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

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Published by:
Department of Materials and Metallurgical Engineering
Bangladesh University of Engineering and Technology (BUET)
Dhaka-1000, Bangladesh
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
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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 airplane 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


Associate Professor


Assistant Professors


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


Lecturers


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

Senior Foundry Instructor

Fazlul Haque Bhuiyan. Diploma in Engineering (Mech.)

Sub-Assistant Engineer

Md. Yusuf Khan. Diploma in Engineering (EEE)

* 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:

<table>
<thead>
<tr>
<th>Classes</th>
<th>14 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recess before Term Final Exam</td>
<td>2 weeks</td>
</tr>
<tr>
<td>Term Final Examination</td>
<td>2 weeks</td>
</tr>
</tbody>
</table>

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 course 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.

**MME 131 Introduction to Metallurgy and Materials**
- Course Title
- Last odd digit designates a theoretical course
- Second digit reserved for departmental use
- An one in first position signifies first level/first year
- Department identification code

**MME 338 Application of CAD to Materials Processing**
- Course Title
- Last even digit designates a laboratory/sessional course
- Second digit reserved for departmental use
- A three in first position signifies third level/third year
- Department identification code
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 registrar'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 theoretical 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:

<table>
<thead>
<tr>
<th>Attendance</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>90% and above</td>
<td>10</td>
</tr>
<tr>
<td>85% to less than 90%</td>
<td>9</td>
</tr>
<tr>
<td>80% to less than 85%</td>
<td>8</td>
</tr>
<tr>
<td>75% to less than 80%</td>
<td>7</td>
</tr>
<tr>
<td>70% to less than 75%</td>
<td>6</td>
</tr>
<tr>
<td>65% to less than 70%</td>
<td>5</td>
</tr>
<tr>
<td>60% to less than 65%</td>
<td>4</td>
</tr>
<tr>
<td>Less than 60%</td>
<td>0</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Numerical Grade</th>
<th>Letter Grade</th>
<th>Grade Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>80% or above</td>
<td>A+ (A plus)</td>
<td>4.00</td>
</tr>
<tr>
<td>75% to less than 80%</td>
<td>A (A regular)</td>
<td>3.75</td>
</tr>
<tr>
<td>70% to less than 75%</td>
<td>A- (A minus)</td>
<td>3.50</td>
</tr>
<tr>
<td>65% to less than 70%</td>
<td>B+ (B plus)</td>
<td>3.25</td>
</tr>
<tr>
<td>60% to less than 65%</td>
<td>B (B regular)</td>
<td>3.00</td>
</tr>
<tr>
<td>55% or less than 60%</td>
<td>B- (B minus)</td>
<td>2.75</td>
</tr>
<tr>
<td>50% to less than 55%</td>
<td>C+ (C plus)</td>
<td>2.50</td>
</tr>
<tr>
<td>45% to less than 50%</td>
<td>C (C regular)</td>
<td>2.25</td>
</tr>
<tr>
<td>40% to less than 45%</td>
<td>D (D regular)</td>
<td>2.00</td>
</tr>
<tr>
<td>Less than 40%</td>
<td>F</td>
<td>0.00</td>
</tr>
<tr>
<td>Continuation</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

(for project and thesis)

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

\[
GPA = \frac{C_1 \times G_1 + C_2 \times G_2 + C_3 \times G_3 + C_4 \times G_4 + C_5 \times G_5}{C_1 + C_2 + C_3 + C_4 + C_5}
\]

4.10.2 A Numerical Example

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

<table>
<thead>
<tr>
<th>Courses</th>
<th>Credits</th>
<th>Grade</th>
<th>Grade Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>MME 203</td>
<td>3.00</td>
<td>A+</td>
<td>4.00</td>
</tr>
<tr>
<td>EEE 205</td>
<td>3.00</td>
<td>B</td>
<td>3.00</td>
</tr>
<tr>
<td>ME 207</td>
<td>3.00</td>
<td>A</td>
<td>3.75</td>
</tr>
<tr>
<td>Math 205</td>
<td>2.00</td>
<td>B+</td>
<td>3.25</td>
</tr>
<tr>
<td>Hum 203</td>
<td>1.00</td>
<td>A-</td>
<td>3.50</td>
</tr>
</tbody>
</table>
Then his GPA for the term will be as follows:

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

### 4.11 Earned Credits

The courses in which a student has obtained 'D' or a higher grade will be counted as credits earned by him/her. Any course in which a student has obtained 'F' grade will not be counted towards his/her earned credits. A student who obtains 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. 1 and 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.**

<table>
<thead>
<tr>
<th>Module 1: Basic Science and Engineering Courses (Minimum 47.50 Credits)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 171 Calculus and Differential Equation (3.00 Credits)</td>
</tr>
<tr>
<td>Math 173 Vector Analysis and Matrices (3.00 Credits)</td>
</tr>
<tr>
<td>Math 271 Numerical Analysis, Statistics &amp; Partial Differential Eqn. (4.00 Credits)</td>
</tr>
<tr>
<td>Chem 107 Inorganic and Physical Chemistry (3.00 Credits)</td>
</tr>
<tr>
<td>Chem 114 Inorganic Quantitative Analysis (1.50 Credits)</td>
</tr>
<tr>
<td>Chem 221 Organic Chemistry (3.00 Credits)</td>
</tr>
<tr>
<td>Chem 222 Organic Chemistry Sessional (1.50 Credits)</td>
</tr>
<tr>
<td>Phy 102 Physics Sessional - I (1.50 Credits)</td>
</tr>
<tr>
<td>Phy 103 Optics, Waves and Oscillation (3.00 Credits)</td>
</tr>
<tr>
<td>Phy 113 Prop. of Matter, Electricity &amp; Mag. &amp; Modern Physics (3.00 Credits)</td>
</tr>
<tr>
<td>EEE 155 Electrical Engineering Fundamentals (3.00 Credits)</td>
</tr>
<tr>
<td>EEE 156 Electrical Engineering Fundamentals Sessional (1.50 Credits)</td>
</tr>
<tr>
<td>EEE 267 Electrical and Electronic Technology (3.00 Credits)</td>
</tr>
<tr>
<td>IPE 491 Engineering Management (3.00 Credits)</td>
</tr>
<tr>
<td>IPE 483 Production Planning and Control (3.00 Credits)</td>
</tr>
<tr>
<td>ME 141 Engineering Mechanics (3.00 Credits)</td>
</tr>
<tr>
<td>ME 160 Mechanical Engineering Drawing - I (1.50 Credits)</td>
</tr>
<tr>
<td>ME 221 Elements of Fluid Mechanics and Machinery (3.00 Credits)</td>
</tr>
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<td>ME 243 Mechanics of Solids (3.00 Credits)</td>
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<th>Module 2: Core Courses (39.00 Credits)</th>
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<td><strong>Sub-module 2.1: Structure (X1X)</strong></td>
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<tr>
<td>MME 211 Crystallography and Structure of Materials (2.00 Credits)</td>
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<td>MME 212 Crystallography and Structure Sessional (0.75 Credits)</td>
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<td>MME 213 Phase Diagrams and Transformation (4.00 Credits)</td>
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<td>MME 214 Metallography (1.50 Credits)</td>
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<th><strong>Sub-module 2.2: Properties (X2X)</strong></th>
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<td>MME 321 Crystal Defects, Deformation and Fracture (3.00 Credits)</td>
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<td>MME 323 Physical Properties of Materials (3.00 Credits)</td>
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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 and Metallurgy majors.

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.

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<th>Level</th>
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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

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<th>Course Number</th>
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<td>Met: MME 476</td>
<td>Polymers and Composites Sessional</td>
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## LEVEL FOUR / TERM TWO

<table>
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<tr>
<th>Course Number</th>
<th>Course Name</th>
<th>Credit Hour</th>
<th>Pre-requisite Course(s)</th>
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<tr>
<td>MME 445</td>
<td>Metallic Alloys and Materials Selection</td>
<td>3.00</td>
<td>MME 443</td>
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<tr>
<td>MME 447</td>
<td>Industrial Metal Working Processes</td>
<td>3.00</td>
<td>ME 243 or MME 233</td>
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<tr>
<td>MME 449</td>
<td>Ferrous Production Metallurgy</td>
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<td>OPTION-XI</td>
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<tr>
<td>Mat: MME 473</td>
<td>Composite Materials</td>
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<tr>
<td>Met: MME 457</td>
<td>Powder Metallurgy</td>
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<td>OPTION-XII</td>
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<tr>
<td>IPE 483</td>
<td>Production Planning and Control</td>
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<td>MME 481</td>
<td>Industrial Metallurgy</td>
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<tr>
<td>MME 483</td>
<td>Industrial Pollution Control and Safety</td>
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<tr>
<td>MME 400</td>
<td>Thesis</td>
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<tr>
<td>MME 442</td>
<td>Failure of Materials and Artifact Study</td>
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<td>OPTION-XII</td>
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<tr>
<td>Mat: MME 474</td>
<td>Composite Materials Sessional</td>
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<tr>
<td>Met: MME 458</td>
<td>Metal Forming Sessional</td>
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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

MME211 Crystallography and Structure of Materials
2.00 Credits

MME212 Crystallography and Structure Sessional
0.75 Credits

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

**MME214 Metallography**
1.50 Credits


**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


**MME231 Materials Thermodynamics**
3.00 Credits

MME233 Mechanical Behaviour of Materials
3.00 Credits  Prereq. Math171


MME235 Heat and Mass Transfer
3.00 Credits  Prereq. Math271


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


MME241 Fuels and Combustion
3.00 Credits


MME242 Fuels and Combustion Sessional
1.50 Credits

MME321 Crystal defects, deformation and fracture
3.00 Credits

MME323 Physical Properties of Materials
3.00 credits

MME325 Corrosion and Degradation of Materials
3.00 credits

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


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

MME344 Surface Engineering of Materials Sessional
0.75 Credits


MME345 Foundry Engineering
4.00 Credits


MME346 Foundry Engineering Sessional
1.50 Credits


MME347 Metal Joining Technology
3.00 Credits


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


MME354 Chemical Metallurgy Sessional
1.5 Credits


MME361 Ceramics: Raw Materials and Processing
3.00 Credits


MME362 Ceramics Processing Sessional
1.50 Credits


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.

**MME364 Glass Science and Engineering Sessional**
0.75 Credits


**MME365 Ceramics and Glass Engineering**
3.00 Credits


**MME366 Ceramics and Glass Engineering Sessional**
0.75 Credits


**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


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


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

**MME445 Metallic Alloys and Materials Selection**

3.00 Credits  
Prereq. MME443


**MME447 Industrial Metal Working Processes**

3.00 Credits


**MME449 Ferrous Production Metallurgy**

4.00 Credits


**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


**MME457 Powder Metallurgy**
2.00 Credits


**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

MME471 Polymer Science and Engineering
3.00 Credits


MME472 Polymer Science and Engineering Sessional
0.75 Credits


MME473 Composite Materials
2.00 Credits


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

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


**MME483 Industrial Pollution, Control and Safety**

3.00 Credits


### 6.2 Courses Offered to Other Departmental Students

**MME195 Engineering Materials - I**

3.00 Credits For IPE students


**MME291 Metallic Materials**  
3.00 credits  For ME students  


**MME292 Metallic Materials Sessional**  
1.50 credits  For ME students  

Experiments based on MME291.

**MME293 Shipbuilding Materials**  
3.00 credits  For NAME students  


**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


MME391 Fundamentals of Metallurgy
3.00 credits For ChE students


6.3 Courses for MME Students Offered by Other Departments

Chem107 Inorganic and Physical Chemistry
3.00 Credits


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


Chem222 Organic Chemistry Sessional
1.50 Credits


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

Hum101 English
3.00 Credit


HUM103 Economics
3.00 Credit


Hum201 Sociology
3.00 Credit


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


Hum 302 Principles of Accounting
3.00 Credit


Hum305 Economics of Development and Planning
2.00 Credit  Prereq. Hum 103 or Hum 113


**HUM401 Business Law**
3.00 Credit


**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...

Math171 Calculus and Differential Equation
3.00 credit


Math173 Vector Analysis and Matrices
3.00 credit


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.


Math271 Numerical Analysis, Statistics and Partial Diff. Equations
4.00 credit

Newton's general interpolation formula. Lagrange's interpolation formula.
Inverse interpolation by Lagrange's formula and by successive approximations.
Numerical differentiation of Newton's forward and backward formulae.
Numerical integration. General quadrature formula for equidistant ordinates.
Trapezoidal rule, Simpson's rule, Waddle rule. Calculation of errors. Relative
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.
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
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


ME243  Mechanics of Solids
3.00 credit  Prereq. Math161


ME260  Mechanical Engineering Drawing-II
1.50 Credit  Prereq. M 160


Phy103  Optics, Waves and Oscillation
3.00 Credit


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


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.