

**UNIVERSITY OF  
RAJSHAHI**



**FACULTY OF ENGINEERING**

**DEPARTMENT OF MECHANICAL  
ENGINEERING**

**Syllabus for  
B.Sc. in Mechanical Engineering  
Session 2014-2015**

**December 2014**

**University of Rajshahi**  
**Faculty of Engineering**  
**Department of Mechanical Engineering**  
**Syllabus for B.Sc. in Mechanical Engineering**  
**Session: 2014-2015**

The courses designed for B.Sc. in Mechanical Engineering consist of 4075 marks of 163 credits distributed over eight semesters in four academic years. Each academic year is divided into two semesters (odd & even) each of duration not less than 11 weeks (66 working days). There shall be final examinations at the end of each semester. The medium of answer in all examinations will be either Bangla or English, but not the mixer of both. The theoretical examination of courses less than or equal to 2 credits shall be of 2 hours duration and courses greater than 2 credits shall be of 3 hours duration. An academic schedule for an academic year shall be announced for general notification before the start of the academic year, on the prior approval of the academic committee.

**1.Attendance** (Ref. The Rajshahi University Academic Ordinance, 2013 for B.Sc. in Engineering Curriculum of the Affiliated Colleges/Institutes, article no: 13): In order to be eligible to appear, as a regular candidate, at the semester final examinations, a student shall be required to have attended at least 70% of the total number of periods of lectures/tutorials/laboratory classes offered during the semester in every course. A student whose attendance falls short of 70% but not below 60% in any course may be allowed to appear at the final Examinations as **non-collegiate** student and **he/she shall not be eligible for the award of any scholarship or stipend** for the following academic year/semester. A student, appearing the examination under the benefit of this provision shall have to pay in addition to the fees, the requisite fee prescribed by the syndicate for the purpose. Students having less than 60% attendance in lectures/tutorials/laboratory classes of any courses will not be allowed to appear in the final examinations of the semester. The basis of awarding marks for class participation and attendance is shown in Table-1.

**Table-1: Distribution of Marks in Attendance**

Attendance	Marks%	Remarks
90% and above	100	Regular
85% to less than 90%	90	
80% to less than 85%	80	
75% to less than 80%	70	
70% to less than 75%	60	
65% to less than 70%	50	Non-collegiate
60% to less than 65%	40	
less than 60%	00	

(Ref. The Rajshahi University Academic Ordinance, 2013 for B.Sc. in Engineering Curriculum of the Affiliated Colleges/Institutes, article no: 13), unit=100 marks.

## 2. The Grading System

The letter grade system shall be used to assess the performance of the students as shown in Table-2 (Ref. The Rajshahi University Academic Ordinance, 2013 for B.Sc. in Engineering Curriculum of the Affiliated Colleges/Institutes, Article no. 14.1):

**Table-2: Letter Grade System**

Numerical grade	Letter Grade (LG)	Grade point (GP) (G <sub>i</sub> )	Credit (C <sub>i</sub> )
80% or above	A+	4.00	4.00
75% to less than 80%	A	3.75	4.00
70% to less than 75%	A-	3.50	4.00
65% to less than 70%	B+	3.25	4.00
60% to less than 65%	B	3.00	4.00
55% to less than 60%	B-	2.75	4.00
50% to less than 55%	C+	2.50	4.00
45% to less than 50%	C	2.25	4.00
40% to less than 45%	D	2.00	4.00
less than 40%	F	0.00	4.00
Incomplete	I	0.00	4.00

A letter grade 'I' ((incomplete)) shall be awarded for courses in the odd semester which continue through to the even semester.

A **Grade Point Average (GPA)** shall be calculated for each semester as follows:

$$GPA = \frac{\sum_{i=1}^n C_i \cdot G_i}{\sum_{i=1}^n C_i} \quad (i)$$

Where, n is the number of courses offered during the semester, C<sub>i</sub> is the number of credits allotted to the i-th course and G<sub>i</sub> is the grade point earned for that course.

**Illustration:** Suppose a student obtained following grade in Part-1 odd semester:

Code No	Subject	Credit	Letter Grade	GP
PHY 1111	Physics-1	4	C	2.25
CHEM 1113	Chemistry-1	4	A+	4.0
MATH1115	Mathematics-1	4	B-	2.75
TE 1111	Introduction to Textile Engineering	6	B+	3.25
CE 1112	Engineering Drawing	2	A+	4.0

$$\text{Therefore, GPA in the Part - 1 odd semester} = \frac{4(2.25) + 4(4) + 4(2.75) + 6(3.25) + 2(4)}{4 + 4 + 4 + 6 + 2} = 2.40$$

And let's assume that his/her GPA in Part-1 even semester is 3.13

A **Yearly Grade Point Average (YGPA)** shall be calculated for each academic year as follows:

$$YGPA = \frac{\sum_{j=1}^2 C_j \cdot G_j}{\sum_{j=1}^n C_j} \quad (ii)$$

$$\text{Therefore, YGPA of Part-1 Examination} = \frac{20(2.40) + 20(3.13)}{20 + 20} = 2.77$$

The **Cumulative Grade Point Average (CGPA)** gives the cumulative performance of students from the first year upto the end of the fourth year to which it refers, and will be calculated as follows:

$$CGPA = \frac{\sum_{k=1}^m C_k G_k}{\sum_{k=1}^m C_k} \quad (iii)$$

where, m is the total number of years being considered,  $C_k$  is the total number of credits registered during the k-th year and  $G_k$  is the YGPA earned in that particular year.

Similarly assume that, the YGPA of the student for the other 3 Parts are as follows:

Year	Credit	YGPA
Part-II	40	3.47
Part-III	40	2.96
Part-IV	40	3.33

Then his/her CGPA of four academic years is

$$\text{Therefore, } CGPA = \frac{40(2.77) + 40(3.47) + 40(2.96) + 40(3.33)}{40 + 40 + 40 + 40} = 3.13$$

(Both YGPA & CGPA will be rounded upto the second place of decimal for reporting. For instance, YGPA= 2.212 shall be rounded up as YGPA=2.22)

### 3. Earned Credit

The courses in which a student has obtained minimum 'D' in 'Theoretical courses' and 'C' in 'Laboratory courses & Board Viva-Voice' or higher grade will be counted as credits earned by the student. Any course in which a student has obtained 'F' grade will not be counted towards his/her earned credit. 'F' grade will not be counted for GPA calculation but will stay permanently on the Grade sheet and Transcripts.

### 4. Marks and Credits distribution for B.Sc. in Mechanical Engineering

The distribution of marks and credits in various Definitions of Disciplines in the ordinance for B.Sc.. Engineering Degree in the Department of Mechanical Engineering are given in Table-3 [Ref. The Rajshahi University Academic Ordinance, 2013 for B.Sc. in Engineering Curriculum of the Affiliated Colleges/Institutes, Article no 6.1]

**Table-3: Marks and Credits distribution in discipline for B.Sc. in Mechanical Engineering**

Course Type		Marks	Marks (%)	Credits
<sup>a</sup> Humanities		175	4.294	7
<sup>b</sup> Basic Sciences (with Lab)		825	20.245	33
Engineering		3075	75.46	123
Distribution	a. Theoretical	3000	73.62	120
	b. Board Viva-Voce	75	1.84	3
	c. Laboratory	1000	24.54	40
<b>Total</b>		<b>4075</b>	<b>100</b>	<b>163</b>

<sup>a</sup>Each department must include course on English.

<sup>b</sup>Each department must include courses on Physics, Chemistry and Mathematics.

**5. Courses offered to the undergraduate students of Mechanical Engineering Department for B.Sc. Engineering degree (Session 2014-2015)**

**Part-1 Odd semester**

Code No.	Name of Subject	Theory		Sessional		Total	
		Credit Hours	Contact Hours	Credit Hours	Contact Hours	Credit Hours	Contact Hours
PHY1131	Physics-I	3	3	0	0	3	3
PHY1132	Physics-I Sessional	0	0	1	2	1	2
CHEM1133	Chemistry-I	3	3	0	0	3	3
CHEM1134	Chemistry -I Sessional	0	0	1	2	1	2
HUM1135	English	2	2	0	0	2	2
MATH1137	Differential Calculus and Geometry	3	3	0	0	3	3
ME1131	Thermodynamics-I	3	3	0	0	3	3
ME1132	Thermodynamics-I Sessional	0	0	1	2	1	2
ME1136	Shop Practice-I	0	0	1	2	1	2
ME1138	Engineering Drawing-I	0	0	2	4	2	4
Total		14	14	6	12	20	26

No. of Theory Course : 05      Total Contact Hours : 26  
 No. of Sessional Course : 05      Total Credits Hours : 20

**Part-1 Even semester**

Code No.	Name of Subject	Theory		Sessional		Total	
		Credit Hours	Contact Hours	Credit Hours	Contact Hours	Credit Hours	Contact Hours
PHY1231	Physics-II	3	3	0	0	3	3
PHY1232	Physics-II Sessional	0	0	1	2	1	2
CHEM1233	Chemistry-II	3	3	0	0	3	3
CHEM1234	Chemistry -II Sessional	0	0	1	2	1	2
HUM1235	Economics	2	2	0	0	2	2
MATH1237	Integral Calculus, Differential Equation and Power Series Method	3	3	0	0	3	3
EEE1231	Electrical Engineering -I	3	3	0	0	3	3
EEE1232	Electrical Engineering -I Sessional	0	0	1	2	1	2
ME1236	Shop Practice-II	0	0	1	2	1	2
ME1238	Engineering Drawing-II	0	0	2	4	2	4
Total		14	14	6	12	20	26

No. of Theory Course : 05      Total Contact Hours : 26  
 No. of Sessional Course : 05      Total Credits Hours : 20

## Part-2 Odd semester

Code No.	Name of Subject	Theory		Sessional		Total	
		Credit Hours	Contact Hours	Credit Hours	Contact Hours	Credit Hours	Contact Hours
HUM2133	Accounts and Industrial Law	3	3	0	0	3	3
MATH2137	Matrices, Vector and Partial Differential Equation	4	4	0	0	4	4
CSE2131	Basic Computer and Programming	3	3	0	0	3	3
CSE2132	Basic Computer and Programming	0	0	1	2	1	2
ME2133	Engineering Mechanics-I	3	3	0	0	3	3
ME2135	Production Processes	3	3	0	0	3	3
ME2136	Production Processes Sessional	0	0	1	2	1	2
ME2138	Engineering Drawing-III	0	0	1	2	1	2
Total		16	16	3	6	19	22

No. of Theory Course : 05      Total Contact Hours : 22

No. of Sessional Course : 03      Total Credits Hours : 19

## Part-2 Even semester

Code No.	Name of Subject	Theory		Sessional		Total	
		Credit Hours	Contact Hours	Credit Hours	Contact Hours	Credit Hours	Contact Hours
MATH 2237	Complex Variable, Harmonic Analysis and Laplace Transformation	3	3	0	0	3	3
EEE2231	Electrical Engineering-II	3	3	0	0	3	3
EEE2232	Electrical Engineering-II Sessional	0	0	1	2	1	2
ME2231	Thermodynamics-II	3	3	0	0	3	3
ME2232	Thermodynamics-II Sessional	0	0	1	2	1	2
ME2233	Engineering Mechanics-II	3	3	0	0	3	3
ME2234	Engineering Mechanics-II Sessional	0	0	1	2	1	2
ME2235	Mechanics of Solids	4	4	0	0	4	4
ME2236	Mechanics of Solids Sessional	0	0	1	2	1	2
Total		16	16	4	8	20	24
ME2200	Board Viva-Voce			1		1	

No. of Theory Course : 05      Total Contact Hours : 24

No. of Sessional Course : 04      Total Credits Hours : 21

### Part-3 Odd semester

Code No.	Name of Subject	Theory		Sessional		Total	
		Credit Hours	Contact Hours	Credit Hours	Contact Hours	Credit Hours	Contact Hours
MATH3137	Numerical Analysis and Statistics	3	3	0	0	3	3
MATH3138	Numerical Analysis and Statistics Sessional	0	0	1	2	1	2
ME3131	Fluid Mechanics-I	3	3	0	0	3	3
ME3132	Fluid Mechanics-I Sessional	0	0	1	2	1	2
ME3133	Quality Control & Materials Handling	3	3	0	0	3	3
ME3134	Quality Control & Materials Handling Sessional	0	0	1	2	1	2
ME3135	Design of Machine Elements-I	3	3	0	0	3	3
ME3136	Design of Machine Elements-I Sessional	0	0	1	2	1	2
ME3137	Heat Transfer	3	3	0	0	3	3
ME3139	Machine Tools	3	3	0	0	3	3
Total		18	18	4	8	22	26

No. of Theory Course : 06      Total Contact Hours : 26  
 No. of Sessional Course : 04      Total Credits Hours : 22

### Part-3 Even semester

Code No.	Name of Subject	Theory		Sessional		Total	
		Credit Hours	Contact Hours	Credit Hours	Contact Hours	Credit Hours	Contact Hours
ME3231	Fluid Mechanics-II	3	3	0	0	3	3
ME3232	Fluid Mechanics-II Sessional	0	0	1	2	1	2
ME3233	Engineering Mechanics-III	3	3	0	0	3	3
ME3234	Engineering Mechanics-III Sessional	0	0	1	2	1	2
ME3235	Design of Machine Elements-II	3	3	0	0	3	3
ME3236	Design of Machine Elements-II Sessional	0	0	1	2	1	2
ME3237	Engineering Metallurgy	3	3	0	0	3	3
ME3238	Engineering Metallurgy Sessional	0	0	1	2	1	2
ME3239	Power Plant Engineering	3	3	0	0	3	3
Total		15	15	4	8	19	23
ME3230	Industrial Training			1	4 weeks	1	4 weeks
ME 3200	Board Viva-Voce			1		1	

No. of Theory Course : 05      Total Contact Hours : 23+ 4 weeks  
 No. of Sessional Course : 05      Total Credits Hours : 21



### Part-4 Odd semester

Code No.	Name of Subject	Theory		Sessional		Total	
		Credit Hours	Contact Hours	Credit Hours	Contact Hours	Credit Hours	Contact Hours
ME4130	Project and Thesis	0	0	3	6	3	6
ME4131	Applied Thermodynamics-I	3	3	0	0	3	3
ME4132	Applied Thermodynamics-I Sessional	0	0	1	2	1	2
ME4133	Advanced Heat and Mass Transfer	3	3	0	0	3	3
ME4134	Advanced Heat and Mass Transfer Sessional	0	0	1	2	1	2
ME 4135	Production Planning and Control	3	3	0	0	3	3
ME 4137	Industrial Management	3	3	0	0	3	3
ME4139(*)	<b>Optional-I</b> (a) Refrigeration and Air Conditioning (b) Computer Aided Design	3	3	0	0	3	3
Total		15	15	5	10	20	25

No. of Theory Course : 05      Total Contact Hours : 25  
 No. of Sessional Course : 03      Total Credits Hours : 20

### Part-4 Even semester

Code No.	Name of Subject	Theory		Sessional		Total	
		Credit Hours	Contact Hours	Credit Hours	Contact Hours	Credit Hours	Contact Hours
ME4230	Project and Thesis	0	0	3	6	3	6
ME4231	Applied Thermodynamics-II	3	3	0	0	3	3
ME4233	Fluid Machinery	3	3	0	0	3	3
ME4234	Fluid Machinery Sessional	0	0	1	2	1	2
ME4235	Instrumentation and control Theory	3	3	0	0	3	3
ME4236	Instrumentation and control Theory Sessional	0	0	1	2	1	2
ME4238	Seminar	0	0	2	4	2	4
ME 4239(*)	<b>Optional-II</b> (a) Automobile Engineering (b) Operations Research	3	3	0	0	3	3
Total		12	12	7	14	19	26
ME4200	Board Viva-Voce			1		1	

No. of Theory Course : 04      Total Contact Hours : 26  
 No. of Sessional Course : 04      Total Credits Hours : 20

**6. Rules for Promotion** (Ref. The Rajshahi University Academic Ordinance, 2013 for B.Sc. in Engineering Curriculum of the Affiliated Colleges/Institutes, Article no. 15):

There shall be final examinations conducted by the Examinations Conducting Committee of the college/institute at the end of each semester. The results shall be finalized at the end of the even semester of the academic year. A student entering in an odd semester shall automatically move on to the next semester, unless she/he was debarred from appearing at the final examinations at the end of the semester. Individual course grades and GPA shall be announced within a date ordinarily not later than three weeks after the end of the semester final examinations.

**6.1 Minimum passing grade:** The minimum passing grade in a theoretical course will be D and the minimum passing grade in a laboratory/project/field work/in-plant training/ workshop/ similar Courses (henceforth referred to as laboratory course) and Viva-voce will be C.

**6.2 Promotion to higher class:** A student who has a grade point average of 2.25 or higher and no F grade in the theoretical courses and not less than C grade in the laboratory courses and viva-voce of the two semesters shall be promoted to the next higher class.

**6.3** There shall be no refereed in laboratory courses and viva-voce. A student failing to secure a minimum C grade in any of the laboratory courses and Viva-voce in any semester will not pass in that year.

**6.4 Course Improvement:**

**6.4.1 Referred (with 'F'):** A student who has a grade point average of 1.7 or higher, with 'F' grade in the theoretical courses, not more than 10 credit points in an academic year shall be awarded Referred up to 10 credits in the courses where less than B grade (including F grade) were obtained and he/she may appear at a supplementary examination in those courses only. In such case the student has to give his/her choice of course/courses for supplementary examination in writing.

**6.4.2 Referred (with no 'F'):** A student having grade point average of less than 2.2 and no 'F' grade in theoretical courses may appear at a supplementary examination in not more than 10 credit points in an academic year, only for courses in which less than B grade was obtained. In such case the student has to give his/her choice of course/courses for supplementary examination in writing.

**6.4.3 Promotion of Referred student to higher Class:** In order to be promoted to the next higher class, a student must obtain a grade point average of 2.2 with no less than D grade in any of the courses in which he/she appeared in supplementary examination.

**6.4.4** Grades obtained by a student in the courses in which s/he appeared at the supplementary examination will be recorded for assessment and the grade obtained by him/her in those courses at the regular final examination shall automatically be treated cancelled.

**6.4.5** Clause 6.4.4 is not valid for a candidate, who cannot improve his/her course grade at the supplementary examination, in that case the previous grade shall remain valid.

**6.4.6 Improvement of YGPA:** A candidate obtaining an YGPA of less than 2.75 at the end of the academic year shall be allowed to sit for supplementary examination up to a maximum of 8 credit points of (courses in where less than 'B' grade was obtained) theoretical courses in the academic year. No improvement shall be allowed for laboratory examination and Board Viva-voce. If a candidate fails to improve YGPA with the block of new GP in total, the previous YGPA shall remain valid.

**6.4.7 All Referred examinations** shall ordinarily be held during the inter-session break. This break may also be utilized for industrial attachment training or survey practical, etc.

**6.5 Course Exemption:** students who fail to be promoted to the next higher class shall be exempted from taking the theoretical and laboratory courses where they obtained grades equal to or better than B. These grades would be counted in calculating GPA in the next year's examination results.

- 6.6 **Merit Position:** The YGPA obtained by a student in the semester final examinations will be considered for determining the merit position for the award of scholarships, stipends etc.

## 7. Publication of Results:

- 7.1 A student must successfully complete the courses of all the semesters within a maximum of seven academic years as outlined by the Committee of Courses with all its pre-requisites in order to be eligible for the award of B.Sc. Engineering degree. The student must earn 160 credits (no 'F' grade) and CGPA 2.25 or higher.
- 7.2 **Merit position:** Merit position of a student for each academic year of each degree) awarding department shall be determined on the basis of his/her YGPA of that particular year. Merit position for the award of the degree of B.Sc. Engineering will be based on CGPA of all the academic years.
- 7.3 **Honours:** Candidates for Bachelor's degree in engineering will be awarded the degree with Honours if their CGPA is 3.75 or higher.
- 7.4 **Result Improvement:** A candidate obtaining a CGPA of less than 2.75 at the end of Part-IV even semester examinations, within 4 or 5 academic years shall be allowed to improve his/her result, of upto a maximum 4 units (courses less than B grade) of the Part-IV, maximum 2 units from any one semester of the year, theoretical courses in the immediate next regular examination after publication of his/her result. No improvement shall be allowed for laboratory examinations and Board Viva-voce. If a candidate fails to improve CGPA with the block of new GP in total, the previous result shall remain valid.
- 7.5 **Dean's List:** As a recognition of excellent performance, the names of students obtaining a cumulative GPA of 3.75 or above in two regular semesters in each academic year may be published in the Dean's List in the faculty. Students who have received an 'F' grade in any course during any of the two regular semesters will not be considered for Dean's List in that year.
- 7.6 **Industrial and Professional Training Requirements:** Depending on each department's own requirements, a student may have to complete a prescribed number of days of industrial/professional training in addition to minimum credits and other requirements, to the satisfaction of the concerned department.
- 7.7 **Recording of Results:** The overall results of a successful student covering all semesters' examinations of four years shall be declared on the basis of CGPA with the corresponding Letter Grade (LG). The transcripts in English will show the course designation, course title, credit, grade and grade point of individual courses. YGPA of each year, CGPA and corresponding LG for the overall result.

## 8. Eligibility for Examination:

- 8.1 A candidate may not be admitted to any semester final examinations unless he/she has
- 8.1.1 Submitted to the registrar/ Vice-Chancellor an application in the prescribed form for appearing at the examination.
  - 8.1.2 Paid the prescribed examination fees, and all outstanding college/institute dues.
  - 8.1.3 Fulfilled the conditions for attendance in class and
  - 8.1.4 Been barred by any disciplinary rule.
- 8.2 On special circumstances the Vice- Chancellor may permit a student to appear at the examination.
- 8.3 A student whose attendance falls short of 70% but not below 60% in any course as mentioned above may be allowed to appear at the final examinations as a non-collegiate student

## Details of course outline of each subject for Bachelor of Science in Mechanical Engineering

### Part-1 Odd Semester

#### PHY1131 Physics-I

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Physical Optics:** Theories of light, Huygens's principle and construction, superposition of light waves.

**Interference:** Introduction, Condition of Interference, Young's double slit experiment, Interference due to multiple reflections, Newton's rings.

**Diffraction:** Introduction, Fresnel and Fraunhofer diffraction, diffraction by single slit and double slit diffraction gratings,

**Polarization:** Introduction, Polarization by double refraction. Nicole Prism and Polarimeters, Production and analysis of polarized light, Optical activity, optics of crystals

**Geometrical Optics:** Reflection and Refraction of spherical surfaces, Lenses, Combination of Lenses, Equivalent Lens and equivalent focal length. Defects of images formed by lenses, Monochromatic and Chromatic aberrations, Spherical aberrations, Astigmatism, Coma, Distortion and curvature of images, achromatism and achromatic combination of lenses.

**Oscillations :** Simple Harmonic Motion, Combination of Simple Harmonic Motion and Lissajous figures, Vibrating systems, Undamped and Damped Oscillations. Forced Oscillations, Resonance.

**Waves:** Transverse waves, Longitudinal Waves, Wave motion, Superposition of waves, Reflection of waves, progressive and stationary waves.

**Sound Waves:** Sources of sound, Transmitting medium, Speed of sound, Beats, the Doppler effect, Sonic Booms, Audible Ultrasonic, Infrasonic and Supersonic Waves.

**Acoustics:** Introduction, Related terms in acoustics, loudness and intensity Reverberation echo, Noise reduction, Sound absorption, Sound distribution.

#### PHY1132 Physics-I Sessional

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

**Sessional** based on the theory of course PHY1131

#### CHEM1133 Chemistry-I

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Concept of Atomic Structure:** Quantum numbers, electronic configuration, and periodic table. Properties and uses of noble gases. Molecular structure of compounds. Selective organic reactions.

**Solution:** Types of solutions and their compositions. Phase rule. phase diagram of mono-component system. Properties of dilute solutions.

**Thermo-Chemistry:** Laws of thermo-chemistry: Heat of reaction. heat of solution, heat of combustion, heat of formation and heat of neutralization; Experimental determination of thermal changes during chemical reactions.

**Kinetics & Chemical Equilibrium :** Chemical kinetics., chemical equilibrium.

**Colloids:** Classification of colloids, methods of preparation and purification of colloidal solutions; properties of colloids; associated colloids; gels; emulsions; applications of colloids.

**Electrochemistry :** Electrolysis; Theories of electrolytic dissociation, conductivity and mobility of ions; Transport number, ionic equilibrium: Ostwald's dilution law; law; elementary idea about intrinsic attraction theory of Debye and Huckel; Activity and activity coefficients, Ionization of water and PH concept. Electric Properties of solution.

#### CHEM1134 Chemistry-I Sessional

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

**Sessional** based on the theory of course CHEM1133

## **HUM1135 English**

**Theory: Credit Hours- 2**

**Contact Hours/week 2 + 0**

English phonetics: the places and manners of articulation of the English sounds. Vocabulary. English grammar Construction of sentences, some grammatical problems. Comprehension. Composition on current affairs. Amplification, precis writing, Phrases and idioms. Commercial correspondence and tenders. Technical report writing, Lessons in spoken English, Drafting notes. - Short stories written by some well-known classic writers.

## **MATH1137 Differential Calculus and Geometry**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Differential Calculus:** Limit, Continuity, Differentiation and Successive Differentiation on various types of function, Leibnitz's theorem, Expansion of functions; Rolle's theorem, Mean value theorem, Taylor's theorem, Partial differentiation, Determination of maximum and minimum values of functions, point of inflection, its applications. Indeterminate form; L'Hospital rule, Curvature, Curve tracing.

**Geometry :**

**Two-dimensional Coordinate Geometry :** Change of axis pair of straight lines, general equation of second degree; circle, parabola, ellipse, pole, tangent, normal, subnormal.

**Three-dimensional Coordinate Geometry :** System of coordinate, distance between two points, section formula, projection, direction cosines, equation of planes and lines.

## **ME1131 Thermodynamics-I**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Energy:** Concepts & fundamentals, Forms and sources of energy- conventional & renewable energy; energy conservation & environmental pollution.

**Fundamental concepts of Thermodynamics:** Basic concepts and definitions; Thermodynamic system, property and state, cycles, Thermodynamic processes, Thermal equilibrium and Zeroth law.

**First Law of Thermodynamics:** Corollaries, internal energy and Enthalpy.

**Pure Substance:** Properties of water and Steam, Control volume energy analysis; conservation of mass and energy.

**Mixtures of Gases & Vapors:** Psychometrics; Real gases.

**Study of Steam Generating Units:** Introduction, accessories and mountings; performance study of steam generator, steam engines.

## **ME1132 Thermodynamics-I Sessional**

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

Sessional based on the theory of course ME1131

## **ME1136 Shop Practice-I**

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

## **ME1138 Engineering Drawing-I**

**Sessional: Credit Hours - 2**

**Contact Hours/week 0 +4**

## **B.Sc. in Mechanical Engineering Part-1 Even Semester**

### **PHY1231 Physics-II**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Atomic Physics:** Atomic structure, atom model, Nature of Electron, orbit, orbital Energy, Origin of Spectral lines. Photo electric emission and Einstein's photoelectric equation, Compton effect, De-Broglie's waves.

**Nuclear Physics :** Introduction, Binding energy, Isotope, Isobar, Isotones, Fission and Fusion Process, Chain reaction, Nuclear Reactors.

**Radioactivity:** Radioactive decay, Half-life, and Mean life Law of disintegration, successive disintegration.

**Electricity and Magnetism:** Electric charge, Coulomb's law, The electric Field, Calculation of 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, dielectric and atomic view, dielectric and Gauss's law, current and resistance, current and current density; an atomic view, Ampere's law, Faraday's law, self inductance and mutual inductance, Magnetic properties of matter, magneto motive force, magnetic field intensity, permeability, susceptibility classifications of magnetic materials, magnetization curves magnetostriction.

**Structure of Matter:** Structure of matter, Different types of bonds in solids, metallic, Vander-Walls, Covalent and ionic bond, packing in solids, inter atomic distances and forces of equilibrium, x-ray diffraction, Bragg's law, distinction between insulator, semiconductor and conductor.

### **PHY1232 Physics-II Sessional**

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

**Sessional** based on the theory of course **PHY1231**

### **CHEM1233 Chemistry-II**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Corrosion:** Introduction to Corrosion, Corrosion Protection, Cost & importance of corrosion; Electrochemical & thermodynamic principles of corrosion; Different types of corrosion; Methods of corrosion prevention; Prevention by design improvement, change of metal, inhibitors, cathodic protection, anodic protection, paint, varnish & metallic coatings.

**Pollution:** Source of environmental pollution; harmful effect of pollution; Measuring pollution; control of pollution.

**Non-metallic Engineering Materials:** Raw materials & production technology of cement, porcelain, glass ceramic, fertilizer, synthetic & natural rubber; Refining of crude oil; plastic & synthetic fibers, lubricants.

### **CHEM1234 Chemistry-II Sessional**

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

**Sessional** based on the theory of course **CHEM1233**

### **HUM1235 Economics**

**Theory: Credit Hours- 2**

**Contact Hours/week 2 + 0**

**Fundamental Concepts of Economics:** Definition of economics. Economics and Engineering; Microeconomics and macroeconomics; economic theories; Demand, Supply and elasticity; Price system; market & equilibrium.

**Unemployment & its Measurement:** Inflation; concept of inflation, causes, consequences & remedies. Price index number & consumer price index: laws of returns, Economies & Diseconomies; Production; Production function.

**Gross National Product (GNP) & National Income:** Concepts, measurements and importance of national income in the modern economics.

**Economic Growth & Development:** Definition, Relationship between growth & development, Economic planning; Development problems in Bangladesh; The role of the state in economic activity, market and government failures; Economic policy of Bangladesh. A review of Five Year Plans in Bangladesh.

**International Trade:** Size & scope of trade; Terms in trade; Free trade & trade protection; Tariffs & Quotas; Trade adjustment; Review of Export Import-trade policy of Government of Bangladesh.

## **MATH 1237 Integral Calculus, Differential Equation and Power Series Method**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Integral Calculus:** Review of elementary technique( Integration by the method of substitution, Integration by parts, Successive reduction, Standard integrals) Improper integrals; Beta, Gamma and Error Function, Differential inside integral, Applications, Area, Length of curves, volume.

**Differential Equation:** Basic concept and ideas of differential equation, solution of first order differential equations by various methods, solution of general linear equations of second and higher order with constant coefficient, applications.

**Power Series Method:** Bessel's equation, Bessel function, Legendre's equation, and Legendre polynomial, Application of Bessel function especially in heat transfer & mechanics.

## **EEE1231 Electrical Engineering -I**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Fundamental Concepts and Units, Electrical Networks:** Network laws and theorems, methods of analysis. Electrical field concepts: Capacitance. Transient and steady state analyses of electrical networks for different forcing functions, Introduction to magnetic circuits.

**Alternating Current:** Effective and average values of alternating waveforms. Phasors and complex-impedance, Steady state analysis of AC networks. Balanced Poly phase systems.

**Introduction to Measurement of Electrical Quantities:** Voltage, current and power.

## **EEE1232 Electrical Engineering -I Sessional**

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

**Sessional** based on the theory of course **EEE 1231**

## **ME1236 Shop Practice-II**

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

## **ME1238 Engineering Drawing –II**

**Sessional: Credit Hours - 2**

**Contact Hours/week 0 +4**

## **B.Sc. in Mechanical Engineering Part-2 Odd Semester**

### **HUM2133 Accounts and Industrial Law**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Accounts: Definition of Book keeping:** Its objects and advantages; Principle of double entry. Nature of transaction; Classification of accounts: Capital transaction and Revenue transaction. Rules for debit and credit. Journal, Cash book with bank column. Trial balance, Ledger, Final Account, Trading and manufacturing Account. Profit and loss A/C. Balance sheet.

**Cost Accounts:** Definition, objects, Method of ascertaining cost, element of cost, overhead charges and distribution of overhead. Cost control. Operating costing.

**Industrial Law :** Industrial law in Bangladesh: Various ordinance payment of wages, legislation relating employment in industries, Factories, shops and agriculture.

Principle of law of contract, agency, partnership, sales of goods.

**Trade Union Act:** Workmen's compensation Act, Arbitration and conciliation. The industrial courts; the policy of the state in relation to labor, ILO and other industrial body affecting welfare. The Law of social insurance.

## MATH 2137 Matrices, Vector and Partial Differential Equation

**Theory: Credit Hours- 4**

**Contact Hours/week 4 + 0**

**Matrices:** Vector space; subspace, Linearly dependent and independent vectors, linear combination, basis, span, matrix algebra; Rank of matrices, Elementary transformation, Eigen-systems, Solution of linear algebraic and differential equations by matrix method; Diagonalization and orthogonalized transformation, Quadratic form, positive, semi-positive, negative and semi-negative matrices.

**Vector Analysis:** Vector geometry; Addition and multiplication of vectors.

**Vector Calculus:** Differentiation and Integration of vectors with respect to a parameter, Line integration surface integration and volume integration; Gradient, divergence and curl of a vector, and its physical significance; Conservative systems; Green's theorem, Gauss's divergence theorem and Stokes, theorem and their applications in some physical problems.

**Partial Differential Equations:** Introduction, First order linear and nonlinear equations; Standard forms; Solutions of Heat and wave equations (One-dimensional).

## CSE2131 Basic Computer and Programming

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**History and Development of Computer:**

**Introduction to Digital Computer:** Main parts like I/O devices, Memory unit and CPU.

Primary and secondary storage devices, different memory types

Introduction to Number System.

Languages: Assembly level language and Machine level language, High level language Compiler, Interpreter, Source and Object programs.

**Application and System Software:** Overview of DOS, Windows and UNIX operating systems, Essential general purpose packages for word processing spreadsheet analysis etc.

**Concept of Algorithms:** Development of Flowcharts to solve engineering problems.

**Introduction to C Language:** Preliminaries, Program construction and data types, I/O statements, Expressions, Decision making, Loops, Function and its calling procedure, Recursion, Arrays and pointer, structure, Application of computer programming for solving engineering problems.

## CSE2132 Basic Computer and Programming Sessional

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

Sessional based on the theory of course CSE 2131

## ME2133 Engineering Mechanics-I

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Statics:** State of equilibrium; conditions of equilibrium in space; Equilibrium in space for concurrent, non-concurrent and parallel force systems; couple; Transmissibility of forces and force couple system; wrench; coulomb friction; sliding friction; pivot friction; Belt friction; journal friction; rolling friction; method of virtual work and applications; Equilibrium positions of composite bodies. Analysis of forces in trusses and frames.

**Distributed Forces:** Centroids of lines, areas and volumes; Moments of inertia of area and mass; Radius of gyration; Product of inertia: Parallel axis theorem and angular shift of axis and transfer formulae; Principal axis and principal moments of inertia; Ellipsoid of inertia.

## ME2135 Production Processes

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Casting:** Patterns & allowance; Molding tools & operation. Sand molds casting. Other casting processes; Shell mold, plaster mold, lost wax casting, centrifugal casting, permanent mold casting, Die casting, continuous casting. Casting sensing, casting defects & remedies.

**Chip-less Metal Forming Process:** Different types of hot & cold working process; rolling, cold drawing, deep drawing, forging, extrusion, stamping, shearing, bending & press works. Different forming processes of non-metals: plastics, ceramics & non-metallic composite materials.



**Tool Geometry :** Cutting force analysis; force & power estimation, relations among speed, feed, depth of cut and power input; Metal cutting dynamometers; Tool wear, tool life & machinability; Economics of metal cutting.

**Chip Formation Process:** Types of chips; breakers; Tool materials; friction between tool & chip; Cutting fluid & its action; surface finish.

**Metal Removing Process:** Introduction to turning, drilling shaping planning, milling, broaching, grinding, precision and non-precision finishing processes.

**Welding:** Arc, Gas, TIG, MIG, resistance, Thermit & other special types. Electrodes & their uses; Causes & remedies of common welding troubles; Brazing & soldering processes; welding symbols.

### **ME2136 Production Processes Sessional**

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

Sessional based on the theory of course ME2135

### **ME2138 Engineering Drawing-III**

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

## **B.Sc. in Mechanical Engineering Part-2 Even Semester**

### **MATH2237 Complex Variable, Harmonic Analysis and Laplace Transformation**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Complex Variable:** Analytic function singularity; Line integration, Cauchy's theorem; Cauchy's integral formula; power series; Taylor and Laurent series, Zeros and poles. Residue theorem and contour integration; Conformal mapping; Simple applications to fluid dynamics.

**Harmonic Analysis:** Periodic functions; sine and cosine series; Fourier transformations and Fourier integral, its application to boundary value problems. Harmonic functions. Laplace equations, spherical harmonic, surface zonal harmonic; gravitational potential due to spherical shell and sphere.

**Laplace Transformation:** Laplace transformation to algebraic and trigonometric functions, Inverse Laplace transformation, Applications to linear differential equations (both ordinary and partial)

### **EEE2231 Electrical Engineering-II**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Basic Principles of Electromagnetic Energy Conversion Systems:**

Transformers: Single phase and Three phases. open and short-circuit tests.

**Electrical Machines:** DC-machines: DC generator and motors, speed control and applications of DC motors. AC- machines; Synchronous and asynchronous machines; speed control and applications, Starting of motors.

**Introduction to Semiconductor Devices:** Diode, transistors, FET, Amplifiers and their applications.

**Thyristor:** Its application for controlling speed of electrical machines.

Oscilloscopes, Transducers: Temperature, pressure and speed transducers.

### **EEE2232 Electrical Engineering-II Sessional**

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

Sessional based on the theory of course EEE2231

### ME2231 Thermodynamics-II

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

General Thermodynamic Relationships: Vapor pressure; The Clausius Clapeyron equation; equation of state. Thermodynamic cycles., refrigeration cycle & heat pump.

Second Law of Thermodynamics: Corollaries- reversibility, irreversibility, and entropy.

**Heat Engine:** Introduction to diesel and gasoline engines; operation; performance tests; two and four stroke engines; valve timing diagrams; PV and TS diagrams for two and four stroke gasoline and diesel engines.

**Fuels:** Introduction to solid, liquid and gaseous fuels, conventional and alternate fuels, fuel compositions, fuel properties, elemental analysis of fuel.

Introduction to Combustion Phenomena: Stoichiometry, combustion processes, combustion chemistry, and determination of products of combustion.

### ME2232 Thermodynamics-II Sessional

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

Sessional based on the theory of course ME2231

### ME2233 Engineering Mechanics-II

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Kinematics of Particles:** Rectilinear and curvilinear motion of particles; Motion of several particles; Components of velocity and acceleration; Motion relative to frame in translation; Tangential, normal, radial and transverse components.

**Kinematics of Rigid Bodies:** Translation; Rotation; General plane motion; Motion about a fixed point and general motion; Absolute velocity and acceleration. Relative velocity and acceleration; Coriolis acceleration; Mechanism-Velocity and acceleration analysis; Angular acceleration due to precession; Gyroscopic motion and couple-principles and applications.

**Kinetics of Particles:** Newton's second law of motion; linear and angular momentum; Radial and transverse component of motion; motion under a central force; two-body problem; Satellite motion; Equation of orbit; Cycle time; Orbit change.

**Kinetics of Rigid Bodies:** Plane motion of rigid bodies; Angular momentum and D'Alembert's principle; Inertial force and inertia torque; Center of percussion; Combined rolling and sliding.

**Work, Energy and power:** Work and kinetic energy; conservative force systems; Work done by a conservative force; potential energy; Work due to friction force in sliding and rolling.

**Impulse and Momentum:** Principle of conservation of momentum; direct and oblique impact; angular impulse and angular momentum; Impulse and momentum of rigid bodies.

### ME2234 Engineering Mechanics-II Sessional

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

Sessional based on the theory of course ME2233

### ME2235 Mechanics Solids

**Theory: Credit Hours- 4**

**Contact Hours/week 4 + 0**

**Introduction:** Concept of stress and strain, Displacements and deformations, mechanical properties of solid materials, Isotropic, linear, elastic, viscoelastic & plastic materials.

**Simple Stress & Strain:** Various types of stresses viz., tensile, compressive, shearing bearing & thermal stresses, thin-walled pressure vessels, stress-strain diagram. Hook's law, Poisson's ratio, Biaxial & triaxial deformations, statically indeterminate members.

**Torsion:** Assumption & derivation of Torsion formulas, torsion of hollow thin walled shaft, shear flow, helical spring.

**Statically Determinate Beam:** Beam, beam support, types of loading, shearing force & bending moment their diagrams, relations among load, shear & moment.

**Stresses in Beam:** Sign conventions Derivation of flexure formula, economic section, Unsymmetrical beam, reinforced concrete beams.

**Beam Deflection:** Theories of area moment method, double integration & superposition method, moment diagram by parts, deflection of cantilever & simply supported beam, mid-span deflection.

**Statically Indeterminate Beam:** Introduction to strain-energy method, Castiglianos theorem & its application.

**Combined Loading & theories of Elastic Failure:** Introduction, combined axial and flexural loads, Eccentrically loaded member in tension or compression, core or kern of a section, variation of stress with inclination of element, analytical derivation, Mohr's circle to combined loading, transformation of strain components, Relation between modulus of rigidity and modulus of elasticity, Theories of elastic failure, Equations of equilibrium in terms of stress components.

**Column Theory:** Introduction, critical load, Euler's column formula, various types of column, Empirical formulas, Eccentrically loaded column.

### **ME2236 Mechanics Solids Sessional**

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

**Sessional** based on the theory of course ME 2235

### **ME2200 Board Viva-Voce**

**Credit Hours - 1**

## **B.Sc. in Mechanical Engineering Part-3 Odd Semester**

### **MATH3137 Numerical Analysis and Statistics**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Numerical Analysis:** Solution of Algebraic and transcendental equations; Bisection method, Regula falsi method, Initial approximation and convergence criteria of Iteration method, Newton- Raphson method. Solution of simultaneous linear algebraic equations; Gauss Eliminations method, gauss- Jordan method, Jacobi method, Gauss Seidel method. Finite differences, Interpolation with equal and unequal intervals, Central difference interpolation formulae, Numerical solution of differentiation and Integration.

**Numerical Solution of Ordinary Differential Equations:** Taylor's series method, Euler's method, Runge-Kutta method, Finite difference method, and numerical solution of partial differential equations.

**Statistics:** Frequency distribution, Mean, Median, Mode and other measures of Central tendency; standard deviation and other measures of dispersion, moment, skewness and kurtosis. Elementary probability and discontinuous probability distribution e. g. Binomial and Poisson distribution; Normal distribution, Correlation and regression analysis, Curve fitting.

### **MATH3138 Numerical Analysis and Statistics Sessional**

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

**Sessional** based on the theory of course MATH3137

### **ME3131 Fluid Mechanics-I**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Fundamental Concept:** Concept of fluid as a continuum, Fluid classification and properties

**Basic Hydrostatic Equation:** pressure variation in static incompressible fluids; manometers; forces on plane and curved surfaces; Buoyant force; stability of floating and submerged bodies, compressible fluid.

**Velocity Field:** stream line, streak line and stream tube; steady and unsteady flow; relation between system approach and control volume approach; continuity, momentum and energy equation; special forms of energy and momentum equations and their applications; velocity and flow measurement devices.

**Dimensional Analysis:** Its application in various flow problems.

**Irrotational Flows:** Stream function; circulation; vorticity; velocity potentials; continuity equation and divergence of velocity field; Stokes theorem; Kutta Joukowski conditions; Magnus effect

### **ME3132 Fluid Mechanics-I Sessional**

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

**Sessional** experiments based on ME3131

### **ME3133 Quality Control and Materials Handling**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Quality Control:** Introduction to Statistical analysis of quality control, Sampling theory, Estimation, Rectifying inspection plan, control charts. X-R & C charts, Regression analysis, Concept of quality circle, TQM, TEC & ISO Standardization.

**Materials Handling:** Classification of conveying equipment, operator, principles of belt, chain, apron, flight, screw, pneumatic and hydraulic conveyors.

**Packaging:** Packaging materials, load testing procedure of packages.

### **ME3134 Quality Control and Materials Handling Sessional**

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

**Sessional** experiments based on ME3133

### **ME3135 Design of Machine Elements-I**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Engineering Design:** Mechanical Engg. Design, Design process, morphology of design-need analysis, feasibility study, design productions etc.

**Detail Design:** Material specification, Material & their properties, variation in performance, factor of safety, standard specification and design equations.

**Design practices:** Stress analysis, design of simple machine elements, variable load & stress concentration, shock and impact, combined stresses, pressure vessels, shaft design, column design, design of screw fastening, rivet joints, welded joints, springs.

### **ME3136 Design of Machine Elements-I Sessional**

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

**Sessional** experiments based on ME3135

### **ME3137 Heat Transfer**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Introduction:** Basic modes of heat transfer, thermal properties of materials.

**Conduction:** General conduction equation for one, two and three dimensional steady state situation, steady state conduction in different geometry and composite structures for one dimensional situation, electrical analogy, heat transfer from extended surfaces, transient heat conduction in one dimension, multidimensional transient heat conduction by superposition in one dimension, multidimensional transient heat conduction by superposition methods, analytical & numerical solutions or methods.

**Radiation:** Radiation fundamentals—properties and laws, electromagnetic wave spectrum and thermal radiation, intensity of radiation, radiation exchange between surfaces, shape factor – analysis, radiation exchange in enclosures, gas radiation, solar radiation & its prospects in Bangladesh, radiation shield.

### ME3139 Machine Tools

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Locating and Clamping:** Purpose of work-piece location; Degree of freedom; Proper placement of locating points; Fundamental locating arrangements; Clamping devices and forces.

**Tooling:** Types of tools; Machine tools; Cutting tools; Fixtures; Jigs; Examples of drill jigs; Open and closed jigs; Index Jigs; Fixtures for turning, Milling, Grinding and other operations, General tool design principles and their applications.

**Dies:** Progressive & Compound dies; Blank developments; Design of cutting forming and drawing dies; Punch design.

**Detailed Study of the Following:** Engine lathe; Turret late; Turret lathe; Automatic lathe; Milling m/c; Shaping m/c, Planning m/c Drilling m/c; Boring mills, Hobbing m/c; Grinding m/c; Broaching, Lapping & Honing m/c with their operations.

**Study of Bearings:** Ball, roller, taper and needle bearings; Hydrostatic and hydrodynamic bearings; Axial and radial bearings; Methods of bearing manufacture.

**Design of Bed, Tables and Columns:** Types of bed; design feature, stiffness and natural frequency of machine bed, determination of force, types of vibration in machine tools; minimization of vibration.

### B.Sc. in Mechanical Engineering Part-3 Even Semester

#### ME3231 Fluid Mechanics-II

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Viscous Flows:** Viscous flow between parallel flat plates; velocity distribution for fixed of moving Horizontal and inclined plates; Hagen- Poiseuille equation; Frictional losses in pipes and fittings; wall shear and shear velocity; Mixing length theory and universal velocity profile; Laminar and turbulent flows. Criteria for smooth and rough pipes. Prandtl's one-seventh power law.

**Introduction to Boundary Layer Theory:** Estimation of boundary layer and momentum thickness; Skin friction and drag of a flat plate.

**Introduction to Open Channel Flow:** Best hydraulic channel cross- sections; Hydraulic jump: specific energy: Froude No and its significance in channel flow; critical depth.

**Fundamental Relations of Compressible Flow:** Speed of sound wave, Stagnation states for the flow of an ideal gas; Flow through converging diverging nozzles; Normal shock waves; Flight of bodies through a compressible fluid.

#### ME3232 Fluid Mechanics-II Sessional

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

**Sessional** based on the theory of course ME3231

#### ME3233 Engineering Mechanics-III

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Mechanics of Machinery:** Inertia and kinetic energy of rotating and reciprocating parts. Turning moment diagram; Fluctuating energy and speed; Flywheel; Dynamometer; Balancing of stationary, rotating and reciprocating parts. Balancing of in- line and V-engine, Firing order, Principle of direct and reverse cranks in balancing problems. Balancing machines; Law of gearing and toothed gearing; Types of gear and gear trains; Types of governor; Stability of governors and controlling force curve of governor; Cam and follower.

**Vibration:** Free, forced and damped vibration of systems having one degree of freedom, Beat, Resonance and transient phenomenon in forced vibration, Torsional oscillation of shafts, Whirling of shaft, Transverse vibration of shafts, pendulum treated by energy method, Simple situations of vibration with two degree of freedom having elastic constraints, Torsional oscillation of sh..ft with multi rotors, vibration isolation and control, Vibration measuring instruments, Elastic suspension of machinery for isolation of vibration.

### **ME3234 Engineering Mechanics-III Sessional**

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

**Sessional** based on the theory of course **ME3233**

### **ME3235 Design of Machine Elements-II**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Design practice:** Design of keys and coupling, Design of belts, rope and chain drives, Design of journal and rolling contact bearing, Design of spur, helical, bevel and worm gearing, Brakes and clutches, Design with composite materials.

### **ME3236 Design of Machine Elements-II Sessional**

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

**Sessional** based on the theory of course **ME3235**

### **ME3237 Engineering Metallurgy**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Introduction to Materials:** Basic concept of important mechanical properties of materials-elasticity, plasticity strength, ductility, brittleness, malleability, hardness, toughness, stiffness, creep, endurance, fatigue, resilience, Metal & alloys: single phase metals and multi-phase materials.

**Thermometry & Pyrometer:** High temperature measurement and control.

**Concepts of Crystal Geometry:** Types of lattices, solidification metal & alloys, variables affecting solidification, Nucleation, Grain growth crystal structures and their defects. Deformations and dislocation theories.

**Equilibrium Diagrams for Binary Alloy:** Interpretation of equilibrium diagram, structure and properties of metals and alloys related to equilibrium, Iron-iron carbide equilibrium diagram, plain carbon steels and their microstructures, various types of steels, Martensitic transformation, composite of tool steel.

**Heat Treatments of Steels:** Annealing, Normalizing, Quenching, Tempering and types of hardening processes, precipitation processes.

**Ferrous & Non-ferrous Metals:** Production and properties of pig, wrought and cast iron; Carbon steels, their properties and microstructures, Production, properties and uses of Cu, Al, Ni, Zn, Sn, Pb with their alloys, bearing metals and spring metals, Alloy of Noble metals.

**Metallurgical Aspect of Metal Joining:** Surface treatments like plating, metal coating, metal spraying, shaping and forming of metals and alloys and their effects.

**Powder Metallurgy:** Principles and processes, metal powder and their characteristics, method of producing metal powders, application, advantages, disadvantages of powder metallurgy, polymers, Ceramics.

### **ME3238 Engineering Metallurgy Sessional**

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

**Sessional** based on the theory of course **ME3237**

### **ME3239 Power Plant Engineering**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Introduction:** Sources of energy, Types of power plants and its modern trend Survey of power plants in Bangladesh.

**Variable Load Problems:** Principle of optimization, its application to power system planning, and design and technical operation.

**Power Plant Economics:** Theory of tariffs Instrumentation in power plants selection of plants advantages, disadvantages & comparisons of different types of power plant.

**Diesel Engine Power Plants:** scope, arrangements, air fuel system, cooling system and lubrication system, starting methods.

**Steam Power Plant:** Furnaces, stokers and burners, fuel handling, steam turbines, installation and operation, overall plant, efficiency.

**Hydroelectric power plant:** Types of operation, site selection, turbine selection, seasonal and intermittent plants, components of the plant, efficiency.

**Gas Turbine Power plant:** Scope, cycle analysis, installation, governing and maintenance.

**Nuclear Power Plant:** Scope, plant layout, types of reactors, fuels, waste disposal, safety.

**Power Plant Accessories:** Draft systems, chimney design, water-cooling systems, water conditioning & industrial water treatment.

**Electrical transmission:** Basic concept, types of transmission & distribution system, major electrical equipment in power plants.

### **IPE3230 Industrial Training**

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +4 Weeks**

### **ME3200 Board Viva-Voce**

**Credit Hours - 1**

## **B.Sc. in Mechanical Engineering Part-4 Odd Semester**

### **ME4130 Project and Thesis**

**Sessional: Credit Hours - 3**

**Contact Hours/week 0 +6**

### **ME4131 Applied Thermodynamics-I**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Internal combustion Engines:** Engines Types, CI and SI engines combustion process, pre –ignition. Detonation and diesel Knock. Fuel requirements and fuels ratings- octane and cetane ratings. Carburetion and fuel injection. Excess air ratio, equivalence ratio, Scavenging and supercharging of IC engines. Lubrication and engine cooling- methods, requirements and calculations. Combustion Chamber-design and their influence on engine performance.

Factors limiting the performance of IC engines, Engine Emission and control; Stirling engine, Wankle engine, Free piston engine and Dual fuel engine. Principle of similitude applied to the design of IC engines.

**Gas power Cycles:** Introduction to gas turbine and its principle of operation, simple gas turbine cycles-with inter-cooling, regeneration & reheating, closed cycle gas turbine.

**Thrust Propulsion:** Jet propulsion, Rocket propulsion, Propellant and its criteria, Estimation of fuel consumption and efficiency.

### **ME4132 Applied Thermodynamics-I Sessional**

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

**Sessional based on the theory of course on ME4131**

### **ME4133 Advanced Heat and Mass Transfer**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Convection:** Mechanism of convective heat transfer, momentum and energy equations, concept of thermal boundary layers, forced & free convection, dimensional analysis, fully developed flows and boundary layer developments in tubes of ducts over flat plates natural convection around vertical plate & cylinder, combined heat transfer.

Heat Transfer with Change of Phase: Condensation, drop wise and film condensation.

**Boiling Heat Transfer:** Evaporation & boiling, mechanism & heat transfer correlation process of bubble growth & bubble dynamics; Heat pipe.

**Mass Transfer:** Introduction, Co-efficient of mass transfer, Fick's law of diffusion in gases, liquids & solids, Simultaneous heat and mass transfer phenomena.

**Heat Exchanger:** Types, LMTD, exchanger effectiveness, fouling & scaling, design.

### **ME4134 Advanced Heat and Mass Transfer Sessional**

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

**Sessional** based on the theory of course **ME4133**

### **ME4135 Production Planning and Control**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Introduction:** Function of production planning & control; Plant/Facility location, Location factor, Analysis of industrial facilities location. Plant layout; objectives, types of layout, criteria of successful layout.

**Forecasting:** Forecasting, methods and their applications.

**Inventory Control:** Classification of inventories; Economic order Quantity, Reorder point, safety stock, economic production quantity, Inventory control under conditions of uncertainty, other inventory controls systems, min-max, two bin, perpetual inventory record and ABC analysis, Zero inventory.

**Scheduling:** Objectives of scheduling, aggregate scheduling, scheduling single machine and multiple jobs, multi-machine models, network scheduling, CPM, PERT techniques, arrow diagrams, coping with variance and unbalance in production MPS, MRP.

**E- Manufacturing:** Definition, EM- Functions and application

**Work Study: Methods study techniques:** operation process chart; flow process chart; activity chart; flow diagram; travel diagram; motion study; micro motion study and SIMO chart. Principles of motion economy. Work measurement; Objectives, time study; selected time, normal time, standard time, allowance; rating factor, stop watch time study, work sampling; sufficiency of reading.

**Ergonomics:** Introduction, Bio-clock; human efficiency; effect of temperature humidity, noise and glare; physical factors in ergonomics, Introduction to cybernetics.

### **ME4137 Industrial Management**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Management and Organization:** Definitions of management, management functions, organization fundamentals, Organization structures, span of control,

**Business:** Single proprietorship; Partnership; Joint stock company; Corporation, Private & public sector; business collusion's and combinations; share, bond, loan; share market; mortgage; bankruptcy, liquidation.

**Financial Planning:** Classification of capital; Capital procurement; economic analysis of cost pattern; break-even analysis; depreciation; depreciation calculation, estimation of life of an engineering asset; replacement of plant machinery.

**Budgeting:** Types of expenditure; controllable and non-controllable expenditure; flexible budgets; budget revision; zero based budgets; cost control through budgeting.

**Personnel Management:** Functions of personnel management; staffing; recruitment and development; motivation; labor relations; collective bargaining, strike; lockout; grievance arbitration.

**Wage and Salary Administration:** Job evaluation; techniques of evaluation; merit rating; salary and wages; wage incentive plans; fringe benefit.

**Purchase and Sales:** Purchasing policies; Purchasing procedures; purchasing problems; salvage department; Sales forecasting; distribution channels; concept of marketing; advertising and sales promotion.

**Research and Development:** Technological change; process of innovation; importance of R & D; research cost and risks; patent and royalty; industrial espionage; product life cycle; development of a product; creativity.



## **Optional-I**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

### **ME4139(a) Refrigeration and Air Conditioning**

**Refrigeration:** Concept and application of refrigeration, different refrigeration methods, Analysis of vapor- compression refrigeration system and its modifications, Absorption refrigeration, Air-cycle refrigeration, Low-temp. Refrigeration, Multi-pressure systems of refrigeration. Refrigeration equipment; Defrost mechanism and automatic controls used in commercial refrigeration systems, Heat-flow problems in condensers and evaporators. Manufacture of water ice and dry ice, Refrigerants.

**Air Conditioning:** Concept and classification of a/c and its use, Psychometric properties, comfort data, cooling and heating load calculation of various applications, Air distribution system and duct design. Air conditioning equipment, Air Class, air purification, Installation of units, Charging, Leak detection, wiring diagram and service, Trouble shooting.

### **ME4139(b) Computer Aided Design**

Methodology of interactive, graphical, engineering design, concepts of descritization optimization, simulation in CAD. Concepts of algorithm developments in CAD. Application of different types of data structures in CAD. Concepts of engineering graphics and differential geometry in CAD, design of curves and surface, application of geometrical design in conveyor system, sheet metal design, tool design, die design, design of pump and impeller rotor surface.

Design of volumes: Evolution of integral properties of volumes. Derivation of NC codes from solid design and it's graphic representation, intersection of surfaces and interference of volumes, Application of CAD in mechanism design, piping systems lay out design, hit exchanger design. Design of Mechanical components.

## **B.Sc. in Mechanical Engineering Part-4 Even Semester**

### **ME4230 Project and Thesis**

**Sessional: Credit Hours - 3**

**Contact Hours/week 0 +6**

### **ME4231 Applied Thermodynamics-2**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Vapor Cycles:** Carnot & Rankine cycles, Reheat and regenerative cycles, Binary vapor cycles, Economizer & air- preheater, Back pressure and Extraction turbines, steam cycles for nuclear power plants.

**Steam Turbine:** Introduction, working principle, performance, stage efficiency.

**Combined Cycles:** Basic concepts, coupling of two different power cycles, MHD power generation.

**Direct Energy Conversion:** Electro-chemical effects and fuel cells, reversible cells, ideal fuel cells and other fuel cells, thermo-ionic emission and conversion, electrode configuration, practical consideration.

**Thermoelectric System:** Power generation, properties of thermoelectric materials.

Fusion Plasma Generation: Generation, plasma confinement, and pinch effect.

### **ME4233 Fluid Machinery**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Introduction:** Rot dynamic and positive displacement machines; Velocity diagram and Euler pump/turbine equation; Impulse and reaction turbines; Centrifugal and axial flow pump; Compressors (with thermo-dynamic aspects): Reciprocating pump.

**Performance Study:** Performance and characteristics of turbines, pumps and compressors. Design on pumps. System analysis and selection of fluid machine.

Dimensional Analysis Applied to Fluid Machinery: Specific speed, unit power, unit speed, and unit discharge.

**Hydraulic Transmissions:** Fluid coupling and torque converter; Applications and features of fluid coupling and torque converter.

### **ME4234 Fluid Machinery Sessional**

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

**Sessional** based on the theory of course ME4233

### **ME4235 Instrumentation and control Theory**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

**Measurement:** Functional Elements of a measurement system, Standard units of measurements, Accuracy and precision, Introduction to linear and angular measurement; Surface roughness: Screw & gear measurement; Taylor's principles on limit gauges.

**Instrumentation:** Classification of measuring instrument, Characteristics of instrument, Sensitivity and resolution of instrument, Measurement system errors, Electromechanical and electronic meters and their uses, Different types of sensors and their principle of operations.

**Controlling System:** Introduction; electrical equipment; selection of motors, circuit diagram for starting the motor, electrical brakes, automatic and semiautomatic control. Hydraulic control: introduction, typical systems, and basic parameters for design efficiency.

**Unconventional Machining Processes:** EDM, ECM, VSM, AJM, USM, Laser, Automations & NC machines.

### **ME4236 Instrumentation and control Theory Sessional**

**Sessional: Credit Hours - 1**

**Contact Hours/week 0 +2**

**Sessional** based on the theory of course ME4235

### **ME4238 Seminar**

**Sessional: Credit Hours - 2**

**Contact Hours/week 0 +4**

### **Optional-II**

**Theory: Credit Hours- 3**

**Contact Hours/week 3 + 0**

#### **ME4239(a) Automobile Engineering**

**Fundamentals:** Introduction, components of automobile, Automotive engines; Types and construction, performance study.

**Automotive Engine Systems:** Automotive fuel systems for SI and CI engines, ignition systems, alternative fuels, lubrication systems, cooling systems, exhaust systems, circuits--- their details.

**Electrical Systems and Equipment:** Storage battery & its construction. Cranking motor and generators, lighting, regulators, indicators, ignition system, electrical safety devices & accessories, electrical & electronic control systems.

**Power Transmission & Chassis:** Clutch, gear, differential and final drives, manual and automatic transmission system and their geometry braking system.

**Safety Devices and Controls:** Types and functions, modern development of economy speed and fuel economy, emissions, pollution and controls.

#### **ME4239(b) Operations Research**

Introduction: Origin and development of OR, Art of modeling, Assumptions, Scope, Limitations and application of OR techniques.

Linear Programming Models: Mathematical formulations, Graphical solution, Simplex and dual simplex methods, Types of solutions, Duality, Interpretation of the dual problem and post optimality analysis, Transportation and assignment models.

Decision and Game Theory: Non-linear, integer programming, simulation, dynamic programming, queuing theory and Markov chains.

#### **ME4200 Board Viva-Voce**

**Credit Hours - 1**