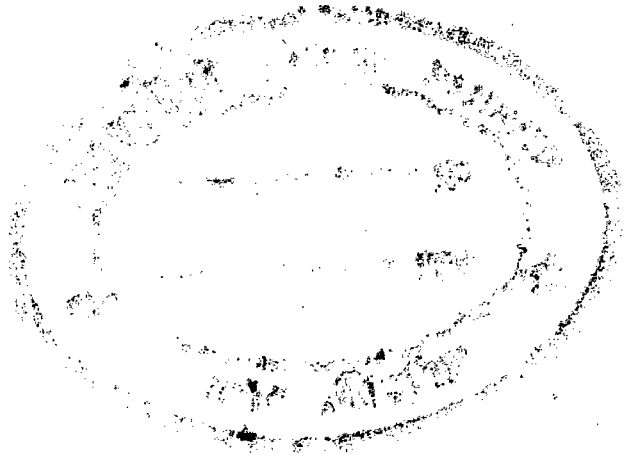
October 1999.



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PREFACE

In March 1998 the Department of Metallurgical Engineering is renamed as the Department of Materials and Metallurgical Engineering. This has been a significant development in the history of this department. The department has adopted an unified approach towards all kinds of materials and included more courses on non-metallic materials in its curriculum. This concise publication is for the students of undergraduate studies of this department of session 1997-98 onwards who will follow the new syllabus and subsequently have the degree of Bachelor of Science in Engineering (Materials and Metallurgical).

The present booklet provides information about the department and outline of courses effective from the session 1997-98. Some general aspects of the course system of undergraduate studies are also included in the booklet.

We hope that this concise booklet will be useful both to the new undergraduate students and to the student advisers of the department of Materials and Metallurgical Engineering.

Dhaka
October 1999

Ehsanul Haque
A. K. M. Bazlur Rashid

CONTENTS

1 WELCOME TO THE WORLD OF MATERIALS

Our world is a materials world. Everything we see, everything we use is made of materials. From just a hundred elements that exit naturally you can develop or engineer millions of combinations of materials that differ in how they look, how they act and how strong they are , how shining, how heavy or light, how they behave, ... the list goes on. Materials cater all branches of engineering and technology, be it for sub-micron sized component of an electronic circuit or a gigantic bridge weighing several thousand tons.

Engineered materials are special combinations designed to behave in a predictable way regarding strength, heat resistance, electrical conductivity, resistance to corrosion etc. Materials (and how we use them) will play a big role in our future and the materials engineer will play a very important part in fulfilling both our basic needs and the most exotic dreams.

Metal are the mainstay of the materials world and make up more than 70 per cent of the earth's elements. Metals make today's transportation, industry, agriculture, construction and communication systems possible. And the equipment and machines used to develop and process all other materials are built primarily from metals. A specialist in engineering metals is called a metallurgical engineer.

Till recently the activities in the department of Materials and Metallurgical Engineering at the Bangladesh University of Engineering and Technology, Dhaka centred primarily on topics related to metals - the most predominant materials. In conformity with the changes in other parts of the world, the courses in the department have now been modified to encompass a broader understanding of other engineering materials that are useful in engineering construction and common products such as ceramics, composites, glasses and polymers. It is expected that the new course will enable a student to build a career, including higher studies and research, in any of these materials. However considering the special needs of Bangladesh the major emphasis still remains on metals.

The materials and metallurgical engineer must develop a system of concepts that permits him to understand the constitution, structure, extraction, technology and characterisation of metals and other materials and use this understanding for the welfare of mankind. He/she has to be conversant not only with the relationship between structure and properties of a metal but also know how to alter the structure so as to effect a desired change in properties. Within the field of materials and metallurgical engineering the activities can range from pure research to practical engineering and you have a choice of what kind of work you will find most interesting. For example you may prefer to produce metals, to create products or to sell them, to do research or to teach.

1. If your interest is more towards practical engineering and you want to be a product or process engineer you will not only find a job maintaining and improving manufacturing operations to make the best possible product at the lowest possible cost, but you will also be a member of the team that designs new processes and new materials. In industries in Bangladesh, the field of materials and metallurgical engineering may encompass such job titles as materials engineer, metallurgist, metallurgical engineer, foundry engineer, welding engineer, ceramic engineer, refractory engineer, and so on.

2. If you prefer to be a scientist, you will find in the research on materials excitement of discovery coupled with the satisfaction of practical accomplishment. You will learn to design and perform experiments and interpret the data obtained. Graduates from this department are now engaged in research laboratories at home and abroad. If you like teaching the academic world offers many opportunities for an interesting and satisfying career. Teaching offers not only the satisfaction of guiding the intellectual development of the students but also provides a fertile field of personal accomplishment and recognition.

3. Often the materials and metallurgical engineer becomes a detective, where his/her technical knowledge is bolstered by his ingenuity. For example, a crack developed in an air plane wing and lives were lost. Why? It is the job of the materials engineer to pinpoint the one small variation in material composition, fabrication, treatment, processing, installation, environment, negligence or sabotage that caused the failure, and then to see that it does not happen again. Tracking down this tiny but vital variation from the norm is a fascinating pursuit. This department takes pride in being involved in the analysis of the causes of many important failures in Bangladesh, ranging from small gears to aircraft components.

4. Sales is a stimulating field for those who understand people and like to deal with them. But whether it be selling a new type of structural steel, a better design of a tool or a ceramic magnet for a refrigerator door, if he/she is to succeed, a sales engineer must have a sound and thorough knowledge of his/her products. He/she must understand the manufacture and characteristics not only of his/her own materials but also its competitors. Technical service, often an extension of sales, also demands broad knowledge. The service engineer must be able to explain a failure, recommend an alternative solution, provide engineering data and arrange for appropriate tests to obtain data for new applications.

Once a man's world, materials/metallurgical engineering has now open its door wide to women and in the universities offering metallurgical engineering or materials engineering degrees, a woman is no longer a novelty (Bangladesh is no exception!). Throughout the world women are well-established in the field.

2 THE DEPARTMENT OF MATERIALS AND METALLURGICAL ENGINEERING

The Department of Materials and Metallurgical Engineering (MME) at the Bangladesh University of Engineering and Technology, Dhaka is the only seat of education in the field of materials and metallurgical engineering in Bangladesh. The then Department of Metallurgical Engineering was established at BUET in 1952 with a two-fold objectives:

1. to provide an advanced course of instruction on metallurgical engineering and allied subjects, and

2. to provide facilities for fundamental and applied research in metallurgical engineering with special emphasis on the utilisation of indigenous raw materials.

At the beginning the department could attract a few students because of the limited industrial activity in the country. With the emergence of Bangladesh as an independent country there has been a change in the situation and with the increase in demand of graduates in metallurgical engineering an increasing number of students are showing interest towards this department.

Since then, considerable changes have been taking place in this field over the years. Non-metallic materials like ceramics, polymers, composites etc. have been emerging at an increasing rate, sometime replacing the traditional metallic materials. It is interesting to know that many of the concepts of structure, processing and properties of different kind of materials are common. As such an unified approach has been adopted by educationists and researchers world wide and the curricula of traditional metallurgical engineering have been widened to include all sorts of materials. Former metallurgical engineering department in different Universities of the world have been changing their names into Materials Science and Engineering/Materials and Metallurgical Engineering etc.

In order to keep pace with the world wide trend as well as to satisfy local demand for engineers with better background on non-metallic materials, this department at BUET has been gradually re-orienting its curriculum over the years. It has adopted an unified approach towards all kind of materials and included more courses on non-metallic materials in its curriculum. Befittingly, the academic council of BUET changed the name of this department from Metallurgical Engineering into Materials and Metallurgical Engineering on 18 March, 1997. This has been a very significant development in the history of this department. The department has geared up its efforts in education and research on ceramic, polymers and composite; in addition to its traditional interest - metals and alloys.

The department presently admits 20 students per year in a four-year degree programme. This department also offers post-graduate courses (masters and doctorate of philosophy) in the field of metallurgy.

In addition, this department offers theoretical and laboratory courses to the students of Mechanical Engineering, Naval Architecture and Marine Engineering, Industrial and Production Engineering and Chemical Engineering departments. Moreover students from all other departments of the university utilise the laboratory facilities of this department for their project and research assignments.

3 THE TEACHING STAFF

The members of the teaching staff of this department are well-trained and most of them have experience of study and research abroad. In recognition of his work on modern metallography one of them first prize from the Metals Society, London and also received "Certificate of Merit" from the Institute of Physics for his work on Electron Microscopy, one of them received the "Best Scientist" award in 1996 from Bangladesh Academy of Science and also has recognition from the American Electrochemical Society, three of them received University Grants Commission (Bangladesh) awards for outstanding research publication and three others have received university recognition for excellence in research work. A detailed list of the teaching staff is given below.

Professors

*Ehsanul Haque.** B.Sc. Engg. (Met.), M.Met., PhD (U.K.).

Md. Mohor ali Bepari. B.Sc. Engg. (Met.), M.Sc. Engg. (Met.), M.Met., PhD (U.K.).

Abu Syed Wais Kurny. B.Sc. Engg. (Met.), M.Sc. Engg. (Met.), PhD (India).

Md. Mohafizul Haque. B.Sc. Engg. (Met.), M.Sc. Engg. (Met.), M.Sc. (Indl. Met), PhD (U.K.)

A. A. Md. Rezaul Haque. B.Sc. Engg. (Met.), M.Sc. Engg. (Met.), M.Met. (U.K.), PhD (India).

Md. Nasrul Haque. B.Sc. Engg. (Met.), M.Sc. Engg. (Met.), PhD (U.K.).

Associate Professor

A. S. Md. Abdul Haseeb. B.Sc. Engg. (Met.), M.Sc. Engg. (Met.), PhD (Belgium).

A. K. M. Bazlur Rashid. B.Sc. Engg. (Met.), M.Sc. Engg. (Met.), PhD (U.K.)

Md. Fakhrul Islam. B.Sc. Engg. (Met), M.Sc. Engg. (Met), M.Sc. Engg. (Mat.) and PhD (U.K.)

Assistant Professors

Qumrul Ahsan. B.Sc. Engg. (Met.), M.Sc. Engg. (Met), PhD (U.K.)

*Md. Zahidul Haque.*** B.Sc. Engg. (Met.), M.Sc. Engg. (Met)

*Md. Aminul Islam.*** B.Sc. Engg. (Met), M.Sc. Engg. (Met)

*Asma Yasmin.*** B.Sc. Engg. (Met), M.Sc. Engg. (Met)

A. K. M. Shaestagir Chowdhury. ** B.Sc. Engg. (Met), M.Sc. Engg. (Met)

*Md. Moniruzzaman.*** B.Sc. Engg. (Met), M.Sc. Engg. (Met)

Lecturers

Md. Ohidul Alam. B.Sc. Engg. (Met), M.Sc. Engg. (Met)

Syed A. Md. Tofail. B.Sc. Engg. (Met)**

Senior Foundry Instructor

Fazlul Haque Bhuiyan. Diploma in Engineering (Mech.)

Sub-Assistant Engineer

Md. Yusuf Khan. Diploma in Engineering (EEE)

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* Present Head of the Department

** On leave for higher studies at universities in the U.K., Belgium and Ireland

4 THE COURSE SYSTEM

4.1 Introduction

From the academic session of 1990-91 the undergraduate curricula at Bangladesh University of Engineering and Technology is based on the Course System. The rules and regulations of the new system was duly published by the Registry Office in a booklet entitled "Report of the Committee for Framing Recommendations for Implementation and administration of course System" which is revised and approved in the meeting of the Academic Council held on 7th and 13th September 1993. Only the relevant sections of the report are included in this information booklet so that students can have a clear understanding about the course system.

4.2 The Course System

The salient features of the course system are:

1. reduction of the number of theoretical courses and examination papers to around five in each term,

2. the absence of a pass or a fail on an annual basis,

3. continuous evaluation of student's performance,

4. introduction of Letter Grades and Grade Points instead of numerical grades,

5. introduction of some additional optional courses and thus enable students to select courses according to his interest as far as possible,

6. opportunity for students to choose fewer or more courses than the normal course load depending on his/her capabilities and needs,

7. the flexibility to allow the student to progress at his own pace depending on his ability or convenience, subject to the regulations on credit and minimum grade point average (GPA) requirements, and

8. promotion of teacher-student contact.

The course system is expected to reduce the work load which now accumulates at the end of the semesters demanding extended/long preparatory leave due to the presence of decisive final examination. The proposed system will create a continuous, even and consistent work load throughout the term for the students.

4.3 Number of Terms in a Year

There will be two Terms (Term I and Term II) in an academic year. In addition to these two regular Terms, there may be a Short Term in the intervening period between end of Term II and commencement of Term I. During this term students, those who need, may take additional courses either to make up deficiencies in credit and GPA requirements or to fulfill the credit requirements for bachelor's degree spending less time than the normal duration; and other students may take vacation.

The duration of each of Term I and Term II will be 18 weeks which will be used as follows:

Classes	14 weeks
Recess before Term Final Examination	2 weeks
Term Final Examination	2 weeks
	Total = 18 weeks

The duration of a Short Term will be around 8 weeks of which about 7 weeks will be spent for class lectures and one week for Term Final Examination.

4.4 Course Pattern and Credit Structure

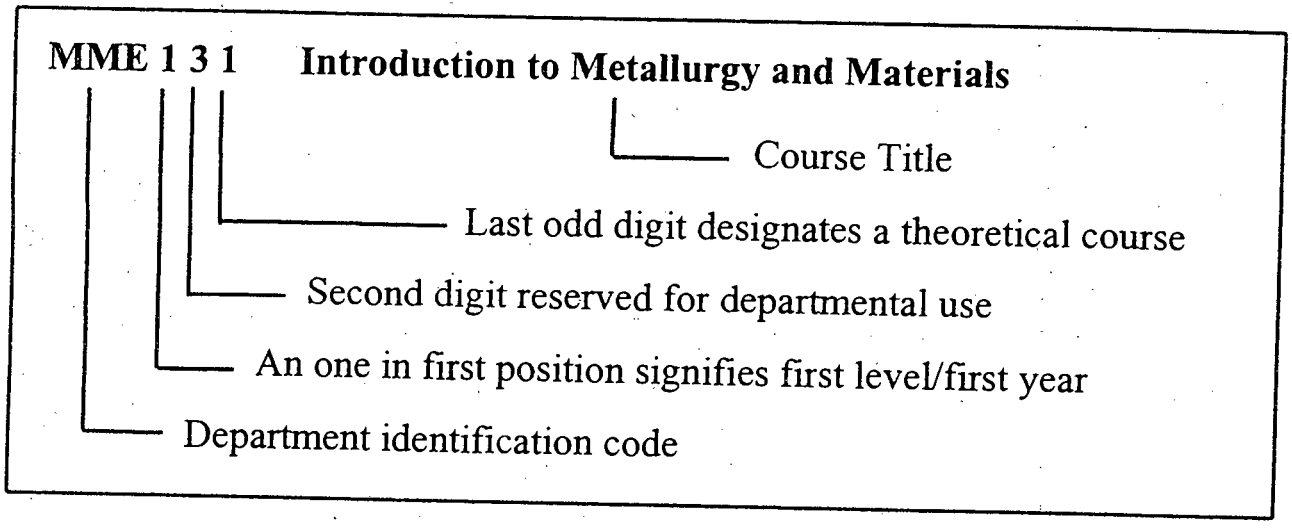
The entire undergraduate programme of the department is covered through a set of theoretical and laboratory/sessional courses. Each course is designated by a two to four letter word identifying the department which offers it following by a three digit number with the following criteria:

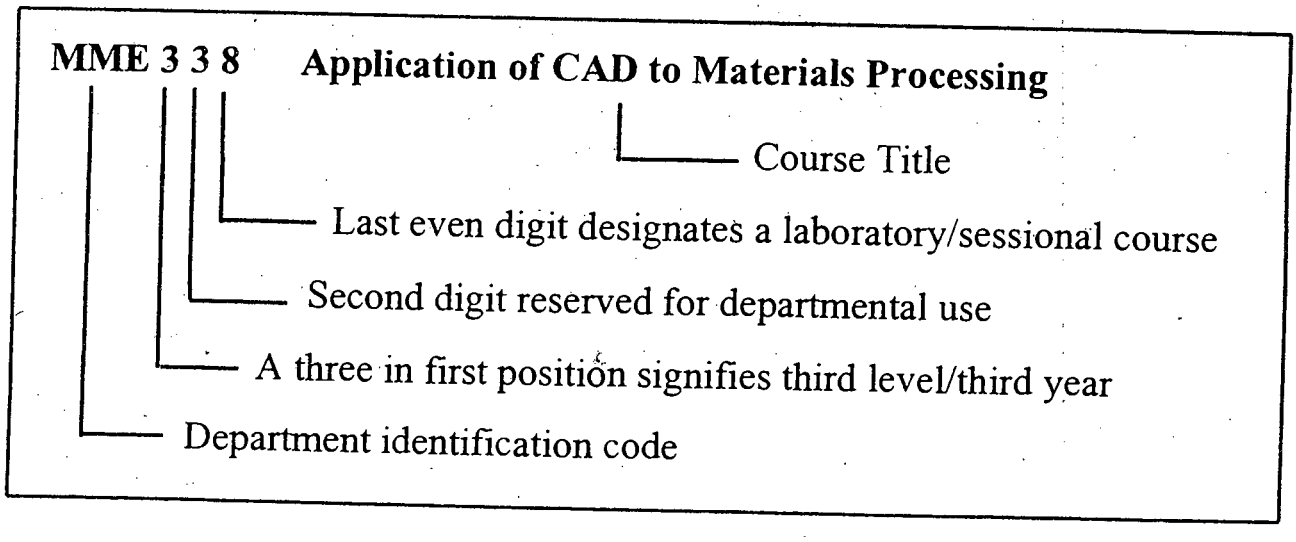
1. The first digit will correspond to the year/level in which the coursey is normally taken by the students.

2. The second digit will be reserved for departmental use for such things as to identify different areas within a department.

3. The last digit will usually be odd for theoretical and even for laboratory or sessional courses.

The course designation system is illustrated by the following two examples.





4.5 Assignment of Credits

1. For theoretical courses, one lecture per week per term will be equivalent to one credit.

2. For laboratory/sessional courses, credits will be half of the class hours per week per term.

Credits are also assigned to project and thesis work taken by students.

4.6 Types of Courses

The courses included in the undergraduate curricula are divided into several groups as follows:

4.6.1 Core Courses

In each discipline a number of courses will be identified as core courses which form the nucleus of the respective Bachelor's degree programme. A student has to complete all of the designated core courses for his/her discipline.

4.6.2 Pre-requisite Courses

Some of the courses are identified as pre-requisite courses. A pre-requisite course is one which is required to be completed before some other course(s) can be taken. Any such course, on which one or more subsequent courses build up, may be offered in each of the two regular terms.

4.6.3 Optional Courses

Apart from the core courses, students will have to complete a number of courses which are optional in nature in that students will have some choice to choose the required number of courses from a specified group/number of courses.

4.7 Teacher-Student Contact

The proposed system encourages students to come in close contact with teachers. For promotion of teacher-student contact, each student is assigned to an Adviser and the student is free to discuss with his adviser all academic matters. Students are also encouraged to meet with other teachers any time for help and guidance in academic matters.

4.8 Student Adviser

One adviser will normally be appointed of a group of student by the BUGS of the concerned department who will advise each student about the courses to be

taken by a student. In each term the adviser will discuss with the student his academic programme and help him decide the number and the nature of courses for which he can register. However, it is the student's responsibility to keep contacts with his/her adviser who will review and eventually approve the students specific plan of study and check on subsequent progress.

For a student of second and subsequent terms, the number and nature of courses for which he can register will be decided on the basis of his academic performance during the previous term(s). The adviser will advise the student to register for the courses during the next term within the framework of the guidelines in respect of minimum/ maximum credit hour limits, etc. which are discussed later. He may also permit a student to drop one or more courses based on his academic performance.

4.9 Registration Requirements

Any student who makes use of class room or laboratory facilities or faculty time is required to register formally. Being admitted to the university, each student is assigned to a student adviser. The student can register for courses he intends to take during a given term only on the basis of the advise and consent of his/her adviser.

4.9.1 Course Registration Procedure

Students must register for each class in which they will participate. Each student will have to fill up a Course Registration Form in consultation with and under guidance of his adviser. The original copy of the course registration form will be submitted to the Registrar's Office for distribution to the concerned adviser, head, dean and controller of examination and the student. The date, time and venue of registration will be announced in advance by the registrar's office. Much counselling and advising are accomplished at the registration time. It is absolutely necessary that all students be present for registration at the specific time.

Late registration is permitted during the first week on payment of a late registration fee. Students having outstanding dues to the university or a hall of residence shall not be permitted to register. All students must clear their dues and obtain a clearance or no dues certificate, on the production of which, they will be given necessary course registration forms. These registration forms will normally be available in the register's office.

However, for the first year students prior department-wise enrolment/ admission is mandatory. An orientation programme will be conducted for them at the beginning of the first term when they will be handed over the registration package after producing enrolment slip/proof of admission.

4.9.2 Limits on the Credit Hours to be Taken

A student must enrolled for at least 15 credit hours. He/she may be allowed to enrol in up to a maximum of 24 credit hours if recommended by his/her adviser. A student must enrol for the prescribed laboratory/sessional courses in the respective term within the allowed credit-hour limits.

4.9.3 Course Adjustment Procedure

A student will have some limited options to add to delete courses from his/her registration list. He/she may add courses only within the first two weeks of a regular term and only during the first week of the short term. In case of dropping a course, a student will be allowed to do so within four weeks after the commencement of a regular term and two weeks after the commencement of a short term. Adjustment of initially registered courses in any term can be done by duly completing the Course Adjustment Form. These forms will normally be available in the registrar's office. For first level/year students such forms can be included in the registration package at the time of orientation.

All changes in courses must be approved by the adviser and the head of the concerned department. The course adjustment form will have to be submitted to the registrar's office after duly filled in and signed by the concerned persons. To add/drop a course, respective teacher's consent will be required.

4.9.4 Withdrawal from a Term

If a student is unable to complete the Term Final Examination due to serious illness or serious accident, he/she may apply to the Head of the department for total withdrawal from the Term within a week after the end of the Term Final Examination. However, he/she may chose not to withdraw any laboratory/ sessional course if the grade obtained in such a course is 'D' or better. The application must be supported by a medical certificate from the Chief Medical Officer of the University.

4.10 The Grading System

The total performance of a student in a given course is based on a scheme of continuous assessment. For theory courses this continuous assessment is made through a set of quizzes/in class evaluation, class participation, homework assignments, and a term final examination.

Thirty per cent of marks of a theoretical course shall be allotted for continuous assessment i.e. quizzes and homework assignments, in class evaluation and class participation. The remainder of marks will be allotted to Term Final examination of 3 hour duration which will be conducted centrally by the university. There will be internal and external examiners for each courses in

the term final examination. the distribution of marks for a given theroretical course will be as follows:

1.	Class participation	10 %
2.	Homework assignments and quizzes	20 %
3.	Term final examination :	
	Internal (Section A)	35 %
	External (Section B)	35 %
		Total = 100%

All students are expected to attend classes regularly. The university believes that attendance is necessary for effective learning. The first responsibility of a student is to attend classes regularly, and one is required to attend at least 60% of all classes held in every course. Basis for awarding marks for class participation and attendance will be as follows:

Attendance	**Marks**
90% and above	10
85% to less than 90%	9
80% to less than 85%	8
75% to less than 80%	7
70% to less than 75%	6
65% to less than 70%	5
60% to less than 65%	4
Less than 60%	0

For 2 credit courses 2 best out of 3, for 3 credit courses 3 best out of 4, and for 4 credit courses 4 best out of 5 quizzes may be considered for awarding grade. These may be considered as the minimum recommended number of quizzes for any course.

The assessment in laboratory/sessional courses is made through observation of the student at work in class, viva-voce during laboratory hours, and quizzes. As stated earlier, each course has a certain number of credits which describe its weightage. A letter grade with a specified number of grade points is awarded in each course for which a student is registered. A student's performance is measured by the number of credits that he/she has completed satisfactorily and the weightage average of the grade points that he/she has maintained. A minimum grade point average is required to be maintained for satisfactory

progress. Also a minimum number of earned credits should be acquired in order to qualify for the degree.

Letter grades and corresponding grade points will be awarded in accordance with the provisions shown below:

Numerical Grade	Letter Grade	Grade Point
80% or above	A+ (A plus)	4.00
75% to less than 80%	A (A regular)	3.75
70% to less than 75%	A- (A minus)	3.50
65% to less that 70%	B+ (B plus)	3.25
60% to less than 65%	B (B regular)	3.00
55% or less than 60%	B- (B minus)	2.75
50% to less than 55%	C+ (C plus)	2.50
45% to less than 50%	C (C regular)	2.25
40% to less than 45%	D (D regular)	2.00
Less than 40%	F	0.00
Continuation (for project and thesis)	X	

4.10.1 Calculation of GPA

Grade point average (GPA) is the weighted average of the grade points obtained in all the courses passed/completed by a student. For example, if a student passes/completes five courses in a term having credits of C_1, C_2, C_3, C_4 and C_5 , and his grade points in these courses are G_1, G_2, G_3, G_4 and G_5 respectively, then

4.10.2 A Numerical Example

Suppose a student has completed five courses in a term and obtained the following grades:

Courses	Credits	Grade	Grade Points
MME 203	3.00	A+	4.00
EEE 205	3.00	B	3.00
ME 207	3.00	A	3.75
Math 205	2.00	B+	3.25
Hum 203	1.00	A-	3.50

Then his GPA for the term will be as follows:

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

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 a '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.

5 COURSE DETAILS

5.1 Outlines of Subject Courses

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. In the present programme, the courses are rearranged into six modules (Figs. 1and 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 grouped into two clearly distinct divisions, namely Materials and Metallurgy.

Fig. 1 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 221	Organic Chemistry (3.00 Credits)
Chem 222	Organic Chemistry Sessional (1.50 Credits)
Phy 102	Physics Sessional - I (1.50 Credits)
Phy 103	Optics, Waves and Oscillation (3.00 Credits)
Phy 113	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 Creidts)
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 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 Artifacts 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) (For Metallurgy)
MME 366 Ceramics & Glass Engineering Sessional (0.75 Credits) (For Metallurgy)
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) (For Metallurgy)
MME 476 Polymers and Composite Sessional (0.75 Credits) (For Metallurgy)

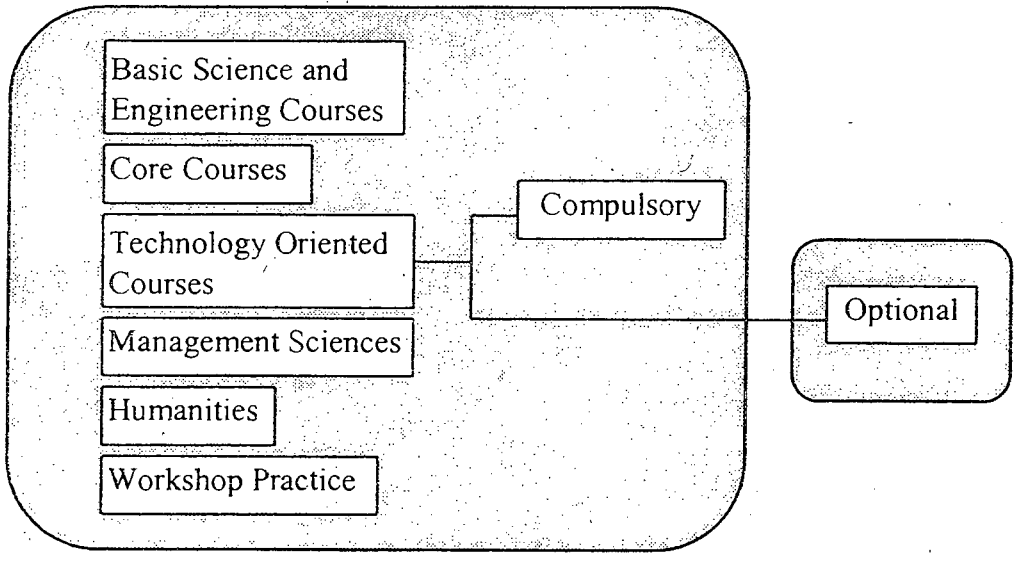
MME 481 Industrial Metallurgy (3.00 Credits)
MME 483 Industrial Pollution Control and Safety (3.00 Credits)

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)

Fig. 2 Distribution of credit hours between common and optional courses for Materials ands Metallurgy majors.



Common for Both Majors
145.25 Credit Hours

Optional for Each Major
17.75 Credit Hours

The present format of the undergraduate degree is changed to accommodate the present need. The new undergraduate degree format will be B.Sc. in Materials and Metallurgical Engineering (MME) in Materials major and B.Sc. in Materials and Metallurgical Engineering (MME) in Metallurgy major. The total time spent on each course combination is equal. Apart from the general basic science, humanities and management subjects, there are core courses

basic science, humanities and management subjects, there are core courses specific to the discipline. In order to obtain a basic knowledge in other discipline, a student of one will study some courses of other discipline as well. So there are some elective materials courses suitably designed for the students studying metallurgy, and vice versa.

Each student takes all six modules, but there is a large amount of choices within module 3. A student who opts to specialise in one branch of the subject will graduate with the appropriate degree. For example, a student intending to graduate in Materials and Metallurgical Engineering in Materials major must take the Materials option in Module 3 and must carry out a materials research project in Level 4. A student who wishes to graduate in Materials and Metallurgical Engineering in Metallurgy major must take the Metallurgy option in Module 3 and take a metallurgical research project in Level 4.

Students registered for Materials and Metallurgical Engineering for both the Materials and Metallurgy disciplines have to complete a total of 160 credits in the four-year undergraduate programme. The summary of credit hours requirements is shown in the following table.

Table 1 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	15.00	4.50	19.50
	Two	15.00	4.50	19.50
	Special		0.00	0.00
Four	One	15.00	4.50	19.50
	Two	15.00	5.25	20.25
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 the tables of the following pages.

LEVEL ONE / TERM ONE

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

LEVEL ONE / TERM TWO

Course Number	Course Name	Credit Hour	Pre-requisite Course(s)
Chem 221	Organic Chemistry	3.00	
Hum 101	English	3.00	
Math 173	Vector Analysis and Matrices	3.00	
ME 141	Engineering Mechanics	3.00	Math 171
Phy 113	Properties of Matter, Electricity and Magnetism and Modern Physics	3.00	
Chem 222	Organic Chemistry Sessional	1.50	
ME 160	Mechanical Engineering Drawing - I	1.50	
MME 138	Introduction to Computing	1.50	
Shop 182	Machine Shop, Sheet Metal and Carpentry	1.50	

LEVEL TWO / TERM ONE

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

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 Transformation	4.00	
MME 235	Heat and Mass Transfer	3.00	Math 271
OPTION-II			
Hum 103	Economics	3.00	
Hum 303	Principles of Accounting	3.00	
Hum 401	Business Law	3.00	
MME 214	Metallography	1.50	
MME 230	Materials and Metallurgical Analysis	1.50	
MME 238	Computer Application to Metallurgy and Materials	1.50	MME 138

LEVEL THREE / TERM ONE

Course Number	Course Name	Credit Hour	Pre-requisite Course(s)
MME 321	Crystal Defects, Deformation and Fracture	3.00	
MME 323	Physical Properties of Materials	3.00	
MME 325	Corrosion and Degradation of Materials	3.00	
MME 341	Refractories and Furnaces	3.00	
OPTION-III			
Mat: MME 361	Ceramic Raw Materials and Processing	3.00	
Met: MME 351	Principles of Ore Dressing and Extractive Metallurgy	3.00	
MME 338	Application of CAD to Materials Processing	0.75	MME 138
MME 340	Communication Techniques	0.75	
MME 342	Refractories and Furnaces Sessional	1.50	
OPTION-IV			
Mat: MME 362	Ceramics Processing Sessional	1.50	
Met: MME 354	Chemical Metallurgy Sessional	1.50	

LEVEL THREE / TERM TWO

Course Number	Course Name	Credit Hour	Pre-requisite Course(s)
MME 343	Surface Engineering of Materials	3.00	
MME 345	Foundry Engineering	4.00	
MME 347	Metal Joining Technology	3.00	
OPTION-V			
Mat: MME 363	Glass Science and Engineering	3.00	
Met: MME 365	Ceramics and Glass Engineering	3.00	
OPTION-VI			
Hum 201	Advanced English	2.00	Hum 101
Hum 211	Sociology	2.00	
Hum 305	Economics of Development and Planning	2.00	Hum 103
MME 344	Surface Engineering of Materials Sessional	0.75	
MME 346	Foundry Engineering Sessional	1.50	
MME 348	Metal Joining Technology Sessional	1.50	
OPTION-VII			
Mat: MME 364	Glass Science and Engineering Sessional	0.75	
Met: MME 366	Ceramics and Glass Engineering Sessional	0.75	

LEVEL THREE / SPECIAL TERM

Course Number	Course Name	Credit Hour	Pre-requisite Course(s)
MME 300	Industrial Training	0.00	

LEVEL FOUR / TERM ONE

Course Number	Course Name	Credit Hour	Pre-requisite Course(s)
IPE 491	Engineering Management	3.00	
MME 411	Principles of Materials Character.	3.00	MME 211, MME 323
MME 443	Physical Metallurgy of Steel and Heat Treatment	3.00	MME 213
OPTION-VIII			
Mat: MME 471	Polymer Science and Engineering	3.00	
Met: MME 475	Polymers and Composites	3.00	
OPTION-IX			
Mat: MME 467	Ceramics for Advanced Applications	3.00	
Met: MME 453	Special Casting Processes	3.00	MME 345
Met: MME 455	Mineralogy and Economic Minerals of Bangladesh	3.00	
MME 400	Thesis	1.50	
MME 440	Materials Processing Plant Design	0.75	
MME 444	Heat Treatment and Microstructure Sessional	1.50	
OPTION-X			
Mat: MME 472	Polymer Science and Engineering Sessional	0.75	
Met: MME 476	Polymers and Composites Sessional	0.75	

LEVEL FOUR / TERM TWO

Course Number	Course Name	Credit Hour	Pre-requisite Course(s)
MME 445	Metallic Alloys and Materials Selection	3.00	MME 443
MME 447	Industrial Metal Working Processes	3.00	ME 243 or MME 233
MME 449	Ferrous Production Metallurgy	4.00	
OPTION-XI			
Mat: MME 473	Composite Materials	2.00	
Met: MME 457	Powder Metallurgy	2.00	
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	
MME 400	Thesis	3.00	
MME 442	Failure of Materials and Artifact Study	1.50	
OPTION-XII			
Mat: MME 474	Composite Materials Sessional	0.75	
Met: MME 458	Metal Forming Sessional	0.75	

6 DETAILS OF COURSES

6.1 Courses Offered to the Departmental Students

MME131 Introduction to Metallurgy and Materials
3.00 Credits

Geological and archeometallurgical 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.

MME138 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.

MME211 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.

MME212 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.

MME213 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 isomorphus and other systems. Equilibrium and nonequilibrium freezing of typical ternary alloys.

MME214 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.

MME222 Materials Testing Sessional
1.50 Credits

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.

MME230 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.

MME231 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.

MME233 Mechanical Behaviour of Materials
3.00 Credits Prereq. Math171

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: Eulers formula and formulae for intermediate column. Curved beam, pressure column etc.

MME235 Heat and Mass Transfer
3.00 Credits Prereq. Math271

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.

MME238 Computer Application to Metallurgy and Materials
1.50 Credits Prereq. MME138

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.

MME241 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.

MME242 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.

MME321 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.

MME323 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.

MME325 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.

MME330 Application of CAD to Materials Processing
0.75 credits Prereq. MME138

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.

MME340 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.

MME341 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.

MME342 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.

MME343 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.

MME344 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.

MME345 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.

MME346 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.

MME347 Metal Joining Technology
3.00 Credits

Types and metallurgy of metal joining: fusion and solid state welding, adhesive bonding. Various welding processes and equipments. 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.

MME348 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.

MME351 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.

MME354 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.

MME361 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.

MME362 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.

MME363 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 fibers, optical glass. Crystallisation, glass ceramics and special glasses. Annealing and toughening of glass. Surface treatment and modification.

MME364 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.

MME365 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 decoarting. 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.

MME366 Ceramics and Glass Engineering Sessional
0.75 Credits

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

MME400 Project and Thesis
4.50 credits

Design and construction of equipments 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.

MME411 Principles of Materials Characterization
3.00 credits Prereq. MME211 and MME323

Principles of spectroscopy: UV-visible, infra-red, atomic emmission 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, ultrasonics, eddy current, magnetic particles and dye penetration. Thermal analysis: DTA, DSC, TGA etc.

MME440 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.

MME442 Failure Analysis and Artifact 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. Artifact study: Dismantling and identification of materials of engineering components.

MME443 Physical Metallurgy of Steels and Heat Treatment
3.00 Credits Prereq. MME213

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.

MME444 Heat Treatment and Microstructure Sessional
1.50 Credits Prereq. MME214

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.

MME445 Metallic Alloys and Materials Selection
3.00 Credits Prereq. MME443

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. Supper 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 machinaries in different industries including ship building, automotive, chemical industries, cement factories, power plants etc.

MME447 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.

MME449 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.

MME453 Special Casting Processes
3 Credits Prereq. MME345

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.

MME455 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.

MME457 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.

MME458 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.

MME467 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.

MME471 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.

MME472 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.

MME473 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.

MME474 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.

MME475 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.

MME476 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.

MME481 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.

MME483 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 Offered to Other Departmental Students

MME195 Engineering Materials - I
3.00 Credits For IPE students

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.

MME291 Metallic Materials
3.00 credits For ME students

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.

MME292 Metallic Materials Sessional
1.50 credits For ME students

Experiments based on MME291.

MME293 Shipbuilding Materials
3.00 credits For NAME students

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.

MME294 Shipbuilding Materials Sessional
0.75 credits For NAME students

Experiments based on MME293.

MME295 Engineering Materials - II
2.00 Credits For IPE students

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.

MME296 Engineering Materials Sessional
1.50 Credits For IPE students

Metallographic sample preparation. Microstudy of ferrous and nonferrous materials. Microstudy of clay-based ceramic materials and semicrystalline polymers. Study of the manufacturing processes of ceramics and glasses. Anisotropic properties of composite materials.

MME391 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.

6.3 Courses for MME Students Offered by Other Departments

Chem107 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.

Chem114 Inorganic Quantitative Analysis
1.50 Credits

Volumetric analysis: acid-base titration, oxidation-reduction titrations, determination of Fe, Cu, and Ca volumetrically.

Chem221 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.

Chem222 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.

EEE155 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.

EEE156 Electrical Engineering Fundamentals Sessional
1.5 Credit

Laboratory experiments based on EEE155.

EEE267 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.

Hum101 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.

HUM103 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.

Hum201 Sociology
3.00 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.

Hum207 Advanced English
2.00 Credit Prereq. Hum 101 or Hum 111

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 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.

Hum305 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.

HUM401 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).

IPE483 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.

IPE491 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.

Math171 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.

Math173 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.

Math271 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.

ME141 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.

ME160 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.

ME221 Elements of Fluid Mechanics and Machinery
3.00 Credit Prereq. Math161, Math163, Math263 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.

ME243 Mechanics of Solids
3.00 credit Prereq. Math161

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.

ME260 Mechanical Engineering Drawing-II
1.50 Credit Prereq. M 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.

Phy103 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.

Phy102 Physics Sessional - I
1.50 Credit

Sessionals based on Phy103.

Phy113 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.

Shop182 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.