2020

Curriculum of Undergraduate Studies

Department of Mechanical Engineering
Dhaka University of Engineering & Technology, Gazipur

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Preface

Dhaka University of Engineering & Technology (DUET), Gazipur is one of the reputed universities for the study of Engineering in Bangladesh. Dhaka University of Engineering & Technology (DUET), Gazipur is surrounded by scenic beauty and busy industrial area of Bangladesh. Only the Diploma in Engineering holders can avail themselves of enrolling here for four years Bachelor degree in different branches of Engineering. The University originated in 1980 as College of Engineering at its temporary campus at Tejgaon, Dhaka under the University of Dhaka offering four years 'Bachelor degree in Civil, Electrical & Electronic and Mechanical Engineering' to help meet the growing need for advanced engineering education in Bangladesh. After a short span of time, College of Engineering is renamed as Dhaka Engineering College (DEC). The then DEC was shifted to its present permanent campus at Gazipur in 1983. DEC was converted to Bangladesh Institute of Technology (BIT), Dhaka as a degree awarding Institute by a government ordinance in 1986 to find solutions to various problems it had been facing since its inception. The journey of BIT, Dhaka was not also so smooth. It faced many problems and could overcome some of the problems faced by DEC. To alleviate this situation, from September 2003, Dhaka University of Engineering and Technology (DUET), Gazipur was created out of BIT, Dhaka. DUET has ultimately turned into an Institution, which can now boost its commitment to quality engineering education and has established a good reputation all over the world for the quality of its graduates. The curriculum and syllabus of DUET are continuously updated to cope with the recent technological development as well as in line with that is being followed in the universities of developed countries. To give students hands-on training, industrial attachment program is included in the curriculum. DUET addresses practical needs through undergraduate and graduate programs. At present all efforts are being made to turn the DUET into a center of excellence. At present there are four faculties in the university: (a) The Faculty of Civil Engineering; this Faculty comprises the Department of Civil Engineering and Department of Architecture (b) The Faculty of Electrical and Electronic Engineering; this Faculty comprises the Department of Electrical and Electronic Engineering and Department of Computer Science & Engineering (c) The Faculty of Mechanical Engineering; this Faculty comprises the Department of Mechanical Engineering, Department of Textile Engineering, Department of Industrial & Production Engineering, Department of Chemical & Food Engineering and Department of Materials and Metallurgical Engineering (MME) and (d) The Faculty of Engineering; this Faculty comprises the Department of Chemistry, Department of Mathematics, Department of Physics and Department of Humanities & Social Sciences. At present, 4 year undergraduate degrees are offered in the University.

The pace of development of DUET towards perfection has already been started. It will continue to convert this university into a centre of excellence for providing quality education by fulfilling the various strategic aims and objectives in which we are committed.

PART A

Tittle of the Program

Bachelor of Science in Mechanical Engineering

Name of the University

Dhaka University of Engineering & Technology, Gazipur

1. Vision of the University

To be the center of excellence for quality education, research and innovation.

Mission of the University

⊕ To provide a congenial environment for world-class education, research and innovation.

⊕ To produce highly efficient technical professionals endowed with practical knowledge, skills and ethical values based on emerging demands.

⊕ To promote multi-faceted academic collaboration across universities and industries for research and innovation.

⊕ To contribute in national policy making for sustainable socio-economic and industrial development of the country.

⊕ To provide consultancy in solving technical problems at national and international levels.

Name of the Degree

Bachelor of Science in Mechanical Engineering

Name of the Faculty Offering the Program

Mechanical Engineering

Name of the Department Offering the Program

Mechanical Engineering

2. Vision of the Program

To be a center of excellence for world-class education, research and innovation in mechanical engineering for solving present and future challenges towards the betterment of mankind.

Mission of the Program

M1	To provide a conducive environment for world-class education, research and innovation in mechanical engineering.
M2	To produce efficient mechanical engineers possessed of ethical values, practical knowledge and skills that meet the emerging demands.
M3	To enhance collaboration with outside entities for research and innovation in the field.
M4	To prepare students for success in the workplace and beyond.
M5	To provide technological advisory services for solving local and global emerging problems.

Description of the Program

Mechanical Engineering is universally considered as the cornerstone of almost all fields of engineering science. The various disciplines of mechanical engineering are ubiquitous, not only in simple to complex applications of industry, but also in our quotidian everyday life. Therefore, any engineering educational program should take into account the inherent multi-disciplinary characteristics of mechanical engineering major. The Department of Mechanical Engineering of Dhaka University of Engineering & Technology, Gazipur has undergone through several stages of evolution and progress since its establishment in 1980. Today, congruent with 21st century's requirements and in harmony with modern branches of science, such as Nanotechnology or Bio-Mechanics, Mechatronics and emergence of modern methods of education such as virtual or e-learning and long life self-learning skills, the mechanical engineering curricula has been programmed based on new paradigms and futuristic visions in order to prepare engineers for confronting the societal and ethical aspects of their professional life and the challenges of modern technologies. The Department's academic program can be divided basically into undergraduate and graduate education. It has always tried to keep a well-defined and logical balance between endeavors towards both undergraduate and graduate programs. In undergraduate level, the program is focused in educating and training qualified engineers to commence their profession on industrial sector and service/commercial sector with high management and leadership skills.

The Department of Mechanical Engineering, DUET, Gazipur has been offering undergraduate program (B.Sc. in Mechanical Engineering) since its inception of 1980. The course curricula have been designed compatible to the existing and emerging needs of the industry. The autonomy of the

University is a privilege to the department in terms of flexibility provided to add, modify and revise courses/syllabi at different time intervals to cater contemporary needs of the industrial concerns. The laboratories have also been initiated and modernized with the assistance of government and UGC. The department shows no hesitation in imbibing valuable suggestions of eminent experts from World class Institutions while framing teaching schemes or course curricula.

3. Program Education Objectives

The Mechanical Engineering Undergraduate Program is designed to prepare students for continued learning and successful careers in industry, government, academia and consulting. Our graduates are expected to:

PE01	Have strong fundamental scientific and technical knowledge and management skills to serve as the foundation for engineering practice and life-long learning.
PE02	Apply their mechanical engineering education to address the full range of technical and societal problems with creativity, imagination, confidence and responsibility.
PE03	Ascertain their ability of designing, analyzing, testing, and implementing mechanical systems utilizing modern engineering tools and sustainable approach.
PE04	Be proficient in multidisciplinary professional settings with awareness and commitment to their ethical, social and environmental responsibilities.
PE05	Be innovative and able to develop and communicate ideas and solutions, either as effective technical leaders, team leaders, or team members.

4. Program Learning Outcome (PLO)

The B.Sc. in Mechanical program learning outcomes (PLOs) are aligned with BAETE outcomes. These are stated as:

PLO1	**Engineering knowledge:** Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization as specified in K1 to K4 respectively to the solution of complex engineering problems.
PLO2	**Problem analysis:** Identify, formulate, research and analyze complex engineering problems and reach substantiated conclusions using the principles of mathematics, the natural sciences and the engineering sciences.
PLO3	**Design/development of solutions:** Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations. (K5)
PLO4	**Investigation:** Conduct investigations of complex problems using research-based knowledge (K8) and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
PLO5	**Modern tool usage:** Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems, with an understanding of the limitations. (K6)
PLO6	**The engineer and society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice. (K7)

PLO7	**Environment and sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development. (K7)
PLO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice. (K7)
PLO9	**Individual work and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
PLO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PLO11	**Project management and finance:** Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PLO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Knowledge Profile

Attribute

⊕ **K1** A systematic, theory-based understanding of the natural sciences applicable to the discipline

⊕ **K2** Conceptually based mathematics, numerical analysis, statistics and the formal aspects of computer and information science to support analysis and modeling applicable to the discipline

⊕ **K3** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline

⊕ **K4** Mechanical engineering knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the mechanical engineering discipline

⊕ **K5** Knowledge that supports engineering design in mechanical engineering area

⊕ **K6** Knowledge of engineering practice (technology) in the practice areas in the mechanical engineering discipline

⊕ **K7** Comprehension of the role of engineering in society and identified issues in engineering practice in the mechanical engineering discipline: ethics and the engineer's professional responsibility to public safety; the impacts of engineering activity; economic, social, cultural, environmental and sustainability

⊕ **K8** Engagement with selected knowledge in the research literature of the mechanical engineering discipline

Range of Complex Engineering Problem Solving

Attribute	Complex Engineering Problems have characteristic P1 and some or all of P2 to P7:
⊕ Depth of knowledge required	P1: Cannot be resolved without in-depth engineering knowledge at the level of one or more of K3, K4, K5, K6 or K8 which allows a fundamentals-based, first principles analytical approach
⊕ Range of conflicting requirements	P2: Involve wide-ranging or conflicting technical, engineering and other issues
⊕ Depth of analysis required	P3: Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models
⊕ Familiarity of issues	P4: Involve infrequently encountered issues
⊕ Extent of applicable codes	P5: Are outside problems encompassed by standards and codes of practice for professional engineering
⊕ Extent of stakeholder involvement and conflicting requirements	P6: Involve diverse groups of stakeholders with widely varying needs
⊕ Interdependence	P7: Are high level problems including many component parts or sub-problems

Range of Complex Engineering Activities

Attribute	Complex activities mean (engineering) activities or projects that have some or all of the following characteristics:
⊕ Range of resources	A1: Involve the use of diverse resources (and for this purpose resources include people, money, equipment, materials, information and technologies)
⊕ Level of interaction	A2: Require resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues
⊕ Innovation	A3: Involve creative use of engineering principles and research-based knowledge in novel ways
⊕ Consequences for society and the environment	A4: Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation
⊕ Familiarity	A5: Can extend beyond previous experiences by applying principles-based approaches

5. PEO to Mission Statement Mapping

M/PEO	PEO1	PEO2	PEO3	PEO4	PEO5
M1	✓	✓	✓		✓
M2	✓			✓	✓
M3	✓	✓	✓	✓	
M4	✓	✓	✓	✓	✓
M5		✓	✓	✓	✓

6. Mapping of PLOs to PEOs

PEO/ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
PEO1	✓	✓		✓					✓		✓	✓
PEO2	✓	✓	✓	✓	✓	✓						
PEO3			✓	✓	✓		✓					
PEO4						✓	✓	✓	✓	✓	✓	
PEO5			✓						✓	✓	✓	✓

PART B

7. Scheme of the Program

Summary of Course Plan

Sl. No.	Year/ Semester	Theory		Sessional		Total Credit
		No. of Course	Credit	No. of Course	Credit	
1.	1st/1st*	4	12.00	3	3.00	15.00
2.	1st/2nd	5	16.00	4	3.75	19.75
3.	2nd/1st	5	17.00	5	3.75	20.75
4.	2nd/2nd	5	17.00	4	3.75	20.75
5.	3rd/1st	5	17.00	4	4.50	21.50
6.	3rd/2nd	5	16.00	4	3.75	19.75
7.	4th/1st	5	15.00	4	5.25	20.25
8.	4th/2nd	5	15.00	5	7.50	22.50
Total		**39**	**125.00**	**33**	**35.25**	**160.25**

**1st year 1st semester is exempted for the students who have completed for year diploma degree from a relevant diploma engineering branch.*

Relevant diploma engineering branches are:

- ⊕ *Mechanical Technology*
- ⊕ *Power Technology*
- ⊕ *Chemical Technology*
- ⊕ *Refrigeration & Air-Conditioning Technology*
- ⊕ *Automobile Technology*
- ⊕ *Food Technology*
- ⊕ *Mechatronics Technology*
- ⊕ *Ship Building Technology*
- ⊕ *Marine Technology*
- ⊕ Mining and Mine Survey Technology

7.1 Scheme of First Year- First Semester (1/1) – Exempted

Sl. No.	Course No.	Course Title	Contact hours/week	Credits
01	ME 1101	Fundamentals of Fluid Mechanics	3	3.00
02	ME 1301	Fundamentals of Engineering Materials	3	3.00
03	ME 1401	Engineering Mechanics-I	3	3.00
04	ME 1501	Introduction to Thermal Engineering	3	3.00
05	ME 1502	Introduction to Thermal Engineering Sessional	3/2	0.75
06	ME 1002	Engineering Drawing-I	3/2	0.75
07	ME 1004	Shop Practice	3	1.50
Total:			**18**	**15.00**

7.2 Scheme of First Year- Second Semester (1/2)

Sl. No.	Course No.	Course Title	Contact hours/week	Credits
01	Math 1301	Differential and Integral Calculus	4	4.00
02	Phy 1301	Physics of Matter, Electricity and Magnetism	3	3.00
03	Phy 1302	Physics of Matter and Electricity Sessional	3/2	0.75
04	Ch 1301	Inorganic and Physical Chemistry	3	3.00
05	Ch 1302	Inorganic and Physical Chemistry Sessional	3/2	0.75
06	HSS 1301	English	3	3.00
07	ME 1503	Basic Thermodynamics	3	3.00
08	ME 1504	Basic Thermodynamics Sessional	3/2	0.75
09	ME 1006	Engineering Drawing-II	3	1.50
Total:			**23.5**	**19.75**

7.3 Scheme of Second Year- First Semester (2/1)

Sl. No.	Course No.	Course Title	Contact hours/week	Credits
01	Math 2301	Coordinate Geometry, Matrices and Vector Analysis	4	4.00
02	Phy 2301	Optics and Modern Physics	3	3.00
03	Phy 2302	Optics and Modern Physics Sessional	3/2	0.75
04	Ch 2301	Industrial Chemistry	3	3.00
05	HSS 2302	English Language Practice	3/2	0.75
06	EEE 2103	Basic Electrical Engineering	3	3.00
07	EEE 2104	Basic Electrical Engineering Sessional	3/2	0.75
08	ME 2401	Engineering Mechanics-II	4	4.00
09	ME 2402	Engineering Mechanics-II Sessional	3/2	0.75
10	ME 2002	Computer Programming	3/2	0.75
Total:			**24.5**	**20.75**

7.4 Scheme of Second Year- Second Semester (2/2)

Sl. No.	Course No.	Course Title	Contact hours/week	Credits
01	Math 2303	Complex Variables and Ordinary Differential Equations	4	4.00
02	HSS 2301	Economics and Accounting	3	3.00
03	EEE 2505	Electrical Machines and Electronics	3	3.00
04	EEE 2506	Electrical Machines and Electronics Sessional	3/2	0.75
05	ME 2301	Metallic Material Science	3	3.00
06	ME 2302	Metallic Material Science Sessional	3/2	0.75
07	ME 2403	Mechanics of Solids	4	4.00
08	ME 2404	Mechanics of Solids Sessional	3/2	0.75
09	ME 2004	Computer Aided Drawing	3	1.50
Total:			**24.5**	**20.75**

7.5 Scheme of Third Year- First Semester (3/1)

Sl. No.	Course No.	Course Title	Contact hours/week	Credits
01	Math 3301	Mathematical Methods and Partial Differential Equations	4	4.00
02	HSS 3301	Sociology and Industrial Law	3	3.00
03	ME 3101	Fluid Mechanics	3	3.00
04	ME 3102	Fluid Mechanics Sessional	3/2	0.75
05	ME 3305	Manufacturing Process	3	3.00
06	ME 3306	Manufacturing Process Sessional	3	1.50
07	ME 3401	Mechanics of Machinery	4	4.00
08	ME 3402	Mechanics of Machinery Sessional	3/2	0.75
09	ME 3002	Professional Ethics	3	1.50
Total:			**24.5**	**21.50**

7.6 Scheme of Third Year- Second Semester (3/2)

Sl. No.	Course No.	Course Title	Contact hours/week	Credits
01	HSS 3303	Government and Bangladesh Studies	3	3.00
02	ME 3103	Fluid Mechanics and Machinery	3	3.00
03	ME 3104	Fluid Mechanics and Machinery Sessional	3/2	0.75
04	ME 3403	Machine Design	4	4.00
05	ME 3404	Machine Design Sessional	3	1.50
06	ME 3501	Heat Transfer	3	3.00
07	ME 3502	Heat Transfer Sessional	3/2	0.75
08	ME 3601	Numerical Methods for Engineering Analysis	3	3.00
09	ME 3602	Numerical Methods for Engineering Analysis Sessional	3/2	0.75
Total:			**23.5**	**19.75**

7.7 Scheme of Fourth Year- First Semester (4/1)

Sl. No.	Course No.	Course Title	Contact hours/week	Credits
01	ME 4201	Production Planning and Control	3	3.00
02	ME 4301	Instrumentation and Quality Control	3	3.00
03	ME 4302	Instrumentation and Quality Control Sessional	3/2	0.75
04	ME 4501	Applied Thermodynamics	3	3.00
05	ME 4502	Applied Thermodynamics Sessional	3/2	0.75
06	ME 4503	Heat and Mass Transfer	3	3.00
07	ME 4504	Heat and Mass Transfer Sessional	3/2	0.75
08	Optional Subject-I		3	3.00
09	ME 4000*	Thesis/Capstone Design	3	3.00
Total :			**22.5**	**20.25**

Optional Subject-I: ME

ME 4509: Automobile Engineering

ME 4705: Mechatronics

ME 4307: Material Handling and Safety Engineering

ME 4101: Aerodynamics

7.8 Scheme of Fourth Year- Second Semester (4/2)

Sl. No.	Course No.	Course Title	Contact hours/week	Credits
01	ME 4203	Industrial Management	3	3.00
02	ME 4505	Power Plant Engineering	3	3.00
03	ME 4507	Refrigeration and Building Mechanical System	3	3.00
04	ME 4508	Refrigeration and Building Mechanical System Sessional	3/2	0.75
05	ME 4002	Industrial Training and Technical Seminar	3	1.50
06	ME 4004	Mechanical Systems Design	3	1.50
07	ME 4303	Machine Tools and Tool Engineering	3	3.00
08	ME 4304	Machine Tools and Tool Engineering Sessional	3/2	0.75
09	Optional Subject-II		3	3.00
10	ME 4000	Thesis/Capstone Design	3	3.00
Total :			**27**	**22.50**

Optional Subject-II: ME YYYY

ME 4205: Operation Research

ME 4309: CAD and CAM. (Computer Aided Design and Computer Aided Manufacturing)

ME 4401: Control Engineering

ME 4603: Solar Energy Technology

7.9 Course Distribution

⊕ LANGUAGE AND GENERAL EDUCATION [17.25 Credits; 10.8%]

Category	Course	Credit
Language	HSS 2302: English Language practice	0.75
	HSS 2301: English	3.00
Social Science	HSS 3301: Sociology and Industrial Law	3.00
Art and Humanities	ME 3002: Professional Ethics	1.50
	HSS 3303: Government and Bangladesh Studies	3.00
Business	HSS 1301: Economics and Accounting	3.00
	ME 4203: Industrial Management	3.00
	Total	**17.25**

⊕ BASIC SCIENCES AND MATHEMATICS [33.25 Credits; 20.7%]

Category	Course	Credit
Physics	Phy 1301: Physics of Matter, Electricity and Magnetism	3.00
	Phy 1302: Physics of Matter and Electricity Sessional	0.75
	Phy 2301: Optics and Modern Physics	3.00
	Phy 2302: Optics and Modern Physics Sessional	0.75
Chemistry	Ch 1301: Inorganic and Physical Chemistry	3.00
	Ch 1302: Inorganic and Physical Chemistry Sessional	0.75
	Ch 2301: Industrial Chemistry	3.00
Mathematics	Math 1301: Calculus	4.00
	Math 2301: Coordinate Geometry, Matrices and Vector Analysis	4.00
	Math 2303: Complex Variables and Ordinary Differential Equations	4.00
	Math 3301: Mathematical Methods and Partial Differential Equations	4.00
	ME 3601: Numerical Methods for Engineering Analysis	3.00
	Total	**33.25**

⊕ OTHER ENGINEERING [16.5 Credits; 10.3%]

Category	Course	Credit
Computer Science and Engineering	ME 2002: Computer Programming	0.75
	ME 3602: Numerical Methods for Engineering Analysis Sessional	0.75
Electrical Engineering	EEE 2103: Basic Electrical Engineering	3.00
	EEE 2104: Basic Electrical Engineering Sessional	0.75
	EEE 2505: Electrical Machines and Electronics	3.00
	EEE 2506: Electrical Machines and Electronics Sessional	0.75
Industrial Production Engineering	ME 4303: Machine Tools and Tool Engineering	3.00
	ME 4304: Machine Tools and Tool Engineering Sessional	0.75
Materials Engineering	ME 2301: Metallic Material Science	3.00
	ME 2302: Metallic Material Science Sessional	0.75
	Total	**16.50**

⊕ CORE COURSES [78.25 Credits; 48.8%]

Category	Course	Credit
Engineering Drawing	ME 1002: Engineering Drawing-I	0.75
	ME 1006: Engineering Drawing-II	1.50
	ME 2004: Computer Aided Drawing	1.50
Thermal Sciences	ME 1501: Basic Mechanical Engineering	3.00
	ME 1502: Basic Mechanical Engineering Sessional	0.75
	ME 1503: Basic Thermodynamics	3.00
	ME 1504: Basic Thermodynamics Sessional	0.75
	ME 3501 : Heat Transfer	3.00
	ME 3502 : Heat Transfer Sessional	0.75
	ME 4501: Applied Thermodynamics	3.00
	ME 4502: Applied Thermodynamics Sessional	0.75
	ME 4503 : Heat and Mass Transfer	3.00
	ME 4504 : Heat and Mass Transfer Sessional	0.75
	ME 4507: Refrigeration and Building Mechanical System	3.00

Category	Course	Credit
	ME 4508: Refrigeration and Building Mechanical System Sessional	0.75
Applied Mechanics	ME 1303: Fundamentals of Engineering Materials	3.00
	ME 1401: Engineering Mechanics-I	3.00
	ME 2401: Engineering Mechanics-II	4.00
	ME 2402: Engineering Mechanics-II Sessional	0.75
	ME 2403: Mechanics of Solids	4.00
	ME 2404: Mechanics of Solids Sessional	0.75
	ME 3401: Mechanics of Machinery	4.00
	ME 3402: Mechanics of Machinery Sessional	0.75
	ME 3403: Machine Design	4.00
	ME 3404: Machine Design Sessional	1.50
Fluids	ME 1301: Fundamentals of Fluid Mechanics	3.00
	ME 3101: Fluid Mechanics	3.00
	ME 3102: Fluid Mechanics Sessional	0.75
	ME 3103: Fluid Mechanics and Machinery	3.00
	ME 3104: Fluid Mechanics and Machinery Sessional	0.75
Instrumentation and Control	ME 4301: Instrumentation and Quality Control	3.00
	ME 4302: Instrumentation and Quality Control Sessional	0.75
Engineering Practices	ME 1004: Shop Practice	1.50
	ME 3306: Manufacturing Process Sessional	1.50
	ME 4004: Mechanical Systems Design	1.50
Project/Thesis	ME 4000: Thesis/Capstone Design	6.00
Industrial Attachment	ME 4002: Industrial Training and Technical Seminar	1.50
	Total	**78.25**

⊕ TECHNICAL ELECTIVES [15 Credits; 9.4%]

Category	Course	Credit
Technical Electives	ME 3305: Manufacturing Process	3.00
	ME 4201: Production Planning and Control	3.00
	ME 4401: Control Engineering / ME 4205: Operation Research / ME 4309: CAD and CAM. (Computer Aided Design and Computer Aided Manufacturing) / ME 4603: Solar Energy Technology	3.00
	ME 4705: Mechatronics / ME 4509: Automobile Engineering / ME 4307: Material Handling and Safety Engineering / ME 4101: Aerodynamics	3.00
	ME 4505: Power Plant Engineering	3.00
	Total	**15.00**

PART C

8. Course Description

8.1. 1st Year 1st Semester (Exempted)

Note:

(a) The 1st semester of 1st year courses are exempted because of the candidates' completion of minimum 4 years Diploma in Engineering backgrounds after 10 years of schooling. Moreover, admission test syllabus also included basic engineering subjects which usually covers in 4 years Diploma in Engineering program.

(b) Outcome-based curriculum is not prepared for exempted courses. Due to exemption of 1st Year 1st Semester courses, course evaluation documents as well as program learning outcomes documented for these courses.

8.1.1. ME 1101

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 1101 **COURSE TITLE:** Fundamentals of Fluid Mechanics		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 1st year 1st semester	
Exam Hours: N/A	**CIE Marks:** 30%	**SEE Marks:** 70%
(Exempted)		

Course Objectives/Summary: Fundamentals of Fluid Mechanics course introduces and explain different properties of fluid, laws of conservation, different flows and fluid machineries such as pump, turbine, hydraulic jack, flow measuring devices etc.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**State** the Newton's law of viscosity and Explain the mechanics of fluids at rest and in motion by observing the fluid phenomena.
CLO2	**Apply** the knowledge of conservation laws during fluid flow.
CLO3	**Introduce** different fluid machineries with their working principles.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√											
CLO2	√	√										
CLO3	√											

COURSE CONTENT

Properties of fluid; Fluid pressure measurement; Flow of fluids through pipes; Bernoulli's equation; Flow through orifices; Flow through mouthpieces; Flow through Notches and Weirs; Viscous flow; Impact of jets; Water turbine; Reciprocating pumps; Centrifugal pumps; Rotary pumps; Hydraulic devices.

8.1.2. ME 1301

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 1301 **COURSE TITLE:** Fundamentals of Engineering Materials		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 1st year 1st semester	
Exam Hours: N/A	**CIE Marks:** 30%	**SEE Marks:** 70%
(Exempted)		

Course Objectives/Summary: Fundamentals of Engineering Materials course introduces different engineering materials used in mechanical engineering field. Classification, scope and source of these materials are conducted also in this course.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** the characteristics of various engineering materials.
CLO2	**Identify** and **classify** the materials used for manufacturing in the field of mechanical engineering.
CLO3	**Recognize** the sources of various engineering materials.
CLO4	**Utilize** the scopes of materials application in mechanical engineering field.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√											
CLO2	√	√										
CLO3	√											
CLO4	√											

COURSE CONTENT

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

8.1.3. ME 1401

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 1401 **COURSE TITLE:** Engineering Mechanics-I		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 1st year 1st semester	
Exam Hours: N/A	**CIE Marks:** 30%	**SEE Marks:** 70%
(Exempted)		

Course Objectives/Summary: Engineering Mechanics-I course facilities different types of forces and their application. The primary purpose of this course is to develop the capacity to predict the effects of forces in static condition and different mechanical properties.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Facilitate** understand the fundamental of units and their conversions.
CLO2	**Understand** different types of forces, their effects, composition and resolution of forces and compute the resultant force & couple.
CLO3	**Understand** the laws of friction and the coefficient of friction & the ability of computing frictional forces.
CLO4	**Compute** CG, moment of inertia, stress, strain, SFD, BMD for different bodies.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√											
CLO2	√											
CLO3	√											
CLO4	√	√										

COURSE CONTENT

Fundamental of mechanics and unit conversion, Composition and resolution of forces. Moment and their applications, centroid and center of gravity of line and area, Friction, support reactions, frame and truss, projectiles, lifting machine, gear trains.

Simple stress and strain; Thermal stresses & strain; Shear force and bending moment; Basics of Riveted and Welded joint; Properties of materials; Testing of mechanical properties.

8.1.4. ME 1501

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 1501 **COURSE TITLE:** Introduction to Thermal Engineering		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 1st year 1st semester	
Exam Hours: N/A	**CIE Marks:** 30%	**SEE Marks:** 70%
(Exempted)		

Course Objectives/Summary: Introduction to Thermal Engineering introduces the Mechanical Engineering discipline and its applications to society. It also enlightens the applications of different fields of Mechanical Engineering and its interrelationship with other fields of science and engineering.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** the differences between conventional and renewable energy sources and analyze different aspects of environmental pollution and how environment pollution poses potential threats.
CLO2	**Understand** steam generator, steam turbines, gas turbines and their components with their functions in the corresponding systems.
CLO3	**Understand** automobiles with their components and their working principles.
CLO4	**Understand** hydraulic pumps and their operation and analyze the difference between fans, blowers and compressors.
CLO5	**Understand** refrigeration and air-conditioning systems and apply ideal Carnot cycle assumptions to evaluate the basic performance parameters of such systems.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√											
CLO2	√											
CLO3	√											
CLO4	√	√										
CLO5	√											

COURSE CONTENT

Study of sources of energy; conventional and renewable, environmental pollution; study of steam generation units with their accessories and mountings; Introduction to steam turbine with their accessories, internal combustion engines and gas turbines with

their accessories, automobiles; Introduction to pumps, blowers and compressors, refrigeration and air-conditioning systems.

8.1.5. ME 1502

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 1502 **COURSE TITLE:** Introduction to Thermal Engineering Sessional		
CREDIT: 0.75 (Sessional)	**TERMS OFFERED:** 1st year 1st semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%
(Exempted)		

Course Objectives/Summary: Introduction to Thermal Engineering Sessional course introduces about different mechanical machines and equipment with their parts and components.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** different parts of steam generation units and achieve a good perception of steam generation components.
CLO2	**Understand** different parts of internal combustion engines.
CLO3	**Understand** different parts of gas turbine unit and their functions.
CLO4	**Understand** different fluid machines and their operations.
CLO5	**Understand** refrigeration and air-conditioning systems and analyze those for discerning the scope of improvement of their performance.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√											
CLO2	√											
CLO3	√											
CLO4	√											
CLO5	√	√										

COURSE CONTENT

Experiments based on **ME 1501.**

8.1.6. ME 1002

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 1002 **COURSE TITLE:** Engineering Drawing-I		
CREDIT: 1.50 (Sessional)	**TERMS OFFERED:** 1st year 1st semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%
(Exempted)		

Course Objectives/Summary: Engineering Drawing-I course describes different drawing methods, rules of conventional drawing and enables aptitudes of technical drawing. It improves visualization skills which is essential for mechanical engineers.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Identify** and **define** basic requirement of engineering drawing according to standard.
CLO2	**Understand** the conventions and the method of engineering drawing.
CLO3	**Learn** how to draw the shapes, angels and lines and others which is essential for engineer.
CLO4	**Improve** visualization skills so that these skills can be used in developing new products.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√											
CLO2	√											
CLO3	√											
CLO4	√											

COURSE CONTENT

Introduction; Instruments and their uses; First and third angle projections; Orthographic drawings; Isometric views; Missing lines and views, Sectional views and conventional practices; Auxiliary views.

8.1.7. ME 1004

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 1004 **COURSE TITLE:** Shop Practice		
CREDIT: 1.50 (Sessional)	**TERMS OFFERED:** 1st year 1st semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%
(Exempted)		

Course Objectives/Summary: Shop Practice course provides the knowledge and skills of different machine tools with their operations and welding processes.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Recognize** commonly used machine tools.
CLO2	**Provide** understanding of functions of commonly used machine tools.
CLO3	**Develop** skills in setting and operating of the machine tools.
CLO4	**Perform** different welding process.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√											
CLO2	√											
CLO3	√											
CLO4	√				√							

COURSE CONTENT

Machine tools; Lathe machine; drilling machine; grinding machine; Milling Machine; Measuring techniques, Shaper machine, Planer machine, cutting tools, Coolant; Fitting: Safety Precautions, Common hand tools; Measuring instruments; Laying out; Sawing, chipping, filing, grinding and finishing, drilling and thread cutting; Welding: Arc welding; Gas welding; welding with non-ferrous metal; Resistance welding; TIG & MIG welding; Gas & Plasma cutting.

8.2. 1st Year 2nd Semester

8.2.1. Math 1301

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** Math 1301 **COURSE TITLE:** Differential and Integral Calculus		
CREDIT: 4.0 (Theory)	**TERMS OFFERED:** 1st year 2nd semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: This is one of the most important courses in Mathematics. Specially, this course is critically important to the study the theory and its applications in solving various problems throughout the science and engineering field.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** mathematical knowledge and skills.
CLO2	**Develop** proficiency in analytical reasoning, and utility in modeling and solving real world problems.
CLO3	**Apply** the knowledge and methods of calculus in the field of mechanical engineering.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√											
CLO2	√	√										
CLO3	√	√										

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Operations, Venn Diagrams, Equivalence relations, and Mapping. Function, Limit	**4**	**CLO1**
2	Continuity, Differentiability	**4**	**CLO1, CLO2**
3	Differentiation of explicit and implicit function and parametric equations, Successive differentiation of various types of functions, Leibnitz's theorem	**4**	**CLO1, CLO3**
4	Rolle's theorem, Mean value theorem, Taylor's theorem in finite and infinite forms, Machaurin's theorem in finite and infinite forms	**4**	**CLO3**
5	Lagrange's form of remainder's, Cauchy's form of remainder, Expansion of functions by differentiation, Partial differentiation, Euler's theorem	**5**	**CLO3**

SN	COURSE CONTENT	Hrs	CLOs
6	Tangent, Normal, Subtangent and subnormal in Cartesian and polar coordinates, Determination of maximum and minimum values of functions and points of inflection	**4**	**CLO3**
7	Evaluation of indeterminate forms by L'Hospital's rule, Curvature, Center of curvature and chord of curvature, Evolute and inevolute, Asymptotes, Envelopes, Curve tracing.	**4**	**CLO3**
8	Definitions of integration, Integration by method of substitution, Partial Fractions, Integration by parts, Standard integrals.	**5**	**CLO3**
9	Integration by the method of successive reduction, Definite integrals and its properties use in summing series, Wallis's formulae.	**4**	**CLO3**
10	Beta and Gamma factions, Are under a plane curve in Cartesian and polar coordinates, Trapezoidal rule, Simpson's rule.	**5**	**CLO3**
11	Lengths of curves in Cartesian and polar coordinates, Parametric and pedal equation, Intrinsic equation.	**4**	**CLO3**
12	Volumes of solids of revolution, Volume of hollow solids of revolution, Volume of hollow solids of revolution by shell method, Area of surface of revolution	**5**	**CLO3**

Teaching Learning Strategies: Classroom lecture (white board and power point presentation), reading, solving mathematical problems and feedback.

TEXTBOOK

1. Howard Anton et al., Calculus, John Wiley & Sons

REFERENCE BOOKS

1. Frank Ayres & Elliott Mendelson, Schaum's Outline of Calculus, McGraw-Hill Education
2. Md. Abdul Matin & Bidhubhushan Chakraborty, Differential calculus, Standard Publications
3. Md. Abdul Matin & Bidhubhushan Chakraborty, Integral calculus & differential equation, Standard Publications

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	50	
Evaluate		
Create		

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	10
Understand	15
Apply	20
Analyze	55
Evaluate	
Create	

8.2.2. Phy 1301

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** Phy 1301 **COURSE TITLE:** Physics of Matter, Electricity and Magnetism		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 1st year 2nd semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: This course includes topics of thermal physics, properties of matter, wave & oscillations, electricity & magnetism. The overall objective of this course is to provide students with a solid foundation in the basic understanding of thermodynamics and kinetic theory of matter, properties of matter, oscillations and waves, electricity and magnetism and to use this knowledge to explore various applications.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Realize** about the heat and thermodynamics for calculating properties like thermal conductivity, Van der Waals constant, entropy, atomicity, enthalpy, free energy etc.
CLO2	**Solve** the mathematical problems of properties of matter (elasticity, gravitation, surface tension and viscosity).
CLO3	**Apply** the knowledge of electricity and magnetism to calculate electric field, electric potential, Magnetic field etc.
CLO4	**Select** engineering materials by determining their physical properties for industrial application.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1		√										
CLO2	√	√										
CLO3	√	√										
CLO4	√	√										

SN	COURSE CONTENT	Hrs	CLOs
1	Kinetic theory of gases; Kinetic calculation of pressure, temperature and energy, Ratio of specific heats, atomicity of gas molecules, Mean free path, Equation of state; Van der Waal's equation of state, Critical constants, Van der Waals constant.	**4**	**CLO1**
2	Thermal conductivity; Rectilinear, Cylindrical and spherical flow of heat, Heat flow through compound walls, Accretion of ice on ponds.	**3**	**CLO1, CLO4**
3	Thermodynamics; First law and Zeroth law of thermodynamics and their applications, Thermodynamic processes, Isothermal and Adiabatic gas equation and Work done, Reversible and irreversible processes, Second law of thermodynamics; The Carnot cycle, Entropy; Entropy of a perfect gas.	**4**	**CLO1**
4	Gravitation; Kepler's Laws of motion, Gravitational Potential and field due to (a) A spherical shell (b) Solid sphere and (c) hollow sphere, Escape velocity, Velocity of satellite, Elasticity; Elastic constants, Relation between Elastic constants,	**4**	**CLO2, CLO3**
5	Surface tension; Surface energy, Excess pressure of curved surface, capillarity, Determination of surface tension of water by capillary tube method, Fluid motion; Equation of continuity, Bernoulli's equation, Viscosity; Poiseuille's equation, Determination of coefficient of Viscosity by capillary flow method.	**4**	**CLO2, CLO4**
6	Oscillations; The simple harmonic wave equation and its solution, Composition of simple harmonic motion- Lissajou's figures, Damped harmonic motion and its solution, Forced oscillation and resonance, Wave motion; Types of wave motion.	**4**	**CLO2, CLO4**
7	Expression for plane progressive wave, Energy calculation of stationary and progressive wave, Interference of sound wave, Beats, Doppler effect.	**4**	**CLO3, CLO4**
8	Electric charge, Electric force, Electric field, Coulomb's law, Gauss' law, Electric potential; their applications due to continuous charge distribution, electric dipole and quadrupole, Capacitance and capacitors.	**4**	**CLO3, CLO4**
9	The magnetic field and flux; Magnetic force on a current carrying conductor, Hall effect, Biot-Savart law and Amperes law and their applications.	**4**	**CLO3, CLO4**

SN	COURSE CONTENT	Hrs	CLOs
10	Induction; Faraday's law, Lenz law, self-induction and mutual induction, Magnetic properties of matter; Different types of magnetism, Three magnetic vectors, Permeability and Susceptibility, Hysteresis.	**4**	**CLO3, CLO4**

Teaching Learning Strategies: Classroom lecture (white board and power point presentation), reading, solving mathematical problems, showing video presentation and feedback.

TEXTBOOKS

1. David Halliday et al., Physics, John Wiley & Sons
2. Giasuddin Ahmed, Physics for engineers, Hafiz Book Centre

REFERENCE BOOKS

1. Brij Lal & N. Subrahmanyam, Heat and Thermo Dynamics, S Chand & Company
2. Brij Lal & N. Subrahmanyam, Properties of Matter, S Chand & Company
3. K. K. Tewari, Electricity & Magnetism with Electronics, S Chand & Company

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	50	
Evaluate		
Create		

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	10
Understand	15
Apply	20
Analyze	55
Evaluate	
Create	

8.2.3. Phy 1302

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** Phy 1302 **COURSE TITLE:** Physics of Matter and Electricity Sessional		
CREDIT: 0.75 (Sessional)	**TERMS OFFERED:** 1st year 2nd semester	
Exam Hours: N/A	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: This sessional course is essential for B.Sc. in engineering and technology to develop in them proper understanding of physical phenomenon, scientific temper and engineering aptitude. This course has opportunity to study and investigate physical properties through an understanding of properties of matter, thermal physics, Waves and electricity.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Determine** various physical properties by designing a simple experimental set-up.
CLO2	**Choose** a proper engineering material (solid or liquid) by determining its physical property.
CLO3	**Comprehend** and **write** effective reports, prepare documentation, make effective presentations, give and receive clear instructions.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√								√			
CLO2		√		√								
CLO3					√					√		

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Introduction	**3**	**CLO1**
2	Determination of the specific heat of a solid by the method of mixture. Determination of the specific heat of liquid by the method of cooling.	**3**	**CLO1, CLO2, CLO3**
3	Determination of the Young's modulus for the material of a given wire by Searle's apparatus. Determination of the coefficient of thermal conductivity of copper by Searle's apparatus.	**3**	**CLO1, CLO2, CLO3**
4	Determination of the density of the material of a given wire by the sonometer. Determination of the mechanical equivalent of heat (J) by electrical method.	**3**	**CLO1, CLO2, CLO3**

SN	COURSE CONTENT	Hrs	CLOs
5	Determination of the ratio of horizontal component of the earth's magnetic field (H) and the magnetic moment (M) of a magnet employing magnetometers. Comparison of the electromotive force (E.M.F) of two cells with a potentiometer.	**3**	**CLO1, CLO2, CLO3**
6	Determination of the specific resistance of a given wire by using a meter bridge. Determination of the value of unknown resistance and verification of the laws of series and parallel resistances by means of a post office box.	**3**	**CLO1, CLO2, CLO3**
7	Determination of the electro-chemical equivalent of copper by using an ammeter and copper voltammeter.	**3**	**CLO1, CLO2, CLO3**

Teaching Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video presentation and feedback.

TEXTBOOK

1. Giasuddin Ahmed, Physics for engineers, Hafiz Book Centre

REFERENCE BOOK

1. Equipment user manuals

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home) / Report (%)	Quiz & Viva (%)	In class Participation (%)
Remember	05	10	50
Understand	10	10	50
Apply	20	20	
Analyze	25	30	
Evaluate	40	30	
Create			

8.2.4. Ch 1301

DEGREE PROGRAM: B Sc. in Mechanical Engineering **COURSE CODE:** Ch 1301 **COURSE TITLE:** Inorganic and Physical Chemistry		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 1st year 2nd semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: This course covers topics that are essential to many disciplines in science and engineering, especially to mechanical engineering, with an emphasis on developing problem-solving skills. Topics include atomic structure; periodic table; solubility; chemical reactions; nomenclature of organic compounds; hydrocarbons.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Learn** the structure of atoms and different principles regarding the distribution of electrons in atoms
CLO2	**Understand** the origin of bond and classify bonding in various substances; to know the different theories of bond formation
CLO3	**Analyze** the geometry and shapes of molecules and to understand oxidation and reduction reactions
CLO4	**Illustrate** the properties of solutions and their importance
CLO5	**Interpret** the thermodynamic and kinetic forces involved in chemical reactions which determine how much and how soon products are formed
CLO6	**Assume** the direction of chemical processes (chemical equilibrium) and the factors upon which their properties depend.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√											
CLO2	√											
CLO3	√	√										
CLO4		√										
CLO5		√										
CLO6	√			√								

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Atomic structure, Quantum numbers and Different principles of electronic distribution in atoms	**6**	**CLO1**
2	Chemical bond: different types of chemical bonds, molecular structure	**6**	**CLO2**

3	Oxidation-reduction reactions	**6**	**CLO2, CLO3**
4	Solutions, Colligative properties, pH and buffer solutions	**6**	**CLO4**
5	Osmosis, Distribution law, Colloids and its Classifications	**3**	**CLO4, CLO5**
6	Chemical kinetics	**6**	**CLO5**
7	Chemical equilibrium	**6**	**CLO6**

Teaching Learning Strategies: Classroom lecture (white board and power point presentation), reading, solving mathematical problems, showing video presentation and feedback.

TEXTBOOK

1. Arun Bahl et al., Essential of Physical Chemistry, S. Chand & Company

REFERENCE BOOK

1. Raymond Chang & Kenneth Goldsby, Chemistry, McGraw-Hill Education

ASSESSMENT PATTERN

CIE: Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	Class Participation (%)
Remember	10	50
Understand	20	50
Apply	40	
Analyze	30	
Evaluate		
Create		

SEE: Semester End Examination

Bloom's Category	Final Exam (%)
Remember	10
Understand	20
Apply	30
Analyze	20
Evaluate	10
Create	10

8.2.5. Ch 1302

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** Ch 1302 **COURSE TITLE:** Inorganic and Physical Chemistry Sessional		
CREDIT: 0.75 (Sessional)	**TERMS OFFERED:** 1st year 2nd semester	
Exam Hours: N/A	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: This course covers topics that are essential to many disciplines in science and engineering, especially to mechanical engineering, with an emphasis on developing problem-solving skills. It enables the knowledge of identification and investigation of different properties and reactions like solubility; chemical reactions; nomenclature of organic compounds; hydrocarbons.

Course Learning Outcomes (CLOs): at the end of the course, the student will be able to

CLO1	**Outline** the laboratory skills needed to design, safely conduct and interpret chemical research.
CLO2	**Acquire** a foundation of chemistry of sufficient breadth and depth to enable them to understand and critically interpret the primary chemical literature
CLO3	**Develop** the ability to write up scientific information and research results
CLO4	**Improve** professionalism, including the ability to work in teams and apply basic ethical principles

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√	√										
CLO2	√											
CLO3										√		
CLO4								√	√			

SN	**COURSE CONTENT**	**Hrs.**	**CLOs**
1	Introduction	**3**	**CLO1**
2	Give proper instruction about fundamental safety rules and basic laboratory skill instruments	**3**	**CLO1**
3	Determination of the strength of supplied HCl solution; with standard Na_2CO_3 solution	**3**	**CLO2, CLO3, CLO4**
4	Determination of strength of given $Na_2S_2O_3$ solution with standard $K_2Cr_2O_7$ solution (Iodometrically)	**6**	**CLO2, CLO3, CLO4**
5	Determination of permanent hardness in a supplied water sample	**3**	**CLO2, CLO3, CLO4**

	Determination of dissolved oxygen (D.O) in a water sample	**3**	**CLO2, CLO3, CLO4**

Teaching Learning Strategies: Classroom lecture (white board and power point presentation), reading, solving mathematical problems, showing video presentation and feedback.

TEXTBOOK

1. G. H. Jeffery et al., Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & Sons Inc.

REFERENCE BOOK

1. Equipment user manuals

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	**Assignment (Class and Home) / Report (%)**	**Quiz (%)**	**In class Participation (%)**
Remember	10	10	50
Understand	20	20	50
Apply	30	20	
Analyze	20	30	
Evaluate	20	20	
Create			

8.2.6. HSS 1301

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** HSS 1301 **COURSE TITLE:** English		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 1st year 2nd semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: This course is designed to improve student's communicative competence that they will apply in their core courses as well as later in their career development. It will further enhance their proficiency in reading, grammar, vocabulary, writing and listening.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** the features of target language to meet various communication needs
CLO2	**Analyze** the linguistic and grammatical aspects of contextual source materials in target language
CLO3	**Apply** grammatical and communicative knowledge in other related courses and areas for effective communication individually and in groups
CLO4	**Evaluate** information from different reading sources for contextual and lexicographical meanings associated with professional and ethical responsibility
CLO5	**Create** various practical samples following appropriate criteria and applying knowledge of the target language

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1										√		
CLO2										√		
CLO3									√	√		
CLO4								√		√		
CLO5										√		√

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	IPA symbols (vowel and Consonant), Phonemic Transcription	**3**	**CLO1, CLO2**
2	Parts of Speech and Word Classification, Affixation and Conversion of words	**3**	**CLO2, CLO3**
3	Reading skill: Inferring, guessing meaning, skimming and scanning	**3**	**CLO2, CLO4**
4	Cohesion & coherence, Writing short composition, Long composition	**3**	**CLO5**
5	Business letters 01: i) Placing order ii) complaint letter iii) Adjustment letter	**3**	**CLO3, CLO5**
6	Joining Sentences, Right form of verbs	**3**	**CLO2, CLO3**
7	WH Questions, Clauses and Completing Complex sentences	**3**	**CLO2**
8	Transformation of Sentences, Articles and determiners	**3**	**CLO2, CLO3**
9	Error correction, Infinitive, Gerund & Participles,	**3**	**CLO2, CLO3**
10	Business correspondence 02: i) CV and Cover letter ii) E-mail writing, Technical report writing, e-tender notice	**3**	**CLO3, CLO5**

SN	COURSE CONTENT	Hrs	CLOs
11	Amplification, Information Transfer	**3**	**CLO4**
12	Usage of Tenses in real life contexts, Appropriate preposition	**3**	**CLO2, CLO3**
13	Paraphrasing, Précis writing, Writing Dialogue /conversation	**3**	**CLO3, CLO5**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing videos and solving practical problems, showing practical systems, online learning platform, feedback.

TEXTBOOKS

1. Prof. Md Ataul Haque, Prof Jahurul Islam, Dr. Binoy Barman, Friends' Language-Grammar, Reading comprehension, Writing Composition, Friends' book corner, Dhaka.
2. Dr. Islam Md. Hashanat, Professional English, Friends' Book Corner, Dhaka.

REFERNCE BOOKS:

1. Wren and Martin, High School English Grammar and Composition, S Chand Publishing.
2. Sadruddin Ahmed, Learning English - The Easy Way, Friends' Book Corner, Dhaka.
3. David Morgan, Nicholas Regan, Take-off: Technical English for Engineering Course Book with Audio CDs, Garnet Education.
4. Eric H. Glendinning and Norman Glendinning, Oxford English for Electrical and Mechanical Engineering, Oxford University Press.
5. John Langan, College Writing Skills with Readings, McGraw-Hill Education.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	25	
Analyze	25	
Evaluate	20	
Create		

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	10
Understand	15
Apply	10
Analyze	20
Evaluate	25
Create	20

8.2.7. ME 1503

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 1503 **COURSE TITLE:** Basic Thermodynamics		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 1st year 2nd semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: Basic thermodynamics is preliminary course of thermal engineering field. Different basic concepts and knowledge will be attained throughout the course like understanding of the various processes, cycles, laws of thermodynamics, the conversion of work-energy, applications of work-energy in various systems and interrelationships amongst those at various environments. This course is also a prerequisite for applied thermodynamics.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** the various processes and various laws of thermodynamics and many systems that are susceptible to many parametric functions such as temperature, pressure, volume, enthalpy etc. in various environments.
CLO2	**Interpret** about the conversion of work to energy and vice versa and its applications in various systems and know how to function the thermal systems properly for a long period of time with minimum maintenance.
CLO3	**Know** the application of various basic laws of nature that cannot be perceived without having any in-depth discussion on this course.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	√	√										
CLO2	√	√										
CLO3	√	√										

SN	COURSE CONTENT	Hrs	CLOs
1	Fundamental concepts and definition; Laws of thermodynamics and their applications	**3**	**CLO1**
2	Zeroth law of thermodynamics; First law of thermodynamics and corollaries	**3**	**CLO1**
3	Energy analysis of control mass and control volume system, non-flow and flow processes	**4**	**CLO2, CLO3**
4	Second law of thermodynamics and corollaries, Entropy and exergy analysis	**3**	**CLO1, CLO3**
5	Third law of thermodynamics; Thermodynamic relations	**2**	**CLO1, CLO2**
6	Properties of pure substances and thermodynamic processes	**3**	**CLO2**
7	Ideal gas cycles: Carnot cycle, Otto cycle, Diesel cycle, Dual cycle, Brayton/Joule cycle	**5**	**CLO1**
8	Stirling cycle, Erickson cycle, Atkinson cycle; Vapor power cycle: Carnot cycle, Reversed Carnot cycle, Rankine cycles	**5**	**CLO1**
9	Mixture of ideal & real gases; Gas vapor mixture; Boilers	**5**	**CLO2, CLO3**
10	Fuels: Characteristics and analysis; calorific value and measurement	**4**	**CLO2, CLO3**
11	Combustion: Flue gas and analysis	**2**	**CLO3**

Teaching Learning Strategies: Classroom lecture (white board and power point presentation), reading, solving mathematical problems, showing video presentation and feedback.

TEXTBOOKS

1. Yunus A. Çengel & Michael A. Boles, Thermodynamics: An Engineering Approach, McGraw-Hill Education
2. R.S. Khurmi & Joyeeta Gupta, A Textbook of Thermal Engineering, Chand (S.) & Co Ltd

REFERENCE BOOKS

1. Borgnakke et al., Fundamentals of Thermodynamics, Wiley
2. P.K. Nag, Engineering Thermodynamics by, McGraw-Hill Education
3. G.F.C. Rogers & Yon Mayhew, Engineering Thermodynamics: Work and Heat Transfer, Longman Pub Group

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	20	50
Understand	45	50
Apply	30	
Analyze	05	
Evaluate		
Create		

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	20
Understand	40
Apply	30
Analyze	10
Evaluate	
Create	

8.2.8. ME 1504

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 1504 **COURSE TITLE:** Basic Thermodynamics Sessional		
CREDIT: 0.75 (Sessional)	**TERMS OFFERED:** 1st year 2nd semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: The course is designed to investigate different processes, properties and verify laws of thermodynamics. It also analyzes the importance of different properties and how they are related with each other.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Learn** how to make experimental setup for analyzing problems individually or collectively
CLO2	**Investigate** and **calculate** different thermodynamic properties and make effective reports
CLO3	**Analyze** and **solve** problems related to open and closed systems devices by applying the conservation of energy principle

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs)-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	√								√			
CLO2				√						√		
CLO3		√										

SN	COURSE CONTENT	Hrs	CLOs
1	Introduction	**3**	**CLO1**
2	Experiment 1: Determination of heating value of Coal by Bomb Calorimeter	**3**	**CLO1, CLO2, CLO3**
3	Experiment 2: Determination of Carbon residue of an Oil by Conradson method	**3**	**CLO1, CLO2, CLO3**
4	Experiment 3: Determination of the viscosity of different Oils using Saybolt Viscosimeter	**3**	**CLO1, CLO2, CLO3**
5	Experiment 4: (a) Determination of Flash point and Fire point of Diesel (b) Study of the technique of temperature measurement with Thermocouple Thermometer	**6**	**CLO1, CLO2, CLO3**
6	Experiment 5: Determination of heating value of Natural Gas by Gas Calorimeter	**3**	**CLO1, CLO2, CLO3**

Teaching Learning Strategies: Classroom lecture (white board and power point presentation), reading, solving mathematical problems, showing video presentation and feedback.

TEXTBOOKS

1. Yunus A. Çengel & Michael A. Boles, Thermodynamics: An Engineering Approach, McGraw-Hill Education
2. R.S. Khurmi & Joyeeta Gupta, A Textbook of Thermal Engineering, Chand (S.) & Co Ltd

REFERENCE BOOK

1. Equipment user manuals

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home) / Report (%)	Quiz (%)	Board Viva (%)	In class Participation (%)
Remember	05	05	50	50
Understand	25	25	30	50
Apply	40	30	20	
Analyze	30	40		
Evaluate				
Create				

8.2.9 ME 1006

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 1006 **COURSE TITLE:** Engineering Drawing-II		
CREDIT: 1.50 (Sessional)	**TERMS OFFERED:** 1st year 2nd semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: Engineering Drawing is the foundation block which strengthens the engineering & technological structure. It is a transmitting link between the ideas and realization. The profile aims at developing the ability to draw and read various drawings, curves & projections of different mechanical parts.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Develop** imagination and ability to represent the shape, size and specifications of physical objects. Familiarize with the improper and incorrect drawing.
CLO2	**Improve** of visualization skills so that these skills will help in developing new products.
CLO3	**Learn** the main idea from assembly and detail drawing.
CLO4	**Represent** of mechanical objects by using different drawing methods.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	√											
CLO2		√										
CLO3	√											
CLO4									√	√		

SN	COURSE CONTENT	Hrs	CLOs
1	Introduction; Instruments and their uses	**3**	**CLO1, CLO4**
2	Review of first and third angle projections	**3**	**CLO2**
3	Orthographic drawings	**6**	**CLO2, CLO4**
4	Isometric views	**6**	**CLO2, CLO4**
5	Missing lines and views	**3**	**CLO3, CLO4**
6	Sectional views and conventional practices	**3**	**CLO3, CLO4**
7	Auxiliary views.	**3**	**CLO3, CLO4**
8	Fasteners and gears, working drawing of machine elements with sectional views;	**6**	**CLO2, CLO3, CLO4**
9	Detail drawing; sub-assembly drawing, assembly drawing.	**6**	**CLO2, CLO3, CLO4**

Teaching Learning Strategies: Classroom lecture (white board and power point presentation), reading, solving mathematical problems, showing video presentation and feedback.

TEXTBOOK

1. Amalesh Chandra Mandal & Md Quamrul Islam, Mechanical engineering drawing, BUET

REFERENCE BOOKS

1. N.D. Bhatt, Engineering Drawing, Charotar Publishing House Pvt Ltd
2. P.S. Gill, Engineering Drawing, S.K. Kataria & Sons
3. David E. Goetsch, Technical Drawing for Engineering Communication, Cengage Learning

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home) / Report (%)	Quiz (%)	Board Viva (%)	In class Participation (%)
Remember	10	10	50	50
Understand	40	50	30	50
Apply	50	40	20	
Analyze				
Evaluate				
Create				

8.3. 2nd Year 1st Semester

8.3.1. Math 2301

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** Math 2301 **COURSE TITLE:** Coordinate Geometry, Matrices and Vector Analysis		
CREDIT: 4.0 (Theory)	**TERMS OFFERED:** 2nd year 1st semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: The goal of this course is to make students familiar with the ideas of matrices and their application in solving engineering problems involving systems of linear equations, as well as introduce vector analysis and coordinate geometry which will provide natural aid to understanding of geometry and physical concepts.

Course Learning Outcomes (CLOs): at the end of the course, the student will be able to

CLO1	**Formalize** physical problems mathematically by a system of simultaneous linear equations in matrix form and **apply** different methods of solution.
CLO2	**Demonstrate** understanding of the principles and concepts of coordinate geometry and use appropriate formulas to solve coordinate geometry equations.
CLO3	**Characterize** rotation in a field expressing conservation of mass and fluid flow.
CLO4	**Apply** or relate vector fields and integrals theorems. Also **differentiate** between the theorems.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√	√										
CLO2		√	√									
CLO3	√	√										
CLO4		√										

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Definition of matrices, Matrix algebra, Transpose, Inverse of a matrix, ranks of matrices. Definition of scalar and vectors, Vector algebra, Cross product, Triple product and multiple products.	**5**	**CLO1, CLO4**
2	Solution of simultaneous equation by matrix method. Differentiation and integration of vectors together with elementary applications.	**6**	**CLO1, CLO4**

SN	COURSE CONTENT	Hrs	CLOs
3	Definitions of line, surface and volume integrals, Gradient of a scalar function, Divergence and curl of a vector functions, Various formulae.	**6**	**CLO3, CLO4**
4	Green's theorem, Stoke's theorem and Gauss's theorem.	**5**	**CLO3, CLO4**
5	Transformation of coordinates, Pair of straight lines.	**6**	**CLO2**
6	Circle, System of circles, General equation of second-degree Parabola, Ellipse, Hyperbola in Cartesian and Polar coordinates.	**6**	**CLO2**
7	Parabola, Ellipse, Hyperbola in Cartesian and Polar coordinates.	**8**	**CLO2**
8	System of coordinates, Distance between two points, Section formulae, Projection Direction cosines, Equations of planes and straight lines.	**10**	**CLO2**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing videos and solving practical problems, showing practical systems, online learning platform, feedback.

TEXTBOOK

1. A.F. M. Abdur Rahman, P. K. Bhattacharjee, A text book on co-ordinate geometry with vector analysis: two and three dimensions, New Book Palace.

REFERENCE BOOKS

1. Khosh Mohammad, A text book on co-ordinate geometry and vector analysis, Ideal Library, 2001.
2. Murray R. Spiegel, Seymour Lipschutz, Dennis Spellman, Vector Analysis: Schaum's Outlines Series, McGraw Hill Education (India) Private Limited.
3. Howard Anton, Elementary Linear Algebra, Wiley.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	20	50
Understand	20	50
Apply	30	
Analyze	30	
Evaluate		

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	15
Understand	15
Apply	30
Analyze	30
Evaluate	10

8.3.2. Phy 2301

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** Phy 2301 **COURSE TITLE:** Optics and Modern Physics		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 2nd year 1st semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: The overall objective of this course is to learn about Physics optics in which interference, diffraction and polarization of light is to be discussed which is necessary to characterize optical properties of any material substances for mechanical application.

Course Learning Outcomes (CLOs): at the end of the course, the student will be able to

CLO1	**Determine** refractive index, wavelength of monochromatic light, resolving and dispersive power of a grating, specific rotation of sugar solution etc.
CLO2	**Analyze** crystal structure and defects of crystal to identify a crystalline material without defect.
CLO3	**Apply** Schrödinger equation for a harmonic oscillator and particle in a box.
CLO4	**Choose** a proper photo-metal to develop a sustainable photocell.
CLO5	**Calculate** the total lifetime and activity of a radioactive element.
CLO6	**Compute** the radius and energy of any orbit of any atom.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	√											
CLO2	√	√										
CLO3		√	√									
CLO4			√									
CLO5	√											
CLO6	√											

SN	COURSE CONTENT	Hrs	CLOs
1	**Optics:** Interference; Huygen's principle, Young's experiment, Coherent sources and it's production methods, Analytical treatment of Interference, Interference from thin films, Newton's rings.	**5**	**CLO1**
2	Diffraction; Fresnel and Fraunhoffer diffraction, Fraunhoffer diffraction by by single and double slit, Plane diffraction grating, Resolving and dispersive power of a grating.	**4**	**CLO1**
3	Polarization; Polarization by reflection, Refraction, Double refraction, Brewster's law and Malus law, Elliptical and circular polarization of light.	**4**	**CLO1**
4	**Structure of Solid:** Crystal structure; Crystalline and amorphous solids, Different types of bonds in crystal and cohesive energy, Different types of crystal structure, Simple cubic, Body centered cubic and Face centered cubic crystal structure, Packing fraction, Miller indices and crystal plane, Defects in solids, Band theory of solids.	**4**	**CLO2**
5	**Modern Physics:** Relativity; Postulates of special theory of Relativity, Galilean and Lorentz transformation equations, Length contraction, Time dilation, Twin paradox, Variation of mass with velocity, Einstein mass energy relation.	**4**	**CLO4**
6	Particle properties of wave; Quantum theory of light, Photoelectric effect, Compton effect, Pair production, X-rays and Xray diffraction, Photons and Gravity, Gravitational red shift, Wave properties of particle; Concept of de-Broglie wave, Phase velocity and group velocity, Heisenberg's Uncertainty principle and its application.	**4**	**CLO4**
7	Atomic Structure; Atom models, Electron orbits, Energy levels and spectral series of Hydrogen atom, Bohr's correspondence principle.	**4**	**CLO6**
8	Nuclear structure; Nuclear compositions, Mass defect, Binding energy, Nuclear decay; Radioactive decay, Laws of radioactive decay, Half-life and mean life, Radioactive series, Nuclear fission and fusion, Q- value of nuclear reaction.	**4**	**CLO5**
9	Quantum Mechanics, Operators, Expectation values, Particle in a box.	**6**	**CLO3**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing videos and solving practical problems, showing practical systems, online learning platform, feedback.

TEXTBOOKS

1. Halliday, Resnick, Krane, Physics I & II, John Wiley and Sons Ltd.
2. Arthur Beiser, Concepts of Modern Physics, McGraw-Hill Higher Education.

REFERENCE BOOKS

1. N Subrahmanyam and Brijlal, A textbook of Optics, S Chand & Co.
2. Gias Uddin Ahmad, Physics for engineers, part 1, Hafiz Book Centre, Dhaka.

3. R Murugeshan & Kiruthiga Sivaprasath, Modern Physics.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	25	50
Understand	30	50
Apply	25	
Analyze	15	
Evaluate	05	

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	20
Understand	30
Apply	20
Analyze	20
Evaluate	10

8.3.3. Phy 2302

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** Phy 2302 **COURSE TITLE:** Optics and Modern Physics Sessional		
CREDIT: 0.75 (Sessional)	**TERMS OFFERED:** 2nd year 1st semester	
Exam Hours: NA	**CIE Marks: 100**%	**SEE Marks:** 00%

Course Objectives/Summary: The aim of this course is to develop proper understanding of physical phenomenon, scientific temper and engineering aptitude. This course has opportunity to study physical properties through an understanding of properties of matter, optics, thermal physics, waves and electricity.

Course Learning Outcomes (CLOs): at the end of the course, the student will be able to

CLO1	**Determine** various physical and optical properties by designing a simple experimental set-up.
CLO2	**Choose** a proper engineering material (solid or liquid) by determining its physical properties.
CLO3	**Comprehend** and write effective reports, prepare documentation, make effective presentations, communicate through clear instructions.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1				√					√			
CLO2				√					√			
CLO3									√	√		

SN	COURSE CONTENT	Hrs	CLOs
1	Introduction	**3**	**CLO1**
2	(a) Determination of the refractive index of a prism by spectrometer. (b) Determination of the radius of curvature of plano-convex lens by Newton's ring method.	**3**	**CLO1, CLO3**
3	(a) Determination of resolving power of a plane diffraction grating. (b) Determination of the specific rotation of a sugar solution by a polarimeter.	**3**	**CLO1, CLO3**
4	(a) Determination of the co-efficient of thermal conductivity of copper by Searle's apparatus. (b) Determination of the wavelength of sodium light by a spectrometer using a plane diffraction grating.	**3**	**CLO1, CLO2, CLO3**
5	(a) Verification of the laws of transverse vibration of a string and determination of the frequency of a tuning fork by Melde's experiment. (b) Determination of the unknown frequency of a tuning fork by a sonometer verifying (n- l) curve.	**3**	**CLO1, CLO3**
6	(a) Determination of the threshold frequency for the photoelectric effect of a photocathode and the value of the Planck's constant.	**3**	**CLO1, CLO2, CLO3**
7	(a) To plot thermo-electromotive force-temperature (calibration) curve for a given thermocouple. (b) Determination of the melting point of a solid using the calibration curve.	**3**	**CLO1, CLO2, CLO3**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing videos and solving practical problems, demonstration of experiment and conduct experiment, online learning platform, feedback.

TEXTBOOK

1. Dr. Giasuddin Ahmad and Md. Shahabuddin, Practical Physics for Degree Students, Hafiz Book Centre, Dhaka.

REFERENCE BOOK

1. Supplied lab manuals

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home) / Report (%)	Quiz (%)	In class Participation (%)
Remember	10	20	50
Understand	20	20	50
Apply	20	30	
Analyze	30	15	
Evaluate	20	15	

8.3.4. Ch 2301

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** Ch 2301 **COURSE TITLE:** Industrial Chemistry		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 2nd year 1st semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: This course covers topics including mixtures, solutions, boiler water chemistry, corrosion, alkalinity and polymer chemistry. Students learn fundamentals of atom structures, acidity, alkalinity, corrosion, and water testing and treatment relating to marine boilers and engines.

Course Learning Outcomes (CLOs): at the end of the course, the student will be able to

CLO1	**Recognize** many functional groups and their reactivity.
CLO2	**Classify** different fundamental bond forming reactions and **comprehend** how to apply them in synthesis.
CLO3	**Discuss** fundamentals of non-metallic engineering materials and polymer chemistry.
CLO4	**Explain** different impurities present in water and the essential treatment methods for their removal.
CLO5	**Evaluate** fuel and lubricant properties.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	√											
CLO2	√											
CLO3	√											
CLO4	√						√					
CLO5	√	√										

SN	COURSE CONTENT	Hrs	CLOs
1	Functional groups in organic chemistry.	**5**	**CLO1**
2	Additional reaction of alkene, alkyne and carbonyl compounds.	**6**	**CLO1, CLO2**
3	Grignard reagent, Friedel-Crafts reaction and Wurtz-Fittig reaction.	**6**	**CLO1, CLO2**
4	Polymers, its classification and properties.	**5**	**CLO3**
5	Important plastic, natural and synthetic rubber manufacturing process.	**4**	**CLO3**
6	Glass and ceramics manufacturing process.	**4**	**CLO3**
7	Corrosion, its classification and prevention, Water treatment.	**5**	**CLO3, CLO4**
8	Fuel and lubricant and their properties.	**4**	**CLO5**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing videos and solving practical problems, showing practical systems, online learning platform, feedback.

TEXTBOOK

1. Prof. Dr. Md Monimul Haque, Chemistry of Engineering Materials.

REFERENCE BOOKS

1. Harish Kumar and Anupama Parmar, Engineering Chemistry: A Textbook, Alpha Science International, Harrow, U.K.
2. Fred W. Billmeyer Jr., Text book of Polymer Science, Ohn Wiley & Sons.
3. Arun Bahl & B S Bahl, A Textbook of Organic Chemistry, S Chand & Company.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	30	50
Understand	30	50
Apply	25	
Analyze	15	
Evaluate		

SEE: Semester End Examination

Bloom's Category	Final Exam (%)
Remember	25
Understand	30
Apply	20
Analyze	15
Evaluate	10

8.3.5. HSS 2302

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** HSS 2302 **COURSE TITLE:** English Language Practice		
CREDIT: 0.75 (Sessional)	**TERMS OFFERED:** 2nd year 1st semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: This course is designed to improve student's communicative competence that they will apply in their core courses as well as later in their career development. It will further enhance their proficiency in reading, grammar, vocabulary, writing and listening.

Course Learning Outcomes (CLOs): at the end of the course, the student will be able to

CLO1	**Develop** communicative competence with emphasis on reading, writing, listening and speaking to facilitate lifelong learning.
CLO2	**Analyze** contextualized reading materials to reformulate information and use creative and analytical language to identify and clarify issues and solve problems in their core courses in written form.
CLO3	**Develop** speaking skills by their control of language in ways that will help them in lifelong learning and in their careers both individually and as part of a team.
CLO4	**Analyze** contextualized listening texts to provide necessary information and data.

CLO5	**Demonstrate** various practical skills following appropriate criteria and **apply** knowledge of the target language.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1										√		√
CLO2										√		
CLO3									√	√		√
CLO4										√		
CLO5										√		

SN	COURSE CONTENT	Hrs	CLOs
1	Introduction	**3**	**CLO1**
1	I) Listening Skill Development (Dictocomp, Websites) II) Speaking Skill Development (Ice breaking session "Who am I")	**1.5**	**CLO1, CLO3, CLO4**
	I) Writing Skill Development (Paragraph Writing) II) Reading Skill Development (Skimming & Scanning)	**1.5**	**CLO1, CLO2, CLO5**
2	I) Listening Skill Development (Websites) II) Speaking Skill Development (Introducing oneself in a conversation, Discussion on a given topic)	**1.5**	**CLO1, CLO3, CLO4**
	I) Writing Skill Development (Essay Writing-Descriptive Essay) II) Reading Skill Development (Inferencing & Guessing meaning from context)	**1.5**	**CLO1, CLO2, CLO5**
3	I) Listening Skill Development (Songs) II) Speaking Skill Development (Presentation on a given topic)	**1.5**	**CLO1, CLO3, CLO4**
	I) Writing Skill Development (Using cohesive devices in writing) II) Reading Skill Development (Paraphrasing)	**1.5**	**CLO1, CLO2, CLO5**
4	I) Listening Skill Development (Listening to speech) II) Speaking Skill Development (Debate)	**1.5**	**CLO1, CLO3, CLO4**
	I) Writing Skill Development (Essay Writing-Argumentative Essay)	**1.5**	**CLO1, CLO2**

SN	COURSE CONTENT	Hrs	CLOs
	II) Reading Skill Development (Summary writing)		
5	I) Listening Skill Development (Websites) II) Speaking Skill Development (Mock interview)	**1.5**	**CLO1, CLO3, CLO4**
	I) Writing Skill Development (Essay Writing-Comparison/Contrast Essay) II) Reading Skill Development (Reading Comprehension)	**1.5**	**CLO1, CLO2**
6	I) Listening Skill Development (Websites) II) Speaking Skill Development (Role Playing)	**1.5**	**CLO1, CLO4, CLO4**
	I) Writing Skill Development (Essay Writing-Cause & Effect Essay) II) Reading Skill Development (Reading Comprehension)	**1.5**	**CLO1, CLO2**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing videos and solving practical problems, showing practical systems, online learning platform, feedback.

TEXTBOOK

1. Peter Roach, English Phonetics and Phonology - A Practical Course, Cambridge University Press.

REFERENCE BOOKS

1. Dr. Islam Md. Hashanat, Professional English, Friends' Book Corner, Dhaka.
2. Nitin Bhatnagar, Mamta Bhatnagar, Communicative English for Engineers and Professionals, Pearson.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Reading and Writing Assignment (%)	Listening (%)	Speaking (%)	In class Participation (%)
Remember	10	10	50	50
Understand	20	20	30	50
Apply	30	20	20	
Analyze	20	30		
Evaluate	20	20		

8.3.6. EEE 2103

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** EEE 2103 **COURSE TITLE:** Basic Electrical Engineering		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 2nd year 1st semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: This course gives an overview of the fundamental aspects of electrical engineering which includes laws of D.C. and A.C. electric circuit, network analysis, electromagnetic forces and torque, balanced poly-phase circuits, and measuring instruments. The overall objective of this course is to learn how to analyze the D.C. and A.C. electrical circuits, design single-phase and poly-phase balanced electrical circuits to have given motions.

Course Learning Outcomes (CLOs): at the end of the course, the student will be able to

CLO1	**Comprehend** basic electrical elements, laws, electrical circuits, electromagnetic force, details concept on electric motor and generator.
CLO2	**Analyze** the various circuit networks, different characteristics of electric motor and generator, single phase and poly phase ac system.
CLO3	**Apply** different laws in electrical circuit solution, and concepts of various measuring instrument to select appropriate instrument in particular application.
CLO4	**Evaluate** the designed circuit parameters based on electrical laws, design codes and standards.
CLO5	**Design** appropriate circuit and networks and select appropriate motor/generator and measuring instrument for specific application.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√											
CLO2	√	√										
CLO3			√									
CLO4	√		√									
CLO5			√									

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Laws of electric circuit: Ohm's law, Kirchhoff's voltage and current laws, delta-wye transformation.	**3**	**CLO1, CLO2**
2	Network Analysis: Network analysis methods of branch and loop currents, method of node-pair voltages,	**4**	**CLO2, CLO3**
3	Network Theorem: Norton's theorm, Thevenin's theorem and Superposition theorem.	**4**	**CLO1, CLO2**

SN	COURSE CONTENT	Hrs	CLOs
4	A.C. Circuits: Introduction to AC Circuits, Instantaneous current and power, R-, L-, C-, RL-, RC- and RLC- circuits. Effective current and voltage, average values, form factor, crest factor, power-real and reactive.	**6**	**CLO1, CLO2**
5	Impedances in polar and Cartesian forms. Sinusoidal single phase circuit analysis. Impedance in series, parallel branches, series-parallel circuits.	**4**	**CLO3, CLO4**
6	Electromagnetic forces & torque: Forces upon a current-carrying conductor and charged particle moving in a magnetic field. Electric motor. Electromagnetic induction and emf, Lenz's law, Blv rule, A.C. generator.	**6**	**CLO1, CLO2, CLO5**
7	Precision Motion: Balanced poly-phase circuits: Three-phase, four wire system of generated emfs, three-phase, three-wire systems, balanced wye loads, balanced delta loads, power in balanced systems, power factor.	**8**	**CLO2, CLO4, CLO5**
8	Measuring Instruments: Ammeter, Voltmeter, Wattmeter etc.	**4**	**CLO3, CLO5**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing videos and solving practical problems, showing practical systems, online learning platform, feedback.

TEXTBOOKS

1. Russell M. Kerchner & George F. Corcoran, Alternating-Current Circuits, John Wiley & Sons.
2. B.L. Theraja and A.K. Theraja, A Textbook of Electrical Technology Volume II – AC and DC machines, S Chand and Company Limited.

REFERENCE BOOKS

1. Charles K. Alexander and Matthew N.O. Sadiku, Fundamentals of Electric Circuits, McGraw-Hill Education.
2. A.E. Puchstein, T.C. Lioyd, A.G. Conrad, Alternating-Current Machines, John Wiley/Charles E. Tuttle.
3. T. K. Nagsarkar and M. S. Sukhija, Basic Electrical Engineering, Oxford University Press.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	20	50
Apply	25	
Analyze	30	
Evaluate	10	

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	10
Understand	15
Apply	20
Analyze	20
Evaluate	20
Create	15

8.3.6. EEE 2104

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** EEE 2104 **COURSE TITLE:** Basic Electrical Engineering Sessional		
CREDIT: 0.75 (Sessional)	**TERMS OFFERED:** 2nd year 1st semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: This course is designed to provide the practical knowledge about the fundamental of electrical circuits along with applying the basic circuit laws practically by performing sessional in laboratory. It will help them to perceive how to simplify a large linear bilateral circuit. In addition to that, the students acquire the basic knowledge of stationary as well as rotary machines.

Course Learning Outcomes (CLOs): at the end of the course, the student will be able to

CLO1	**Analyze** the different characteristics of various electric motors and generators.
CLO2	**Apply** the different electrical laws in circuit design and network analysis.
CLO3	**Evaluate** the designed circuit parameters based on electrical laws, design codes and standards.
CLO4	**Design** appropriate techniques to measure the electric power and extend the range of measuring instruments (voltmeter and ammeter).

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	√											
CLO2		√	√						√			
CLO3		√	√						√			
CLO4			√		√				√			

SN	COURSE CONTENT	Hrs	CLOs
1	Introduction to different electrical components, machines, measuring instruments and their applications.	**6**	**CLO1, CLO4**
2	Observe the different characteristic of various electric motor/generator.	**3**	**CLO1**
3	Verification of Thevenin's theorem and maximum power transfer theorem.	**3**	**CLO2, CLO3**
4	Study about the series R-L-C resonance circuit.	**3**	**CLO2, CLO3**
5	Three phase power measurement using two watt-meter method.	**3**	**CLO3, CLO4**
6	Extension of Ammeter and Voltmeter range.	**3**	**CLO3, CLO4**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing videos and solving practical problems, showing practical systems, demonstration of experiment and conduct experiment, Online learning platform, feedback.

TEXTBOOKS

1. Russell M. Kerchner & George F. Corcoran, Alternating-Current Circuits, John Wiley & Sons.
2. B.L. Theraja and A.K. Theraja, A Textbook of Electrical Technology Volume II – AC and DC machines, S Chand and Company Limited.

REFERENCE BOOKS

1. Stephen J. Chapman, Electric Machinery Fundamentals, McGraw-Hill Education.
2. A.E. Puchstein, T.C. Lioyd, A.G. Conrad, Alternating-Current Machines, John Wiley/Charles E. Tuttle.
3. T. K. Nagsarkar and M. S. Sukhija, Basic Electrical Engineering, Oxford University Press.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home) / Report (%)	Design Project (%)	Board Viva (%)	In class Participation (%)
Remember			50	50
Understand	10	10	30	50
Apply	15	10	20	
Analyze	25	30		
Evaluate	30	20		
Create	20	30		

8.3.8. ME 2401

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 2401 **COURSE TITLE:** Engineering Mechanics-II		
CREDIT: 4.0 (Theory)	**TERMS OFFERED:** 2nd year 1st semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: The primary purpose of this course is to develop the capacity to predict the effects of force and motion while carrying out the creative design functions of engineering. One of the primary objectives is to help the students develop this ability to visualize which is so vital to problem formulation in the context of engineering application.

Course Learning Outcomes (CLOs): at the end of the course, the student will be able to

CLO1	**Comprehend** the principles of engineering mechanics including: Newton's laws, equilibrium, free body diagrams and appropriate units.
CLO2	**Analyze** the reaction of different structural elements by reducing a complex structure into appropriate sub- systems/elements.
CLO3	**Apply** the laws of equilibrium to solve for the forces and moments and also to determine the effect of forces and moments on a structure.
CLO4	**Evaluate** the designed structural elements based on materials data, design codes and standards.
CLO5	**Design** appropriate structural elements and select from manufacturers' catalogues.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√											
CLO2	√	√										
CLO3			√									
CLO4	√		√									
CLO5			√		√							

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Introduction and basic concepts of engineering mechanics	**2**	**CLO1**
2	Resultant and components of forces; Rectangular components of two- and three-dimensional forces; Moment of forces; Couples; Equilibrium of co-planar forces	**6**	**CLO2, CLO3**
3	Concept of free body diagrams; Equilibrium of particle and rigid bodies in two and three dimensions	**4**	**CLO1, CLO2**

SN	COURSE CONTENT	Hrs	CLOs
4	Centroids and center of gravity of lines, areas and bodies	**4**	**CLO2, CLO3**
5	Moment of inertia of area and masses	**4**	**CLO2, CLO3**
6	Forces in cables, trusses and frames; Friction: surface friction, roller friction and belt friction	**6**	**CLO4, CLO5**
7	Introduction to linear motions: displacement, velocity, acceleration; Concepts of absolute and relative velocity and acceleration and their graphical solution	**6**	**CLO2, CLO3**
8	Newton's laws of motion; Conservation of momentum; Concept of dynamic equilibrium and inertia force; Motion under a central force; Application to space mechanics	**6**	**CLO2, CLO3**
9	Work, power and energy of particle and rigid body of a force; Power and efficiency; Conservation of energy; Principle of impulse and momentum; Impulsive force and impact	**6**	**CLO2, CLO3**
10	General plane motions: translation and rotation; Concept of instantaneous center; Absolute and relative velocity and acceleration and equation of motion in plane motion; Constrained plane motion	**8**	**CLO2, CLO3**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing videos and solving practical problems, showing practical systems, online learning platform, feedback.

TEXTBOOKS

1. Ferdinand P. Beer, E. Russell Jhonston, Jr., David F. Mazurk and Phillip J. Cornwell, Vector Mechanics for Engineers, McGraw-Hill Education.
2. R.K. Rajput, A Text Book of Applied Mechanics, Laxmi Publications.

REFERENCE BOOKS

1. R.C. Hibbeler, Statics and Mechanics of Materials, Pearson.
2. S.S. Bhavikatti, Engineering Mechanics, New Age International Private Limited.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	30	
Evaluate	20	

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	05
Understand	15
Apply	10
Analyze	20
Evaluate	30
Create	20

8.3.8. ME 2402

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 2402 **COURSE TITLE:** Engineering Mechanics-II Sessional		
CREDIT: 0.75 (Sessional)	**TERMS OFFERED:** 2nd year 1st semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: This course aims to analyze and predict the behavior of physical systems and leads to skills that an engineer can directly apply to basic analysis and design. These range from structural analysis, advanced dynamics, fluid and particle mechanics to engineering acoustics.

Course Learning Outcomes (CLOs): at the end of the course, the student will be able to

CLO1	**Analyze** the reaction of different structural elements by reducing a complex structure into appropriate sub- systems/elements.
CLO2	**Apply** the laws of equilibrium to solve for the forces and moments and also to determine the effect of forces and moments on a structure.
CLO3	**Evaluate** the designed structural elements based on materials data, design codes and standards.
CLO4	**Design** appropriate structural elements and select from manufacturers' catalogues.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	√	√										
CLO2		√	√									
CLO3			√						√			
CLO4			√						√			

SN	COURSE CONTENT	Hrs	CLOs
1	Introduction	**3**	**CLO1**
2	Problem Solving Session-1: Resultant and components of forces; Moment of forces; Couples; Equilibrium of co-planar forces	**3**	**CLO1, CLO2**
3	Problem Solving Session-2: Centroids and center of gravity of lines, areas and bodies; Moment of inertia of area and masses	**3**	**CLO1, CLO2**
4	Problem Solving Session-3: Forces in cables, trusses and frames; Linear motion; Newton's second law	**3**	**CLO4, CLO5**
5	Problem Solving Session-4: Conservation of momentum and energy; Impulsive force and impact; General plane motions	**3**	**CLO1, CLO2**
6	Determination of mass of roller of a centrifugal force apparatus	**3**	**CLO2, CLO3**
7	Determination of co-efficient of static friction of different materials (metal on metal, glass on metal, leather on metal, wood on metal)	**3**	**CLO2, CLO3**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing videos and solving practical problems, showing practical systems, demonstration of experiment and conduct experiment, online learning platform, feedback.

TEXTBOOKS

1. Ferdinand P. Beer, E. Russell Jhonston, Jr., David F. Mazurk and Phillip J. Cornwell, Vector Mechanics for Engineers, McGraw-Hill Education.
2. R.K. Rajput, A Text Book of Applied Mechanics, Laxmi Publications.

REFERENCE BOOKS

1. R.C. Hibbeler, Statics and Mechanics of Materials, Pearson.
2. S.S. Bhavikatti, Engineering Mechanics, New Age International Private Limited.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home) / Report (%)	Design Project (%)	Board Viva (%)	In class Participation (%)
Remember			50	50
Understand	10	10	30	50
Apply	15	10	20	
Analyze	25	30		
Evaluate	30	20		
Create	20	30		

8.3.9. ME 2002

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 2002 **COURSE TITLE:** Computer Programming		
CREDIT: 0.75 (Sessional)	**TERMS OFFERED:** 2nd year 1st semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: This course is designed with a view to equipping the students with theory and practice on problem solving techniques through structured programming approach using FORTRAN/C programming language. The ultimate purpose of this course is to make students efficient at numeric computation and scientific computing.

Course Learning Outcomes (CLOs): at the end of the course, the student will be able to

CLO1	**Discuss** basic concepts of different computer parts and history of computer programming.
CLO2	**Explain** the rules of declaring valid identifier with valid data types, concepts of different operators, array, pointers and syntax of a Fortran/C program.
CLO3	**Apply** control statements for decision making based on the values of an identifiers, looping statements to calculate various series problems and basic I/O statements to read/write from/to a file.
CLO4	**Create/Write** programs with user defined functions, pointers and arrays.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√											
CLO2	√				√							
CLO3					√							
CLO4		√	√		√							√

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Introduction to Fortran/C programming languages;	**3**	**CLO1**
2	Fortran/C Fundamentals- Data Types and Expressions, Basic Input Output Statements, Operators and Their Precedence, Libraries and Keywords and File Handling	**5**	**CLO2, CLO3**
3	Control Statements, Looping Statements	**5**	**CLO2, CLO3**
4	User Defined Functions	**3**	**CLO4**
5	Arrays and Strings, Pointers	**5**	**CLO4**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing videos and solving practical problems, programming on computers, online learning platform, feedback.

TEXTBOOK

1. Stephen J. Chapman, Fortran for Scientists & Engineers, McGraw-Hill Science/Engineering/Math.

REFERENCE BOOKS

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language.
2. http://www.cplusplus.com/doc/tutorial.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home) / Report (%)	Quiz (%)	Board Viva (%)	In class Participation (%)
Remember	10	10	50	50
Understand	20	20	40	30
Apply	40	50	10	
Create	30	20		20

8.4. 2nd Year 2nd Semester

8.4.1. Math 2303

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** Math 2303 **COURSE TITLE:** Complex Variables and Ordinary Differential Equations		
CREDIT: 4.0 (Theory)	**TERMS OFFERED:** 2nd year 2nd semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: This course focuses on the study of algebra and geometry of complex numbers, and the analysis of complex valued functions of a complex variable, including differentiation and integration in order to enable students to make mathematical models involving differential equations for problems encountered in engineering, social and physical sciences, and to solve them by using one or a combination of the methods.

Course Learning Outcomes (CLOs): at the end of the course, the student will be able to

CLO1	**Understand** about various types of complex operations and differential equation in real life problems.
CLO2	**Analyze** the nature of complex variable and its applications.
CLO3	**Apply** different types of theorems and residues. Also, to be able to differentiate among these theorems.
CLO4	**Evaluate** special types systems in terms of differential equations.
CLO5	**Develop** understanding of special functions, their properties and concepts of different coordinate systems.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√											
CLO2	√	√										
CLO3		√	√									
CLO4		√	√									
CLO5	√											

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	**Complex number system:** general functions of complex variables.	**4**	**CLO1, CLO2**
2	**Limit and continuity** of a function of complex variable and related theorems, Complex differentiation and Cauchy-Riemann equations.	**6**	**CLO2, CLO3**
3	**Cauchy-Riemann equations**, Cauchy's integral theorem, Cauchy's integral formula, line integral of a complex function,	**7**	**CLO3**
4	Taylor's series, Laurent's series, residues, **Cauchy's residue theorem**, singular points.	**6**	**CLO3**
5	**Bilinear transformation**, evaluation of residues, contour integration.	**6**	**CLO3**
6	Formation of differential equation	**5**	**CLO1, CLO4**
7	Differential equation, where variables are separable, First order homogeneous equation, Equation reducible to homogeneous form, First order linear equation, Clairaut's form, One variable absent, Exact differential equation.	**8**	**CLO4, CLO5**
8	General linear equation of second and higher order with constant coefficients. Solution of homogeneous linear equations, Applications. Differential equations with variable coefficients in which either dependent or independent variables are absent, Factorizing the operator, Euler's equation.	**10**	**CLO4, CLO5**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing videos and solving practical problems, showing practical systems, online learning platform, feedback.

TEXTBOOK

1. Murray R. Spiegel, Seymour Lipschutz, John J. Schiller, Dennis Spellman, SHAUM'S outline of Complex Variable, McGraw-Hill Education.

REFERENCE BOOKS

1. Prof. Dr. M. F. Rahman, Complex Analysis, Titas Publications, Dhaka.
2. Earl D. Rainville, Phillip E. Bedient, and E. Richard, Elementary Differential Equations, Prentice Hall.
3. Shepely L. Ross, Differential Equations, John Wiley & Sons.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	30	
Evaluate	20	

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	10
Understand	20
Apply	20
Analyze	20
Evaluate	30

8.4.2. HSS 2301

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** HSS 2301 **COURSE TITLE:** Economics and Accounting		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 2nd year 2nd semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: Economics and Accounting will provide the opportunity to study two interrelated subjects, providing engineers with a comprehensive knowledge of the key areas of economics and accounting. Economics isn't just about supply and demand and taxes. Economics means making good decisions

based on all pros and cons. And there is no exception in case of accounting as well which will introduce to techniques of accounting such as financial reporting, financial statement analysis, ratio analysis, cost accounting, preparation of cost sheet, etc.

Course Learning Outcomes (CLOs): at the end of the course, the student will be able to

CLO1	**Explain** the basic concepts & theories of Economics and Accounting which helps to solves engineering problems & real-life problems relating to economics and business.
CLO2	**Infer** about the changing and uncertain engineering business world and **analyze** individual behavior and dynamics of groups and effective team building.
CLO3	**Compute** the cost and benefit of an engineering project and also **solve** any real-life problems relating to economics, business and society.
CLO4	**Justify** whether the engineering project is environment friendly.
CLO5	**Analyze** economic, environmental, social, political, ethical, healthy, safety and sustainable issues related to mechanical system.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1						√					√	
CLO2						√						
CLO3											√	
CLO4							√					
CLO5					√							

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Definition & Scope of Economics. Importance and uses of Economics, Engineering Economics, Importance of economics for Engineers. Basic Economic Concepts: Wants, Wealth, Goods, Value, Price, Utility, Production, Income, Consumption, Savings, Investment, Exchange, Distribution, Firm and Industry.	**3**	**CLO1**
2	Accounting and its uses in business decisions, characteristics of accounting, functions of accounting, uses of accounting information, conceptual framework, qualitative characteristics of accounting information	**3**	**CLO1**
3	Contemporary economic business and economic issues, Markets, share market, Bangladesh economy, idea of world economy, Banking sector. Growth, Development, GDP, GNP, monetary policy, fiscal policy	**3**	**CLO2**
4	Organizational Behavior-introduction, definition, fundamental principles of OB, contributing disciplines, challenges and opportunities, foundations of Individual Behavior	**3**	**CLO1, CLO2**

SN	COURSE CONTENT	Hrs	CLOs
5	Personality- determinants of personality, traits of personality, MBTI, personality attributes influencing OB. Type A and Type B Personality. Personality Dimensions; Introvert and Extrovert. Personalities.	**3**	**CLO2, CLO1**
6	Attitude: attitude and behavior; Emotional intelligence, Motivation and leadership. Dynamics of Group behavior: Definition, types, formation of groups, building effective teams.	**3**	**CLO1, CLO2**
7	Inter-Group Relations and Conflict Management: Interdependence of Groups; Nature of Conflict in Organizations; Changing View of Conflict; Types of Conflict Situations; The Causes of Conflict; Conflict Management and Negotiation.	**3**	**CLO1, CLO2**
8	Costs of production, fixed cost and variable cost. Economics of development & planning: Economics of development and planning, basic concept-saving, investment, GNP, NNP, per-capita income, growth rate, policy instruments of development.	**3**	**CLO3**
9	Financial statement analysis, ratio analysis, liquidity ratio, leverage ratio, profitability ratio, Capital budgeting, discounted cash flow, NPV, IRR, ARR, Payback period method, Working capital management.	**3**	**CLO3**
10	direct & indirect labor costs, overhead costs, periodic & product costs, Cost volume profit analysis, break-even-point, margin of safety, degree of operating leverage.	**3**	**CLO3**
11	Industry and environment, localization of industry, Waste management, water pollution, air pollution, environmental pollution.	**3**	**CLO4**
12	Nature of Economic Problems and Its Solution: Nature of Economic problems in Human Life, Different Levels of Activities in Solving Economic problems, Production-factors of production, production possibility curve-equilibrium of a firm.	**3**	**CLO4, CLO5**
13	Development & Environment, sustainable development, equity, efficiency, equality and development, five-year plans of Bangladesh, development problems related to industry. Poverty, population, social and political problem of Bangladesh.	**3**	**CLO5**

Teaching Learning Strategies: Classroom lecture (white board and power point presentation), reading, solving mathematical problems, showing video presentation and feedback.

TEXTBOOKS

1. Michael Parkin, Economics, Pearson.
2. Jerry J. Weygandt, Accounting Principles, John Wiley & Sons.

REFERENCE BOOKS

1. N. Gregory Mankiw, Principles of Economics, Cengage Learning.
2. Robert F. Meigs et al., Accounting: The Basis for Business Decisions, Mcgraw-Hill College.
3. Ray Garrison, Managerial Accounting, McGraw-Hill Education.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	30	
Evaluate	20	
Create		

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	05
Understand	15
Apply	10
Analyze	20
Evaluate	50
Create	

8.4.3. EEE 2505

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** EEE 2505 **COURSE TITLE:** Electrical Machines and Electronics		
CREDIT: 3.00 (Theory)	**TERMS OFFERED:** 2nd year 2nd semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: The overall objective of this course is to learn how to analyze the operations of different machines: generator, motor & transformer and analyze different aspects of industrial & digital electronics. This includes performance analysis, speed control, characteristics evaluation, circuit modeling of machines, characteristics analysis of diode as rectifier and transistor as amplifier.

Course Learning Outcomes (CLOs): at the end of the course, the student will be able to

CLO1	**Explain** the principle of operation, construction, classification and speed control of induction motor.
CLO2	**Examine** the behavior, constructional details, loss and efficiency of synchronous motor and generator.
CLO3	**Illustrate** knowledge to design single-phase and three-phase transformers, their classifications, losses and efficiency.
CLO4	**Understand** the basics of semiconductor devices such as diode, transistor, silicon-controlled rectifier, operational amplifier along with their applications and **assess** their design procedures.
CLO5	**Design** appropriate digital electronic systems using PLC and microcontrollers.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√											
CLO2	√	√										
CLO3	√	√										
CLO4	√	√										
CLO5			√		√							

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	**Induction Motor:** Principle of operation, Constructional details, Classifications, Equivalent circuits, starting torque and maximum torque.	**3**	**CLO1**
2	**Induction Motor:** Speed-torque relations, Losses and efficiency, Starters, Methods of speed control, Methods of braking and plugging.	**3**	**CLO1**
3	**Synchronous Generators:** General outline and types of synchronous generators. Voltage expressions, Regulation, Losses and Efficiency.	**3**	**CLO2**
4	**Synchronous Generators:** Conditions, Methods and problems of parallel operation and Load sharing of synchronous generators.	**3**	**CLO2**
5	**Synchronous Motors:** General Constructional feature, Theory of operation, Characteristics.	**3**	**CLO2**
6	**Synchronous Motors:** Speed control, V-curves, Losses, Efficiency and Starting. Fractional horse power motors.	**3**	**CLO2**
7	**Transformer:** Principles, Types, Equivalent circuits, Performance and testing, Regulation, Losses and efficiency.	**3**	**CLO3**
8	**Transformer:** Parallel operation. Introduction to three-phase transformer.	**3**	**CLO3**

SN	COURSE CONTENT	Hrs	CLOs
9	**Analog Electronics:** Semiconductor diode and rectifiers, Transistor characteristics, Equivalent circuits, Self-biasing circuits, Voltage divider biasing circuit.	**3**	**CLO4**
10	**Analog Electronics:** Emitter-follower amplifiers, Push-pull amplifier. Introduction to silicon-controlled rectifier and its application.	**3**	**CLO4**
11	**Operational Amplifiers (Op-Amps):** Introduction to op-amps, Inverting and non-inverting amplifier, Phase inverter, Integrating and differentiating circuits, Adder and summing amplifier.	**3**	**CLO4**
12	**Digital electronics:** Digital and analog systems, Logic gates and Boolean algebra, Flip Flops. Introduction to counters and registers.	**3**	**CLO5**
13	**Digital electronics:** Introduction to PLC and microcontrollers.	**3**	**CLO5**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing videos and solving practical problems, showing practical systems, online learning platform, feedback.

TEXTBOOKS

1. Stephen J. Chapman, Electric Machinery Fundamentals, McGraw-Hill Education.
2. Robert Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson.

REFERENCE BOOKS

1. Ashfaq Husain, Electric Machines, Dhanpat Rai & Co.
2. B.L. Theraja and A.K. Theraja, A textbook of Electrical Technology, S. Chand & Co Ltd.
3. V.K. Mehta and Rohit Mehta, Principles of Electronics, S. Chand & Co Ltd.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	30	
Evaluate	20	

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	05
Understand	15
Apply	10
Analyze	20
Evaluate	30
Create	20

8.4.5. EEE 2506

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** EEE 2506 **COURSE TITLE:** Electrical Machines and Electronics Sessional		
CREDIT: 0.75 (Sessional)	**TERMS OFFERED:** 2nd year 2nd semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: This course facilitates the study of the principle, types, performances and characteristics of various electrical machines and electronic devices. It also emphasizes on different applications of electrical machines and electronic devices to conduct research on semi-conductor materials and analysis of electrical machines.

Course Learning Outcomes (CLOs): at the end of the course, the student will be able to

CLO1	**Describe** the basic working principle, characteristics and various methods for speed control of induction motor.
CLO2	**Summarize** the basic working principle and characteristics of synchronous motor and generator.
CLO3	**Design** a single phase and three phase transformer, losses of transformer, equivalent impedance of transformer.
CLO4	**Justify** the characteristics of semiconductor diode, rectifier and transistor.
CLO5	**Implement** the digital automation circuit by using PLC and microcontroller.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	√											
CLO2	√											
CLO3			√						√	√		
CLO4		√	√									
CLO5					√							

SN	COURSE CONTENT	Hrs	CLOs
1	Introduction	**3**	**CLO1**
1	Study of operating characteristics of a 3-phase Wound-rotor induction motor.	**3**	**CLO1**
2	Study of the V-curve and Inverse V-curve of a synchronous motor.	**3**	**CLO2**
3	Open circuit and short circuit test of a single phase transformer.	**3**	**CLO3**
4	Study the V-I characteristics curve of a semiconductor diode and transistor.	**3**	**CLO4**
5	Introduction to PLC and microcontroller.	**6**	**CLO5**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing videos and solving practical problems, showing practical systems, demonstration of experiment and conduct experiment, online learning platform, feedback.

TEXTBOOKS

1. Stephen J. Chapman, Electric Machinery Fundamentals, McGraw-Hill Education.
2. Robert Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson.

REFERENCE BOOKS

1. Ashfaq Husain, Electric Machines, Dhanpat Rai & Co.
2. B.L. Theraja and A.K. Theraja, A textbook of Electrical Technology, S. Chand & Co Ltd.
3. V.K. Mehta and Rohit Mehta, Principles of Electronics, S. Chand & Co Ltd.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home) / Report (%)	Design Project (%)	Board Viva (%)	In class Participation (%)
Remember			50	50
Understand	10	10	30	50
Apply	15	10	20	
Analyze	25	30		
Evaluate	30	20		
Create	20	30		

8.4.6. ME 2301

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 2301 **COURSE TITLE:** Metallic Materials Science		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 2nd year 2nd semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: This course improves the prediction and control on material properties through an understanding of atomic, crystalline, and microscopic structures of materials. It also emphasizes on heat treatment process, steel and alloy systems, and powder metallurgy that will enhance the ability to produce and design on a multi-disciplinary area such as biomedical, manufacturing and metallurgy.

Course Learning Outcomes (CLOs): at the end of the course, the student will be able to

CLO1	**Discuss** the basic concepts and terms of engineering materials including material properties, structural systems and manufacturing processes.
CLO2	**Justify** the applicability of techniques or processes to conduct tests for new material analysis and design.
CLO3	**Apply** different techniques to differentiate defects in materials and identify concept of phase diagram rules to analyze engineering materials and processes.
CLO4	**Analyze** the behavior of engineering materials by examining composition, properties, and applications and distinguish between different types of steels and alloy steels.
CLO5	**Evaluate** the material properties and designed material characteristics based on analysis of materials data, design standards and measurements.
CLO6	**Synthesize** material properties in a new pattern by solving and presenting the appropriate treatment techniques.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√											
CLO2		√										
CLO3	√	√										
CLO4		√	√									
CLO5		√	√									
CLO6			√									

SN	COURSE CONTENT	Hrs	CLOs
1	Definition of metal and metallurgy; Subject matter of metallurgy; Concept of malleability, ductility, toughness, fatigue resistance and other mechanical properties.	**3**	**CLO1**
2	Nondestructive tests of metals	**2**	**CLO1, CLO2**
3	Metals structure, crystal structure; b.c.c, f.c.c, close-packed hexagonal, the crystal systems, polymorphism and allotropy, crystallographic planes; Miller indices, mechanism of crystallization, crystal imperfections.	**4**	**CLO1, CLO3**
4	Introduction, coordinates of phase diagram, experimental methods, constructions of different types of phase diagram and their interpretation. Gibb's phase rule, lever rule, types and interpretation of binary diagrams, correlation between binary diagrams and properties of alloys.	**3**	**CLO3, CLO4**
5	Introduction, the Iron-Iron Carbide Diagram, definition of structures, slow cooling steel, the critical temperature lines.	**3**	**CLO3, CLO4**
6	Classification of heat treatment and four principal transformations in steel-formation of austenite, decomposition of austenite, martensitic and bainitic transformation, transformation of tempering. Practice of different types of heat treatment: surface hardening; full annealing, spheroidizing, stress-relief annealing, process annealing, normalizing, hardening tempering; case hardening; carburizing, nitriding, cyaniding or carbonitriding, flame hardening, induction hardening.	**4**	**CLO5, CLO6**
7	Powder Metallurgy: Steps in powder metallurgy, metal powder production, characteristics of metal powder, pressing, hot pressing, sintering, presintering, spark-sintering, sizing and finishing, advantages and disadvantages of powder metallurgy. Non-Ferrous Metals and Alloys. Introduction to tribology; Composite materials; Smart materials.	**3**	**CLO4, CLO6**
8	**Ferrous Alloys:** Common metallurgical terms-minerals, ores, calcinations, roasting, sintering, smelting, slag, flux, refractories etc. **Wrought iron**: Its production and application. Production of pig-iron: Blast furnace, construction, chemistry and product of blast furnace. **Carbon steel**: Its classification; composition, micro-structure, characteristics and application of carbon steels. Alloy steel; effect of alloying elements, classification of alloy steel, structural steel, tool steel and their characteristics,	**2 + 4+ 4**	**CLO1, CLO4**

SN	COURSE CONTENT	Hrs	CLOs
	steels with special properties-stainless steel and wear resisting steel. **Cast iron**: Its classification; composition, micro- structure, characteristics and application of different types of cast iron. Alloy cast iron.		
9	Production of steel: Construction, chemistry and relative advantage & disadvantage different steel making processes. Production of cast iron: Cupola furnace.	**5**	**CLO1, CLO4**
10	Nonferrous metals and alloys: Copper and its alloys, Aluminum and its alloys.	**2**	**CLO1, CLO4**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing videos and solving practical problems, showing practical systems, online learning platform, feedback.

TEXTBOOK

1. Sidney H. Avner, Introduction to Physical Metallurgy, Mc Graw Hill India.

REFERENCE BOOKS

1. V. Raghvan, Materials Science and Engineering, PHI.
2. R. A. Higgins, Properties of Engineering Materials, Industrial Press, Inc.
3. William D. Callister Jr. and David G. Rethwisch, Materials Science and Engineering: An Introduction, John Wiley and Sons.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	25	20
Understand	25	40
Apply	15	25
Analyze	15	15
Evaluate	20	

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	15
Understand	20
Apply	20
Analyze	20
Evaluate	15
Create	10

8.4.7. ME 2302

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 2302 **COURSE TITLE:** Metallic Material Science Sessional		
CREDIT: 0.75 (Sessional)	**TERMS OFFERED:** 2nd year 2nd semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: This course has opportunity to study material properties through an understanding of microscopic structures of materials by optical microscope. It also emphasizes on heat treatment process of steel and alloy systems. It has the prospects to work essentially in design and research of materials, product development, synthesis, and manufacturing processing.

Course Learning Outcomes (CLOs): at the end of the course, the student will be able to

CLO1	**Realize** the emphasis of metal structure and its properties and tools for observing those properties.
CLO2	**Apply** the metallographic concepts and heat treatment processes to conduct tests for new material analysis and design.
CLO3	**Analyze** the fundamental idea on heat treatment process and its various techniques applying on materials to solve problems of real material.
CLO4	**Evaluate** the material properties and characteristics based on tested materials data, observations and measurements.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√				√							
CLO2		√		√	√							
CLO3		√		√	√							
CLO4				√	√					√		

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Introduction	**3**	**CLO1**
2	Study and observation of Microscope.	**3**	**CLO1**
3	Experimental study of microscopic view of cast Iron.	**3**	**CLO2, CLO4**
4	Experimental study of microscopic view of mild steel.	**3**	**CLO2, CLO4**
5	Experimental study of microscopic view of non-ferrous alloy.	**3**	**CLO2, CLO4**
6	Experimental study of heat treatment of mild steel by pack carburizing.	**3**	**CLO2, CLO3**
7	Experimental study of heat treatment of mild steel.	**3**	**CLO2, CLO3**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing videos and solving practical problems, showing practical systems, demonstration of experiment and conduct experiment, online learning platform, feedback.

TEXTBOOK

1. Sidney H. Avner, Introduction to Physical Metallurgy, Mc Graw Hill India.

REFERENCE BOOKS

1. V. Raghvan, Materials Science and Engineering, PHI.
2. R. A. Higgins, Properties of Engineering Materials, Industrial Press, Inc.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home) / Report (%)	Quiz (%)	Board Viva (%)	In class Participation (%)
Remember	05	10	40	50
Understand	20	20	20	50
Apply	15	20	20	
Analyze	40	30	10	
Evaluate	20	20	10	

8.4.8. ME 2403

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 2403 **COURSE TITLE:** Mechanics of Solids		
CREDIT: 4.0 (Theory)	**TERMS OFFERED:** 2nd year 2nd semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: This course introduces students to the internal stresses and strains that are present in all structural systems. These structural systems can include buildings, bridges, automobiles, airplanes, and other structures. Stress analysis can help in safer and economic design of structures.

Course Learning Outcomes (CLOs): at the end of the course, the student will be able to

CLO1	**Explain and apply** the concept of stress, strain, and failure theories to analyze and design structural members and machine parts under axial, shear, bending, and torsional loading conditions.
CLO2	**Examine** the behavior of structural and machine components subjected to various loading and support conditions.

CLO3	**Evaluate** buckling loads of columns at different end conditions and loading situation and evaluate internal stresses, moment in beams at different loading situations.
CLO4	**Design** appropriate mechanical elements taking proper materials through evaluating the relationship between stress and strain and applying the strain energy and failure theories.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√	√	√									
CLO2	√	√										
CLO3		√	√									
CLO4			√	√								

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Introduction and analysis of axially loaded members	**2**	**CLO1**
2	Indeterminate members; Principal of superposition and its applications	**3**	**CLO1, CLO2**
3	Thermal stress and centrifugal stress	**3**	**CLO1,CLO3**
4	Stresses in thin walled cylinder; Stresses in composite members	**4**	**CLO1, CLO3**
5	Helical springs	**3**	**CLO1, CLO4**
6	Torsion: shear stress and torque, angle of twist	**3**	**CLO1, CLO2**
7	Strain energy	**2**	**CLO1, CLO4**
8	Combined stress: combined axial and flexural stresses, variation of stresses with inclination, stress analysis, principal stress and planes, Mohr's circle	**5**	**CLO1, CLO4**
9	Shear force and bending moment: their equations, diagrams and relation	**6**	**CLO1, CLO3**
10	Stresses in beams; Deflection in beams: double integration method, area moment method, conjugate-Beam method and method of superposition for finding slopes & deflections	**6**	**CLO3**
11	Curved beams	**5**	**CLO3**
12	Columns: types of column failures; Euler's equation; Column Secant's formula	**6**	**CLO3**
13	Failure Theories; Joints: Riveted and welded joints	**4**	**CLO2, CLO4**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing videos and solving practical problems, showing practical systems, online learning platform, feedback.

TEXTBOOKS

1. Andrew Pytel and Ferdinand L. Singer, Strength of Materials, Harpercollins College Div.
2. R.S. Khurmi and N. Khurmi, Strength of Materials, S. Chand & Co Ltd.

REFERENCE BOOKS

1. Russell C. Hibbeler, Mechanics of Materials, Prentice Hall.
2. Egor P. Popov, Engineering Mechanics of Solids, Pearson.
3. Irving H. Shames and James M. Pitarresi, Introduction to Solid Mechanics, Pearson.
4. R.K. Rajput, Strength of Materials, Mechanics of Solids, S. Chand & Co Ltd.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	10	
Analyze	30	
Evaluate	30	

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	05
Understand	15
Apply	10
Analyze	30
Evaluate	30
Create	10

8.4.9. ME 2404

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 2404 **COURSE TITLE:** Mechanics of Solids Sessional		
CREDIT: 0.75 (Sessional)	**TERMS OFFERED:** 2nd year 2nd semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: This course introduces the fundamental theories and techniques required for the purpose of modelling and analyzing the behavior of

structural and machine components subjected to various loading and support conditions. This will also allow students to compare practical results through evaluating the relationship between deformation, stress and strain.

Course Learning Outcomes (CLOs): at the end of the course, the student will be able to

CLO1	**Understand** and **apply** the concept of stress, strain, and failure theories to analyze and design structural members and machine parts under axial, shear, bending, and torsional loading conditions.
CLO2	**Model** and **analyze** the behavior of structural and machine components subjected to various loading and support conditions.
CLO3	**Assess** beams and columns at different loading situations.
CLO4	**Evaluate** deformation, stress and strain from different tests and compare practical results through evaluating the relationship between deformation, stress and strain.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√	√										
CLO2			√	√	√							
CLO3			√	√	√							
CLO4				√						√		

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Determination of deflection of a cantilever beam.	**3**	**CLO1, CLO3**
2	Determination of critical load of a slender column at different end conditions (free-free, fixed-free, hinged-hinged)	**3**	**CLO3, CLO4**
3	Torsion test of mild steel and brass specimen	**3**	**CLO2, CLO4**
4	Tensile test of mild steel and brass specimen	**3**	**CLO2, CLO4**
5	Compression test of a timber specimen	**3**	**CLO2, CLO4**
6	Fatigue test of mild steel and brass specimen	**3**	**CLO2, CLO4**
7	Impact test of mild steel and brass specimen	**3**	**CLO2, CLO4**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing videos and solving practical problems, showing practical systems, demonstration of experiment and conduct experiment, online learning platform, feedback.

TEXTBOOKS

1. Andrew Pytel and Ferdinand L. Singer, Strength of Materials, Harpercollins College Div.
2. R.S. Khurmi and N. Khurmi, Strength of Materials, S. Chand & Co Ltd.

REFERENCE BOOKS

1. Russell C. Hibbeler, Mechanics of Materials, Prentice Hall.
2. Egor P. Popov, Engineering Mechanics of Solids, Pearson.
3. Irving H. Shames and James M. Pitarresi, Introduction to Solid Mechanics, Pearson.
4. R.K. Rajput, Strength of Materials, Mechanics of Solids, S. Chand & Co Ltd.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home) / Report (%)	Quiz (%)	Board Viva (%)	In class Participation (%)
Remember	10	10	50	50
Understand	10	10	30	50
Apply	20	20	20	
Analyze	30	30		
Evaluate	30	30		

8.4.10. ME 2004

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 2004 **COURSE TITLE:** Computer Aided Drawing		
CREDIT: 1.50 (Sessional)	**TERMS OFFERED:** 2nd year 2nd semester	
Exam Hours: NA	**CIE Marks: 100%**	**SEE Marks:** 00%

Course Objectives/Summary: This course enables students to apply the stages of the design process from scratch using engineering graphics techniques such as sectional projections, dimensioning and computer generated drawings (2D and 3D). Students will also be able to construct solid models, assemblies, and detail drawings using a feature-based parametric design CAD program, such as AutoCAD and SolidWorks, while capturing design intent in the models and solve design problems in parts and assemblies at the basic level.

Course Learning Outcomes (CLOs): at the end of the course, the student will be able to

CLO1	**Understand** the basic concept of CAD, the best use of Computer Aided Manufacture techniques in a modern factory.
CLO2	**Investigate** the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the specific discipline.
CLO3	**Apply** the engineering techniques, concepts, tools and resources for any design task in CAD/CAM environment.
CLO4	**Design** the prototype of the product using the Rapid Prototype Technology.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√				√							
CLO2					√							
CLO3			√		√							
CLO4			√		√							√

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Introduction to Computer aided drawing using AutoCAD and SolidWorks	**6**	**CLO1**
2	Screen parameters, co-ordinate system	**6**	**CLO1, CLO2**
3	Drawing of elementary geometrical objects and CAD environment	**6**	**CLO3**
4	Role of CAD in mechanical system design	**6**	**CLO2, CLO3**
5	Sketching; 2-D and 3-D Engineering drawings	**9**	**CLO3, CLO4**
6	Assembly drawing	**6**	**CLO3, CLO4**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing videos, showing practical systems, engineering drawing on computer, online learning platform, feedback.

TEXTBOOK

1. Jayanta Sarkar, Computer Aided Design: A Conceptual Approach, CRC Press.

REFERENCE BOOK

1. Mikell P. Groover and Emory W. Zimmers Jr., CAD/CAM: Computer-Aided Design and Manufacturing, Pearson.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home) / Report (%)	Design Project (%)	Board Viva (%)	In class Participation (%)
Remember	10		50	50
Understand	10	10	30	50
Apply	10	10	20	
Analyze	20	30		
Evaluate	30	20		
Create	20	30		

8.5. 3rd Year 1st Semester

8.5.1. Math 3301

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** Math 3301 **COURSE TITLE:** Mathematical Methods and Partial Differential Equations		
CREDIT: 4.0 (Theory)	**TERMS OFFERED:** 3rd year 1st semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: The main objective of this course is to learn how we can apply partial differential equation, Laplace transform, Fourier series, Fourier transform, Fourier integrals etc. in Mechanical Engineering fields.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** about various types of Partial Differential Equations (PDEs) and its relation in mechanical engineering real life problem.
CLO2	**Analyze** the nature of Laplace transformation, Fourier series, Fourier transform, and Fourier integral and its application in electrical circuit, mechanics, etc.
CLO3	**Evaluate** special types of systems through PDE, LT and Fourier series.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	✓											
CLO2		✓		✓								
CLO3		✓			✓							

SN	COURSE CONTENT	Hrs	CLOs
1	Particular solution with boundary and initial conditions,	**4**	**CLO1**
2	Linear and non-linear equation, Charpit's methods	**4**	**CLO1, CLO2**
3	Homogeneous PDE of higher order with constant coefficients.	**4**	**CLO1, CLO3**
4	Non-homogenous linear equations with constant coefficients. Non-homogeneous linear PDE with variable coefficients.	**6**	**CLO3**
5	Fourier series	**4**	**CLO2**
6	Fourier transform, Fourier integral	**5**	**CLO2**
7	Solution in series	**4**	**CLO2, CLO3**
8	Legendre's equation and Bessel's function, Laplace transformation and its use in evaluating integrals.	**6**	**CLO2, CLO3**
9	Harmonic analysis, Laplace equation in cartesian, Cylindrical and spherical coordinates.	**7**	**CLO2, CLO3**
10	Cylindrical harmonic, Potential of a ring.	**4**	**CLO2, CLO3**
11	Potential about a spherical surface, General properties of harmonic functions.	**4**	**CLO2, CLO3**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, feedback.

TEXTBOOKS

1. M.D. Raisinghania, Partial differential Equation, S. Chand
2. Md. Abu Yousuf, Methods of Applied Mathematics, Mamun brothers

REFERENCE BOOKS

1. Murray R. Spiegel, Laplace Transforms, Schaum's Outline Series (McGraw-Hill)
2. Murray R. Spiegel, Fourier Analysis with Applications to Boundary Value Problems, Schaum's Outline Series (McGraw-Hill)

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	30	
Evaluate	20	
Create		

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	05
Understand	20
Apply	25
Analyze	20
Evaluate	30
Create	

8.5.2. HSS 3301

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** HSS 3301 **COURSE TITLE:** Sociology and Industrial Law		
CREDIT: 3.00 (Theory)	**TERMS OFFERED:** 3rd year 1st semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: The overall objective of this course is to learn sociology and industrial law issues and understanding them. Sociological knowledge is very much needed to work within the society. And one of the aspects of this course taker is to work in industrial sector. So, ultimately they need to understand people and need to know the laws which ultimately drive industry.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** about basic concept of sociology & laws regarding engineering and industrial view.
CLO2	**Analyze** the different social and legal issues, behavior and its activities with impact for engineers.
CLO3	**Apply** acquire knowledge in social systems and industrial legal and standard practice.
CLO4	**Evaluate** techniques of existence systems to develop the humanistic society and legal justification of industrial activities.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	✓					✓						
CLO2			✓			✓		✓				
CLO3							✓	✓				
CLO4			✓			✓						

SN	COURSE CONTENT	Hrs	CLOs
1	Definition; Basic concepts, Scope & its importance from Engineering point of view.	**3**	**CLO1**
2	Family; Society; Groups; Association; State; Government;	**3**	**CLO1**
3	Nation; Nationality; Community, Culture & Civilization.	**3**	**CLO1, CLO3**
4	Oriental & occidental societies; Population & world resources; Contribution of biology; Geography; Group life & culture to develop-personality; Living habits; Working habits in Bangladesh.	**3**	**CLO2, CLO3**
5	Social evaluation; Techniques of production and transportation in Bangladesh. Social systems;	**3**	**CLO4**
6	Social Problems; Technology and social changes of Bangladesh	**3**	**CLO2**
7	Principles of law of contract; Agency; Partnership; Sales of goods	**3**	**CLO1, CLO3**
8	General principles of company law relating to formation; Management and winding up.	**3**	**CLO1, CLO3**
9	Industrial law in Bangladesh-various legislation affecting labor Factories Act. Industrial relations ordinance; Payment of wages;	**3**	**CLO1, CLO2**
10	Legislation regarding employment in Industries, Factories; Shops; Transport and agriculture	**3**	**CLO1, CLO2**
11	Trade Union Act, Workmen's compensation Act, Arbitration & Conciliation; The Industrial court	**3**	**CLO2, CLO4**
12	The Policy of the state in relation to labor; ILO and other international body affecting labor welfare.	**3**	**CLO1, CLO3**
13	The law of social insurance; Legislation for the control of industries	**3**	**CLO3, CLO4**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video, feedback.

TEXTBOOKS

1. Heather Griffiths, Introduction to Sociology, Openstax College (Saylor Academy)
2. M C Kuchhal & Vivek Kuchhal, Business and Industrial Laws, Vikas Publishing

REFERENCE BOOKS

1. An Introduction to Sociology, American Sociological Association
2. Dr. Joanna Hadjicostandi, Introduction to Sociology
3. Company Act 1994, Bangladesh
4. Factory Act 1965, Bangladesh
5. Wages Act 1923, Bangladesh

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	30	
Evaluate	20	

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	10
Understand	20
Apply	20
Analyze	25
Evaluate	15
Create	10

8.5.3. ME 3101

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 3101 **COURSE TITLE:** Fluid Mechanics		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 3rd year 1st semester	
Exam Hours: 4.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: This course will enrich the students' knowledge and skill of fluid mechanics as well as introduce them its application to the real world.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** the basic properties of different fluids and their relations with each other.
CLO2	**Analyze** the hydrostatic effect on submersed bodies, their stability in underwater environment and various laws involves in static and in dynamic conditions of fluid.
CLO3	**Apply** the flow, momentum, energy and pressure analysis of various bodies to move through fluids based upon design criteria in real world.
CLO4	**Evaluate** the designed model and prototype by dimensional analysis for the accuracy and economic performance as per standard.
CLO5	**Design (i.e. Create)** appropriate system of fluid flow as per demand by maintaining proper safety standards.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	✓											
CLO2		✓		✓								
CLO3	✓				✓							
CLO4		✓			✓							✓
CLO5			✓		✓							

SN	COURSE CONTENT	Hrs	CLOs
1	Elements of Fluid Mechanics, pressure in fluids	**3**	**CLO1**
2	Hydrostatic forces on surfaces	**3**	**CLO1, CLO2**
3	Fundamentals of fluid flow	**6**	**CLO1, CLO3**
4	Analyzing fluid flow	**4**	**CLO3**
5	Motion equation of fluid	**6**	**CLO3**
6	Dimensional Analysis and similarity	**4**	**CLO3, CLO4**
7	Behavior of Real Fluid	**4**	**CLO1, CLO3**
8	Compressible Flow	**6**	**CLO3, CLO5**
9	Open Channel Flow	**3**	**CLO3, CLO5**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOKS

1. Bruce R. Munson, Wade W. Huebsch, Alric P. Rothmayer, Fundamentals of Fluid Mechanics, Wiley
2. Yunus Cengel, John Cimbala, Fluid Mechanics Fundamentals and Applications, McGraw Hill

REFERENCE BOOKS

1. Er. R.K. Rajput, Fluid Mechanics and Hydraulic Machines, S. Chand
2. Victor L. Streeter & E. Benjamin Wylie, Fluid Mechanics, McGraw-Hill
3. Frank M. White, Fluid Mechanics, McGraw-Hill
4. S W Yuan, Foundations of Fluid Mechanics, Englewood Cliffs
5. Fox and McDonald, Fluid Mechanics, Wiley

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	30	
Evaluate	20	
Create		

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	05
Understand	15
Apply	10
Analyze	20
Evaluate	30
Create	20

8.5.4. ME 3102

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 3102 **COURSE TITLE:** Fluid Mechanics Sessional		
CREDIT: 0.75 (Sessional)	**TERMS OFFERED:** 3rd year 1st semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: Practical knowledge on fundamental of fluid mechanics and some other selected topics as studied on ME3101 will enrich the students' knowledge and skill of fluid mechanics as well as introduce them its application to the real world.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Apply** the principles of hydrostatic forces in various bodies.
CLO2	**Analyze** the forces and motion of fluid in piping system and its impact on surface; the principles of fluid flow through various flow measuring devices.
CLO3	**Evaluate** the Bernoulli's theorem with practical applications.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	✓				✓							
CLO2	✓	✓		✓								
CLO3		✓										✓

SN	COURSE CONTENT	Hrs	CLOs
1	Introduction	**3**	**CLO1**
2	Experiment on center of pressure	**3**	**CLO1**
3	Experiment on flow through orifice meter and venturi meter	**3**	**CLO2**
4	Experiment on verification of Bernoulli's theorem	**3**	**CLO3**
5	Experiment on fluid friction in pipe	**3**	**CLO2**
6	Experiment on impact of jet	**3**	**CLO2**
7	Experiment on flow over notches	**3**	**CLO2**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOKS

1. Habib Ahmari and Shah Md Imran Kabir, Applied Fluid Mechanics Lab Manual, MAVS Open Press
2. Quamrul Islam, Fluid Mechanics Lab Manual

REFERENCE BOOKS

1. Bruce R. Munson, Wade W. Huebsch, Alric P. Rothmayer, Fundamentals of Fluid
   Mechanics, Wiley
2. Er. R.K. Rajput, Fluid Mechanics and Hydraulic Machines, S. Chand

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home) / Report (%)	Quiz (%)	Board Viva (%)	In class Participation (%)
Remember	10	10	50	50
Understand	20	20	30	50
Apply	30	20	20	
Analyze	20	30		
Evaluate	20	20		

8.5.5. ME 3305

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 3305 **COURSE TITLE:** Manufacturing Process		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 3rd year 1st semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: The primary aim of the course is to provide students with the basic skills and knowledge required to select an appropriate material and processing method for the manufacture of a component or assembly. The course

develops an understanding of the inter-relationships of material structure and properties, design and processing.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** the manufacturing processes like casting, welding, machining, forming and processes for plastic products.
CLO2	**Analyze** practical problems related to manufacturing processes and select the appropriate processes from them for the solution.
CLO3	**Apply** the concepts of manufacturing processes to manufacture products by castings, machining or forming.
CLO4	**Evaluate** the quality of the castings, welded joints, machined products and forming products.
CLO5	**Design (i.e. Create)** patterns for machine elements and dies for forming process.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	✓											
CLO2		✓		✓								
CLO3	✓				✓							
CLO4		✓	✓									
CLO5			✓		✓							

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Classification of manufacturing process; molding and casting; casting defects	**6**	**CLO1**
2	Joining methods: Soldering, brazing, welding (conventional welding processes, TIG, MIG, submerged arc, thermite, laser, electron beam, friction); welding defects	**6**	**CLO1, CLO4**
3	Different machining processes: various operations, cutting tools and their analyses in turning, milling, drilling, shaping, grinding	**6**	**CLO1, CLO3**
4	Non-conventional machining processes: ECM; EDM; ultrasonic machining; AJM; EBM; LBM and others	**5**	**CLO3, CLO5**
5	Chip less material forming process: hot and cold working processes; rolling; cold drawing; deep drawing; forging; extrusion; stamping; shearing, bending and press works; design of compound and progressive dies; forming	**10**	**CLO3, CLO4**
6	Processes for plastic products: injection molding; compression molding; blow molding; transfer molding; compounding; extrusion; vacuum forming; thermo-forming; etc.	**6**	**CLO4**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOKS

1. RK Jain, Production Technology, Khanna Publications
2. Serope Kalpakjian & Stephen Schmid, Manufacturing Engineering and Technology, Pearson

REFERENCE BOOKS

1. David A. Stephenson and John S. Agapiou, Metal Cutting Theory and Practice, CRC Press
2. P.N. Rao, Manufacturing Technology, McGraw-Hill
3. Asok Kumar Mallik & Amitabha Ghosh, Manufacturing Science, East-West Press

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (60 Marks) (%)	In class Participation (30 Marks) (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	30	
Evaluate	20	

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	05
Understand	15
Apply	10
Analyze	20
Evaluate	30
Create	20

8.5.6. ME 3306

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 3306 **COURSE TITLE:** Manufacturing Process Sessional		
CREDIT: 0.75 (Sessional)	**TERMS OFFERED:** 3rd year 1st semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: This course will enrich the students' knowledge and skill of Manufacturing Processes as well as introduce them its application to the real world.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Analyze** manufacturing processes and select the appropriate processes from them for the solution of practical problems.
CLO2	**Apply** the concepts of manufacturing processes to manufacture products by castings, machining or forming for practical applications.
CLO3	**Evaluate** the quality of the castings, welded joints, machined products and forming products.
CLO4	**Design (i.e. Create)** patterns for machine elements and dies for forming process.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	✓	✓										
CLO2	✓				✓							
CLO3		✓								✓		
CLO4			✓		✓							

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Introduction	**3**	**CLO1**
2	Practice the preparation of molding sand and castings.	**3**	**CLO4**
3	Preparation of a wood pattern according to the supplied drawing of a mechanical part.	**3**	**CLO1, CLO4**
4	Practice arc welding and gas welding to join flat bar as lap, butt and Tee joint.	**3**	**CLO3**
5	Make a machine part as per given dimension using lathe	**3**	**CLO1, CLO2**
6	Manufacture gear using knee type horizontal milling machine.	**3**	**CLO2**
7	Finishing of a surface and cutting a slot using hydraulic shaper.	**3**	**CLO2**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOKS

1. RK Jain, Production Technology, Khanna Publications
2. Serope Kalpakjian & Stephen Schmid, Manufacturing Engineering and Technology, Pearson

REFERENCE BOOKS

1. David A. Stephenson and John S. Agapiou, Metal Cutting Theory and Practice, CRC Press
2. P.N. Rao, Manufacturing Technology, McGraw-Hill
3. Asok Kumar Mallik & Amitabha Ghosh, Manufacturing Science, East-West Press

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home) / Report (%)	Design Project (%)	Board Viva (%)	In class Participation (%)
Remember			50	50
Understand	10	10	30	50
Apply	15	10	20	
Analyze	25	30		
Evaluate	30	20		
Create	20	30		

8.5.7. ME 3401

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 3401 **COURSE TITLE:** Mechanics of Machinery		
CREDIT: 4.0 (Theory)	**TERMS OFFERED:** 3rd year 1st semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: The overall objective of this course is to learn how to analyze the motions of mechanisms, design mechanisms to have given motions, and analyze forces in machines. This includes relative motion analysis and design of gears, gear trains, cams, and linkages, simultaneous graphical and analytical analysis of position, velocity, and acceleration, considering static and inertial forces.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** the working Principles of different types of governor & Gyroscopic effect on the mechanical system.
CLO2	**Analyze** the kinematic chain and mobility, and perform the kinematic analysis of a given mechanism.
CLO3	**Apply** mathematical methods to analyze static and dynamic mass balancing and flywheels design.
CLO4	**Evaluate** the vibrational response of mechanical elements / systems.
CLO5	**Design** and **select** appropriate power transmission and cam for specific application.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	✓											
CLO2	✓	✓										
CLO3	✓			✓								
CLO4		✓		✓								
CLO5			✓		✓							

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Kinetics of machines: Displacement; Velocity and acceleration diagrams; Turing moment; Inertia and kinetic energy of reciprocating parts and connecting rods; Design of wheels.	**8**	**CLO2**
2	Balancing: Static and dynamic balancing applied to rotating and reciprocating parts; partial balance of locomotives; Opposed engines; Multi-cylinder inline engines; V-engines; Radial engines; Concepts of direct and reverse cranks; Balancing machines.	**6**	**CLO3**
3	Cam: Study of cams and cam followers; Different types of follower motion; Cam profiles to impart definite motion to followers; Cam with specified contours.	**4**	**CLO5**
4	Power Transmission Elements: Power transmission by belts; ropes and dynamometers. Geometry of gear tooth profiles-involute and cycloidal; Tooth profiles in different types of gears. Study of gear trains-simple; Compound and epicyclic.	**8**	**CLO5**
5	Governors: Governors' spring and gravity control types, Inertia types. Precision Motion: Precision and Gyroscopic acceleration; Gyroscopic couples. Gyroscopic stabilization and directional control.	**13**	**CLO1**
6	Vibration: Un-damped free vibrations of simple mechanical system with one and two degrees of freedom; Longitudinal; Transverse and torsional vibration. Damped free and steady state forced vibrations with single degree of freedom. Whirling of shafts and rotors; Vibration geared system;	**13**	**CLO4**

SN	COURSE CONTENT	Hrs	CLOs
	vibration absorption dissolution; Vibration measuring instruments; introduction to automatic control.		

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOKS

1. J.J. Uicker, G.R. Pennock, J.E. Shigley, Theory of Machines and Mechanisms, Oxford University Press
2. R. S. Khurmi, J.K. Gupta, Theory of Machines, S. Chand

REFERENCE BOOKS

1. Thomas Beven, Theory of machines, Pearson
2. Ferdinand P. Beer, E. Russell Johnston Jr., Vector Mechanics for Engineers: Dynamics, McGraw-Hill
3. S.S. Rattan, Theory of Machines and Mechanisms, McGraw-Hill

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	5	50
Understand	10	50
Apply	25	
Analyze	30	
Evaluate	20	
Create	10	

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	10
Understand	20
Apply	30
Analyze	20
Evaluate	20

8.5.8. ME 3402

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 3402 **COURSE TITLE:** Mechanics of Machinery Sessional		
CREDIT: 0.75 (Sessional)	**TERMS OFFERED:** 3rd year 1st semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: The overall objective of this sessional course is essential to develop understanding to solve complex problems involved with machinery dynamics such as power transmission, balancing, cam and speed control systems.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Apply** the principles of balancing of masses to various links, mechanisms and engines.
CLO2	**Analyze** the principles of gyroscopic effects and stabilization on various transport vehicles, the forces and motion of complex systems of linkages, gears and cams, applications of various governors.
CLO3	**Evaluate** the vibration parameters of different systems.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	✓				✓							
CLO2	✓	✓			✓							
CLO3		✓								✓		

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Experiment on static and dynamic mass balancing.	**3**	**CLO1**
2	Determination of whirling/critical speed of a rotating shaft.	**3**	**CLO2, CLO3**
3	Experiment on Hartnell Governor.	**3**	**CLO2**
4	Determination of gyroscopic couple for different conditions.	**3**	**CLO2, CLO3**
5	Study of cam and determination of cam profile.	**3**	**CLO2**
6	Experiment on gear train and determination of speed ratio	**3**	**CLO2**
7	Quiz and Board Viva	**3**	**CLO1, CLO2, CLO3**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOKS

1. J.J. Uicker, G.R. Pennock, J.E. Shigley, Theory of Machines and Mechanisms, Oxford University Press
2. R. S. Khurmi, J.K. Gupta, Theory of Machines, S. Chand

REFERENCE BOOKS

1. Thomas Beven, Theory of machines, Pearson
2. Ferdinand P. Beer, E. Russell Johnston Jr., Vector Mechanics for Engineers: Dynamics, McGraw-Hill
3. S.S. Rattan, Theory of Machines and Mechanisms, McGraw-Hill

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home) / Report (%)	Quiz (%)	Board Viva (%)	In class Participation (%)
Remember	10	10	50	50
Understand	20	20	30	50
Apply	30	20	20	
Analyze	20	30		
Evaluate	20	20		
Create				

8.5.9. ME 3002

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 3002 **COURSE TITLE:** Professional Ethics		
CREDIT: 1.50 (Sessional)	**TERMS OFFERED:** 3rd year 1st semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: The objectives of this course is to make student aware about the moral issues in the profession and concepts in addressing the ethical dilemmas that help them advance in their profession.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Remember** the knowledge on different codes of ethics and industrial standards in mechanical engineering field or issues.
CLO2	**Understand** the basic reflection of profession, awareness of professional rights and responsibilities of an engineer in field work, and also the safety responsibility.
CLO3	**Apply** the engineering principles, risk and safety measurements to maintain the technical skills throughout their professional career.
CLO4	**Analyze** the various moral & social issues and judge the situations in their professional lives.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1						✓		✓				
CLO2						✓	✓	✓				
CLO3						✓		✓		✓		
CLO4						✓		✓				✓

SN	COURSE CONTENT	Hrs	CLOs
1	Meaning of ethics and the need for ethical reasoning in mechanical engineering.	**3**	**CLO1**
2	Classical moral theory as applied to science and engineering.	**3**	**CLO2, CLO3**
3	Evaluating ethical judgement.	**6**	**CLO3, CLO4**
4	Preserve communications.	**4**	**CLO2, CLO3**
5	obligations to Clients, Employers, public, and environments.	**4**	**CLO2, CLO3**
6	Ethics in the global engineering profession.	**6**	**CLO1, CLO2, CLO3, CLO4**
7	Engineering code of ethics.	**3**	**CLO1, CLO2**
8	Intellectual property rights/software patent issues.	**6**	**CLO2, CLO3**
9	Issues on fraud, corruption, mismanagement, poor product design, deliberate design faults or and harms from engineering projects/products.	**4**	**CLO2, CLO3, CLO4**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, feedback.

TEXTBOOK

1. Charles B. Fleddermann, Engineering Ethics, Pearson

REFERENCE BOOKS

1. R. Subramanian, Professional ethics, Oxford University Press
2. R. S. Naagarazan, A Textbook on Professional Ethics and Human Values, New Age

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class (Assignments) (40%)	In class Participation/Seminar (10%)	Presentation (20%)	Quiz (30%)
Remember	05	00	15	
Understand	20	30	10	30
Apply	25	20	20	25
Analyze	30	35	30	25
Evaluate	20	15	25	20
Create				

8.6. 3rd Year 2nd Semester

8.6.1. HSS 3303

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** HSS 3303 **COURSE TITLE:** Government and Bangladesh Studies		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 3rd year 2nd semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: This course will introduce the students to the history of Bangladesh and the structure of its government, organs of government-legislature, executive, judiciary, etc. It will also discuss its Vision 2021 and Vision 2041, Fifth Year Economic Plan, progress to the Sustainable Development Goals (SDGs) and Bangladesh Delta Plan 2100 (BDP 2100), etc.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** the history of Bangladesh through the ancient, medieval, colonial and post-colonial periods alignment with form and structured of government.
CLO2	**Analyze** the structural features of the Bangladeshi history, economy and patterns of development processes and the nature of administrative challenges for good governance.
CLO3	**Apply** the way of different constitutional bodies and socio-political government organs rolling their behavior on governance and people in Bangladesh.
CLO4	**Evaluate** the different perspective in Bangladesh Socioeconomic and political culture and role of government, administrational body and government management system.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1						✓						
CLO2						✓						
CLO3			✓									✓
CLO4						✓	✓					

SN	COURSE CONTENT	Hrs	CLOs
1	Basic concepts of government and politics: form and structure of government, organs of government-legislature, executive, judiciary	**3**	**CLO1, CLO2**
2	Theory of democracy; socialism, bureaucracy State, government, nation and nationality etc.	**3**	**CLO1, CLO2**
3	Political views on government structure, cabinet form and presidential form of government, unitary form and federal form of government, main organs of government,	**3**	**CLO1, CLO3**
4	characteristics and functions of Government and good governance, Public Administration in Bangladesh, E-government; Government and Politics of Bangladesh	**3**	**CLO3, CLO4**
5	Constitution and laws for Government, local government, NGOs, public law, principal, rule and policies for Administration and Government	**3**	**CLO3, CLO4**
6	Public Opinion and foreign policy of Bangladesh, Major Administrative Systems of Developed Counties.	**3**	**CLO3, CLO4**
7	Introduction to Bangladesh, Geo-political and socio-economic history of Ancient Bengal, Origin and development of Bengal Civilization from early and medieval periods to pre-Bangladesh period,	**3**	**CLO2, CLO3**
8	Important places and sculptures, Socioeconomic and political contexts in the period of Liberation War	**3**	**CLO1, CLO2**
9	Backgrounds of her Independence: six points demands, Agartala Conspiracy, General Election 1970, Operation searchlight.	**3**	**CLO2**
10	Economic development and its transformation, Economic and social inequality, Social and cultural transformation,	**3**	**CLO2, CLO3**
11	Industrial development from the first industrial to the fourth industrial revolution	**3**	**CLO2**
12	Bangladesh and its Vision 2021 and Vision 2041, Fifth year economic plan	**3**	**CLO2, CLO4**
13	Progress to the Sustainable Development Goals (SDGs), Bangladesh Delta Plan 2100 (BDP 2100).	**3**	**CLO2, CLO4**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and, feedback.

TEXTBOOKS

1. Mrs. Nasrin Sultana & Tauhidul Islam, A comprehensive Study on Bangladesh, Prominence Publications
2. B. Guy Peters, The Future of Governing (Studies in Government and Public Policy), University Press of Kansas

REFERENCE BOOKS

1. Sumon Das & M.N. Mohabbat, Bangladesh Studies and Culture, Rodela Prokashani

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	25	50
Apply	20	
Analyze	20	
Evaluate	20	
Create		

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	15
Understand	25
Apply	20
Analyze	20
Evaluate	20
Create	

8.6.2. ME 3103

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 3103 **COURSE TITLE:** Fluid Mechanics and Machinery		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 3rd year 2nd semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: The subject will introduce the students to the knowledge of fluid flow & related machineries. Hydraulic machines have important

role in power generation, water supply and irrigation and also in most of engineering segments. The fundamentals of this subject are essential for the "Industrial Fluid Power".

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** fluid machinery and its important role in power generation, water supply and irrigation, and also in most engineering segments.
CLO2	**Analyze** the performance parameters of fluid machinery such as pump, turbine, fluid coupling, torque converter etc.
CLO3	**Apply** continuity equation, energy equation and momentum equation to select appropriate fluid machine.
CLO4	**Evaluate** different parameters such as co-efficient of friction, power, efficiency etc. of various fluid machine.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	✓	✓										
CLO2	✓	✓										
CLO3	✓		✓									
CLO4			✓	✓								

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	External Flow: Introduction to boundary layer theory. Estimation of Boundary layer thickness. Skin frictions and drag of a flat plate. Navier-stokes equation. Randal's assumption. Laminar Solution. Blasius solution for flat plate.	**8**	**CLO1, CLO4**
2	Fluid Machinery: Types of Fluid machinery. Rotodynamic and positive displacement machinery. Velocity diagram and Euler, pump Turbine equation.	**3**	**CLO1**
3	Water Turbines: Impulse and Reaction turbines; Pelton wheel. Francis Turbine and Kaplan Turbine. Dimensional analysis applied to Turbines. Specific speed. Unit power, Unit speed. Performance Tests and Characteristic curves of turbines.	**8**	**CLO1, CLO2, CLO3**
4	Pumps: Centrifugal and axial flow machines. Reciprocating pumps. Specific speed. Performance Tests and Characteristic curves. Cavitations and surging. Fans, blowers and compressors.	**8**	**CLO1, CLO2, CLO3**
5	Wind turbines: Wind energy extraction: Horizontal and Vertical axis generators. Application of wind turbines to electrical power generation.	**4**	**CLO1, CLO2, CLO3**

SN	COURSE CONTENT	Hrs	CLOs
6	Hydraulic transmission: Fluid Coupling and Fluid Torque converter.	**4**	**CLO1**
7	Introduction to fluidics: Hydraulic and pneumatic components and systems; Servo-control valves, actuators, fluid motors	**4**	**CLO1**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOK

1. John F. Douglas, Janusz M. Gasiorek & John A. Swaffield, Fluid Mechanics, Prentice Hall

REFERENCE BOOKS

1. Roger Kinsky, Applied Fluid Mechanics, McGraw-Hill Education
2. Dr. R.R. Arora, Fluid Mechanics, Hydraulics and Hydraulic Machines, Standard Publications

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	10	50
Understand	20	50
Apply	30	
Analyze	20	
Evaluate	20	

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	10
Understand	20
Apply	30
Analyze	20
Evaluate	20

8.6.3. ME 3104

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 3104 **COURSE TITLE:** Fluid Mechanics and Machinery Sessional		
CREDIT: 0.75 (Sessional)	**TERMS OFFERED:** 3rd year 2nd semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: The subject will introduce the students to the knowledge of fluid flow & related machineries. Hydraulic machines have important role in power generation, water supply and irrigation and also in most of engineering segments. The fundamentals of this subject are essential for the "Industrial Fluid Power".

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Analyze** the performance parameters of fluid machinery such as pump, turbine, fluid coupling, torque converter etc.
CLO2	**Apply** continuity equation, energy equation and momentum equation to select appropriate fluid machine.
CLO3	**Evaluate** different parameters such as co-efficient of friction, power, efficiency etc. of various fluid machine.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CLO1	✓	✓									
CLO2	✓				✓						
CLO3				✓	✓						

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Introduction	**3**	**CLO1**
2	Study of Laminar and Turbulent Boundary Layer on a Flat Plate.	**3**	**CLO3**
3	Performance test of centrifugal pump.	**3**	**CLO1, CLO2**
4	Performance test of reciprocating pump.	**3**	**CLO1, CLO2**
5	Performance test of Pelton wheel.	**3**	**CLO1, CLO2**
6	Performance test of Francis Turbine.	**3**	**CLO1, CLO2**
7	Study of different impellers and runners.	**3**	**CLO1**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), demonstration of experiment and conduct experiment, showing video, showing practical systems, feedback.

TEXTBOOK

1. John F. Douglas, Janusz M. Gasiorek & John A. Swaffield, Fluid Mechanics, Prentice Hall

REFERENCE BOOKS

1. Roger Kinsky, Applied Fluid Mechanics, McGraw-Hill Education
2. Dr. R.R. Arora, Fluid Mechanics, Hydraulics and Hydraulic Machines, Standard Publications

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home) / Report (%)	Design Project (%)	Board Viva (%)	In class Participation (%)
Remember			50	50
Understand	20	20	30	50
Apply	25	25	20	
Analyze	25	25		
Evaluate	30	30		

8.6.4. ME 3403

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 3403 **COURSE TITLE:** Machine Design		
CREDIT: 4.0 (Theory)	**TERMS OFFERED:** 3rd year 2nd semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%
Prerequisite: ME 2401 (Engineering Mechanics-II)		

Course Objectives/Summary: Through this course the students are introduced to simple design of the machine elements like the screws, pressure vessels, springs, shafts, belts, ropes, chains, etc. While designing data book, design handbook, etc. are to be referred so that the design is economical.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** differences between design and analysis along with fundamental notions and approaches to design.
CLO2	**Analyze** the behavior of different machine elements by reducing a complex machine into appropriate sub- systems/elements.
CLO3	**Apply** stress analysis theory, fatigue theory and appropriate criteria of failure to design simple machine elements.
CLO4	**Evaluate** the designed machine elements based on materials data, design codes and standards.
CLO5	**Design** mechanical components and select from manufacturers' catalogues.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	✓	✓										
CLO2	✓	✓										
CLO3		✓	✓									
CLO4		✓		✓								
CLO5			✓									

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Approach to Design; Simple stress analysis; Factor of safety	**2**	**CLO1**
2	Design of simple machine elements; Material Specifications	**4**	**CLO1, CLO2**
3	Stress concentration and Fatigue strength reduction factor. Notch Sensitivity. Variable Load	**4**	**CLO1, CLO3**
4	Column with axial and transverse loading	**4**	**CLO3, CLO4**
5	Spur, Helical, Bevel and worm gears	**6**	**CLO4, CLO5**
6	Keys and couplings; Brakes and clutches	**6**	**CLO4, CLO5**
7	Screw fastening and other joints	**6**	**CLO4, CLO5**
8	Design of helical and leaf springs	**4**	**CLO4, CLO5**
9	Ball and Roller bearings; Journal and plane bearings and their Lubrication.	**6**	**CLO4, CLO5**
10	Shafts Design	**2**	**CLO3, CLO4**
11	Flexible power transmitting elements: Flat Belts, V-Belts, Ropes and Chains.	**8**	**CLO4, CLO5**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOKS

1. Richard Budynas & Keith Nisbett, Shigley's Mechanical Engineering Design, 10th Edition (SI Unit), McGraw-Hill
2. Machine Design Handbook

REFERENCE BOOKS

1. Virgil Moring Faires, Design of Machine Elements, Macmillan Coll Div
2. Robert L. Norton, Machine Design**:** An Integrated Approach, Pearson Prentice Hall
3. Robert C. Juvinall & Kurt M. Marshek, Machine Component Design, Wiley
4. R.S. Khurmi and J.K. Gupta, A Textbook of Machine Design, S Chand & Co Ltd.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	30	
Evaluate	20	

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	05
Understand	15
Apply	10
Analyze	20
Evaluate	30
Create	20

8.6.5. ME 3404

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 3404 **COURSE TITLE:** Machine Design Sessional		
CREDIT: 1.50 (Sessional)	**TERMS OFFERED:** 3rd year 2nd semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: Through this course the students are introduced to simple design of the machine elements like the screws, pressure vessels, springs, shafts, belts, ropes, chains, etc. While designing data book, design handbook, etc. are to be referred so that the design is economical.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Analyze** the behavior of different machine elements by reducing a complex machine into appropriate sub- systems/elements.
CLO2	**Apply** stress analysis theory, fatigue theory and appropriate criteria of failure to design simple machine elements.
CLO3	**Evaluate** the designed machine elements based on materials data, design codes and standards.
CLO4	**Design** mechanical components and select from manufacturers' catalogues.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	✓	✓										
CLO2		✓	✓									
CLO3		✓		✓								
CLO4					✓							✓

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Approach to Design; Simple stress analysis; Factory of safety	**3**	**CLO1**
2	Design of simple machine elements; Material Specifications	**3**	**CLO2, CLO3**
3	Stress concentration and Fatigue strength reduction factor. Notch Sensitivity. Variable Load	**3**	**CLO2, CLO3**
4	Column with axial and transverse loading	**3**	**CLO3, CLO4**
5	Spur, helical, Bevel and worm gears	**3**	**CLO2, CLO3, CLO4**
6	Keys and couplings. Brakes and clutches	**3**	**CLO2, CLO3, CLO4**
7	Screw fastening and other joints. Power screws.	**3**	**CLO2, CLO3, CLO4**
8	Design of close-coiled helical spring	**3**	**CLO2, CLO3, CLO4**
9	Ball and Roller bearings	**3**	**CLO2, CLO3, CLO4**

SN	COURSE CONTENT	Hrs	CLOs
10	Journal and plane bearings and their Lubrication.	**3**	**CLO2, CLO3, CLO4**
11	Shafts Design	**3**	**CLO2, CLO3, CLO4**
12	Flexible power transmitting elements: Belts, Ropes and chains	**3**	**CLO2, CLO3, CLO4**
13	Design Project	**3**	**CLO1, CLO2, CLO3, CLO4**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOKS

1. Richard Budynas & Keith Nisbett, Shigley's Mechanical Engineering Design, 10th Edition (SI Unit), McGraw-Hill
2. Machine Design Handbook

REFERENCE BOOKS

1. Virgil Moring Faires, Design of Machine Elements, Macmillan Coll Div
2. Robert L. Norton, Machine Design**:** An Integrated Approach, Pearson Prentice Hall
3. Robert C. Juvinall & Kurt M. Marshek, Machine Component Design, Wiley
4. R.S. Khurmi and J.K. Gupta, A Textbook of Machine Design, S Chand & Co Ltd.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home) / Report (%)	Design Project (%)	Board Viva (%)	In class Participation (%)
Remember			50	50
Understand	10	10	30	50
Apply	15	10	20	
Analyze	25	30		
Evaluate	30	20		
Create	20	30		

8.6.6. ME 3501

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 3501 **COURSE TITLE:** Heat Transfer		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 3rd year 1st semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: This course will enhance the students' knowledge and skilfulness of heat transfer as well as familiarize them its application to the real world.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** basic concepts of conduction and radiation along with fundamental notions, laws and approaches to design.
CLO2	**Analyze** equations/laws of heat conduction/radiation for different types of surfaces and elements**.**
CLO3	**Apply** equations/laws of heat conduction/radiation for different types of surfaces and conditions.
CLO4	**Evaluate** heat transfer and angle factor/view factor for different surface orientation.
CLO5	**Design (i.e. Create)** fins to enhance heat transfer considering different end conditions.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	✓											
CLO2	✓	✓										
CLO3		✓										
CLO4			✓	✓								
CLO5			✓		✓							

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Introduction: Basic modes and laws of heat transfer; Thermo-physical properties of substance.	**2**	**CLO1**
2	Conduction: Law of conduction; Derivation of general three-dimensional conduction equations;	**3**	**CLO1, CLO2**
3	Heat conduction of system with and without heat sources; Steady state one-dimensional conduction of heat in different geometries; Analogy between heat flow and electrical flow; Thermal Conductivity: basic concept, factors and property analysis;	**5**	**CLO1, CLO2**

SN	COURSE CONTENT	Hrs	CLOs
4	Fins of uniform cross-section;	**3**	**CLO1, CLO5**
5	Two-dimensional steady state conduction: Analytical and Numerical solutions;	**4**	**CLO2, CLO3**
6	Unsteady state conduction: Transient heat flow with negligible internal resistance, internal resistance and surface resistance; Heisler charts: plates, cylinders and spheres.	**3**	**CLO2, CLO3**
7	Radiation: Basic concepts and types; Electromagnetic wave spectrum; Laws of Radiation: Planck's law, Stefan-Boltzman law, Weins displacement law, Lamberts cosine law, Kirchoff's Law; Emissive power: Monochromatic, total emissive power; Radiation intensity; Radiative properties of surfaces: Direct and diffuse radiation; Radiation analysis for different bodies;	**9**	**CLO1, CLO2**
8	Angle factor and analysis;	**3**	**CLO4**
9	Net radiation interchange between two bodies: Infinite parallel planes, Concentric spheres and long cylinders; Simple enclosure problems; Radiation shield analysis;	**4**	**CLO2, CLO3**
10	Gas radiation analysis; Solar radiation: Concept, Analysis and its prospects in Bangladesh	**3**	**CLO1, CLO2**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOKS

1. Yunus A. Çengel, Heat and Mass Transfer: Fundamentals & Applications, McGraw-Hill Education
2. J. P. Holman, Heat Transfer, McGraw-Hill Education

REFERENCE BOOKS

1. Er. R.K. Rajput, Heat and Mass Transfer, S. Chand Publishing
2. Theodore L. Bergman, Adrienne S. Lavine, Frank P. Incropera & David P. DeWitt, Fundamentals of Heat and Mass Transfer, John Wiley & Sons.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	30	
Evaluate	20	

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	05
Understand	15
Apply	10
Analyze	20
Evaluate	40
Create	10

8.6.7. ME 3502

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 3502 **COURSE TITLE:** Heat Transfer Sessional		
CREDIT: 0.75 (Sessional)	**TERMS OFFERED:** 3rd year 1st semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: This course will enhance the students' knowledge and skilfulness of heat transfer as well as familiarize them its application to the real world.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Analyze** the behavior of heat conduction and radiation of different materials.
CLO2	**Apply** conduction and radiation laws, theories and equations to design simple heat transfer equipment.
CLO3	**Evaluate** the performance parameters of different types of heat transfer systems for conduction and radiation based on reference data, design codes and standards.
CLO4	**Design (i.e. Create)** appropriate numerical codes to predict conduction and radiation heat transfer based on the standard methods.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	✓	✓										
CLO2		✓										
CLO3			✓	✓								
CLO4			✓		✓							

SN	COURSE CONTENT	Hrs	CLOs
1	Introduction	**3**	**CLO1**
2	Experimental study of heat conduction along simple & composite bar in linear flow condition.	**3**	**CLO1, CLO2, CLO3**
3	Experimental study of heat conduction along simple & composite bar in radial flow condition.	**3**	**CLO1, CLO2, CLO3**
4	Experimental study of thermal radiation apparatus and prove inverse square law.	**3**	**CLO1, CLO3, CLO4**
5	Experimental study of thermal radiation apparatus and prove Stefan–Boltzmann law	**3**	**CLO3, CLO4**
6	Experimental study of solar demonstration unit and find the efficiency	**3**	**CLO1, CLO3, CLO4**
7	Study of photovoltaic trainer unit	**3**	**CLO1, CLO2**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), demonstration of experiment and conduct experiment, showing video, showing practical systems, feedback.

TEXTBOOKS

1. Supplied Lab Manual (Experiments 1-6)
2. Handouts (If Necessary)

REFERENCE BOOKS

1. J. P. Holman, Heat Transfer, McGraw-Hill Education
2. Er. R.K. Rajput, Heat and Mass Transfer, S. Chand Publishing
3. Yunus A. Çengel, Heat and Mass Transfer: Fundamentals & Applications, McGraw-Hill Education
4. Theodore L. Bergman, Adrienne S. Lavine, Frank P. Incropera & David P. DeWitt, Fundamentals of Heat and Mass Transfer, John Wiley & Sons.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home) / Report (%)	Design Project (%)	Board Viva (%)	In class Participation (%)
Remember			50	50
Understand	10	10	30	50
Apply	15	10	20	
Analyze	25	30		
Evaluate	30	20		
Create	20	30		

8.6.8. ME 3601

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 3601 **COURSE TITLE:** Numerical Methods for Engineering Analysis		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 3rd year 2nd semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: Through this course the students are introduced to numerical methods to find the roots of non-linear equations and solution of system of linear algebraic equations, ODE and PDE. The fundamentals of finite difference method (FDM), finite volume method (FVM) and finite element method (FEM) along with their application in the context of Mechanical Engineering will also be discussed through this course.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Analyze** errors and evaluate the accuracy of common numerical methods and the process of constructing a curve, or mathematical function, which has the best fit to a series of data points, possibly subject to constraints.
CLO2	**Apply** numerical methods to find the roots of non-linear equations and solution of system of linear algebraic equations, ODE and PDE.
CLO3	**Demonstrate** the method of constructing new data points within the range of a discrete set of known data points.
CLO4	**Perform** numerical differentiation and integration using various methods.
CLO5	**Comprehend** the fundamentals of finite difference method (FDM), finite volume method (FVM) and finite element method (FEM) along with their application in the context of Mechanical Engineering.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	✓	✓										
CLO2		✓			✓							
CLO3				✓	✓							
CLO4	✓											
CLO5			✓		✓							✓

SN	COURSE CONTENT	Hrs	CLOs
1	Error analysis	**2**	**CLO1**
2	Root finding methods: Graphical method, Direct and Iterative methods	**4**	**CLO1, CLO2**
3	Solution of linear algebraic equations: Direct and Iterative methods	**4**	**CLO1, CLO2**
4	Solution of polynomial equations	**3**	**CLO1, CLO2**
5	Interpolation and Extrapolation	**4**	**CLO3**
6	Curve fitting; Regression analysis;	**4**	**CLO1**
7	Numerical differentiation: Use of Newton's interpolation formula, Douglas-Avakian method, Graphical differentiation maxima-minima, Raphson's methods	**6**	**CLO4**
8	Numerical integration: Trapezoidal rule, Simpson's rule, Weddle's rule, use of Lagrange's interpolation formula, graphical integration, determinants and matrices	**4**	**CLO4**
9	Solution of differential equations: Ordinary differential equation, Partial differential equations; Eigen values and eigen vectors.	**4**	**CLO2**
10	Introduction to finite difference method (FDM), finite volume method (FVM) and finite element method (FEM)	**4**	**CLO5**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOK

1. Steven C. Chapra & Raymond P. Canale, Numerical Methods for Engineers, Tata McGraw Hill

REFERENCE BOOKS

1. S.S. Sastry, Introductory Methods of Numerical Analysis, Prentice-Hall of India Pvt. Ltd.

2. E Balagurusamy, Numerical Methods, Tata McGraw Hill
3. Richard L. Burden, J. Douglas Faires & Annette M. Burden, Numerical Analysis, Cengage Learning
4. S.R.K. Iyengar & R.K. Jain Numerical Methods, Wiley Eastern Ltd.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	10	50
Understand	20	50
Apply	20	
Analyze	20	
Evaluate	30	

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	05
Understand	15
Apply	30
Analyze	20
Evaluate	20
Create	10

8.6.9. ME 3602

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 3602 **COURSE TITLE:** Numerical Methods for Engineering Analysis Sessional		
CREDIT: 0.75 (Sessional)	**TERMS OFFERED:** 3rd year 2nd semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: Through this course the students are introduced to numerical methods to find the roots of non-linear equations and solution of system of linear algebraic equations, ODE and PDE. The fundamentals of finite difference method (FDM), finite volume method (FVM) and finite element method (FEM) along with their application in the context of Mechanical Engineering will also be discussed through this course.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** the fundamental features and operations of the MATLAB development environment.
CLO2	**Analyze** statistical data and perform mathematical calculations using MATLAB.
CLO3	**Apply** numeric techniques to solve practical engineering problems.
CLO4	**Design (i.e. Create)** simple plot to analyze, visualize data in MATLAB **and** algorithms to write efficient, well-documented MATLAB programs to solve scientific and mathematical problems.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1					✓							
CLO2		✓			✓							
CLO3	✓			✓								
CLO4					✓							✓

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Introduction to MATLAB programming; MATLAB environment	**3**	**CLO1**
2	Array operations; loop and execution control	**3**	**CLO2, CLO3**
3	Matrices	**3**	**CLO2, CLO3**
4	Scripts and functions	**3**	**CLO2, CLO3**
5	Plotting	**3**	**CLO4**
6	Applications: data analysis; curve fitting; solving engineering problems.	**6**	**CLO4**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOKS

1. Amos Gilat, MATLAB: An Introduction With Applications, John Wiley & Sons, Inc.
2. William J. Palm III, Introduction to MATLAB for Engineers, McGraw-Hill Education

REFERENCE BOOKS

1. David Houcque, Introduction to MATLAB for Engineering Students, Northwestern University

2. Edward B Magrab, An Engineer's Guide to MATLAB, Upper Saddle River, NJ
3. J.H. Mathews & K.D. Fink, Numerical Methods Using MATLAB, McGraw-Hill Education

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home) / Report(%)	Quiz (%)	Board Viva (%)	In class Participation (%)
Remember	05	10	50	50
Understand	10	20	30	50
Apply	25	30	20	
Analyze	30	20		
Evaluate	20	20		
Create	10			

8.7. 4th Year 1st Semester

8.7.1. ME 4201

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4201 **COURSE TITLE:** Production Planning and Control		
CREDIT: 3.0 (Theory, Optional)	**TERMS OFFERED:** 4th year 1st semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: The purpose of this course is to develop knowledge and skills required to run a production unit and to optimize the use of resources in achieving organizational goals.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** production planning and control techniques.
CLO2	**Analyze** forecasting techniques, product development, production scheduling, breakeven point.
CLO3	**Apply** analytical and statistical methods, inventory modeling, project management, time and motion study, capacity analysis.
CLO4	**Evaluate** statistical and analytical methods, optimization of the production processing cost and time.
CLO5	**Design** process plant layout.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	√		√									
CLO2	√											√
CLO3		√			√							
CLO4					√						√	
CLO5			√				√				√	

SN	COURSE CONTENT	Hrs	CLOs
1	Introduction: Functions of production planning & control, production planning systems & master production schedule. MRPII, JIT.	**3**	**CLO1**
2	Forecasting: Coordination between sales, manufacturing and purchase departments, techniques of forecasting.	**5**	**CLO2, CLO3**
3	Break even analysis: Break-even point and its interpretation, profit volume ratio and its application to new design, multi-product profit volume ratio. Break even analysis to step wise cost variation.	**6**	**CLO2, CLO3**
4	Product and Production Systems: Product development & design product analysis, types of production schedule.	**3**	**CLO5**
5	Inventory: Inventory systems, purchase inventory model, EOQ, production inventory model, EPQ, quantity discounts in inventory, safety stock & reorder levels.	**4**	**CLO2, CLO3**
6	Materials requirement planning, Capacity requirements planning.	**3**	**CLO5**
7	Scheduling: Concepts and techniques-Gantt-chart, CPM, PERT, Index method, and line of balance.	**8**	**CLO3, CLO4**
8	Designing production systems: Plant location and its evaluation, Plant layout, types of plant layouts and their analysis, evaluation of plant layout.	**5**	**CLO5**
9	Time & motion study	**2**	**CL02**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, and solving practical problems, showing practical systems, feedback.

TEXTBOOK

1. Norman Gaither & Greg Frazier, **Production and Operations Management,** South-Western College Pub.

REFERENCE BOOKS

1. Roberta S. Russell & Bernard W. Taylor**, Operations Management**, Wiley

2. S. Anil Kumar & N. Suresh, **Production and Operations Management,** New age International publishers.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	30	
Evaluate	20	

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	05
Understand	10
Apply	15
Analyze	25
Evaluate	20
Create	25

8.7.2. ME 4301

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4301 **COURSE TITLE:** Instrumentation and Quality Control		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 4th year 1st semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: This is one of the important course for mechanical engineering graduates as this course deals with the principles and application of mechanical measurement, calibration of instrument and quality control of manufactured products through different statistical techniques.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** the principle of engineering metrology, measurement standards and instruments.
CLO2	**Analyze** the results of statistical process controls on quality issues
CLO3	**Apply** knowledge of various tools and techniques used to determine geometry and dimensions of components in engineering applications and used quality tools to produce quality product.
CLO4	**Evaluate** quality of products, machine and instruments.

CLO5	**Design** gauges to meet desired needs within realistic constraints.

Mapping of Course Learning Outcomes to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	√											
CLO2		√		√								
CLO3	√				√							
CLO4		√										√
CLO5			√		√							

SN	COURSE CONTENT	Hrs	CLOs
1	Measurement: Accuracy of measuring tools; tools and measurements of tapers; elements of gears and screw threads, measurement of errors in all of the above type measurements; instruments for checking straightness; flatness & squareness and for alignment test. Measurement of surface finish & roughness. Accuracy testing of measuring instruments; Electrical & Electronic measurement.	**9**	**CLO1, CLO3**
2	Inspection: Organization and purposes, kinds of inspection; fits, allowance and tolerances-their use and their gauges; Abbes' principle and its application. Standards of length. Scope and techniques for maintaining tolerances, grades of manufacturing accuracy. Assembly-Selective and interchangeable assembly, gauging and limit gauges. Taylor's principles on limit gauges, thread measurement and thread.	**6**	**CLO1, CLO3**
3	Engineering Statistics: Concepts of probability; conditional and joint probability; Baye's rule; Concepts of random variables; discrete and continuous probability distributions, moment and moment generating function; uniform; binomial; hyper-geometric; Poisson distributions; normal distribution; students' t-distribution, Chi-square distribution; exponential distribution. estimation theory; estimation of mean; difference between two means etc.	**9**	**CLO1, CLO2**
4	Statistical hypothesis: Type-I & Type-II error, one-tailed & two-tailed tests.	**3**	**CLO1, CLO2**
5	Statistical quality control: objectives of statistical quality control; Control charts-uses of X & R-charts, p-charts and c-charts. Acceptance sampling-single sampling, double sampling, multiple sampling; sequential sampling; sampling plans and their applications.	**9**	**CLO2, CLO4**

SN	COURSE CONTENT	Hrs	CLOs
6	Regression analysis, analysis of variance. Concepts of quality circle. TQM and TQC.	**3**	**CLO1, CLO2**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOKS:

1. Kenneth William Beaumont Sharp, **Practical Engineering Metrology**, Pitman
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye. **Probability & Statistics for Engineers & Scientists,** Prentice Hall

REFERENCE BOOKS:

1. D. M. Anthony, **Engineering Metrology**, McGraw-Hill
2. Eugene Lodewick Grant & Richard S. Leavenworth, **Statistical Quality Control**, Pergamon Press
3. R.K. Jain, **Engineering Metrology**, Khanna Publisher

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	30	
Evaluate	20	

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	15
Understand	15
Apply	20
Analyze	20
Evaluate	30

8.7.3. ME 4302

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4302 **COURSE TITLE:** Instrumentation and Quality Control Sessional		
CREDIT: 0.75 (Sessional)	**TERMS OFFERED:** 4th year 1st semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: This course provides students the understanding of the principles of engineering metrology, methods of measurement, and their applications in the manufacturing industry.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Summarize** principles of engineering metrology, measurement standards and instruments.
CLO2	**Analyze** and interpret data of different experiments.
CLO3	**Apply** knowledge of various tools and techniques used to determine geometry and dimensions of components in engineering applications.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√											
CLO2		√		√	√							
CLO3	√		√						√			

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Introduction	**3**	**CLO1**
2	1. Measurement of diameter of large bore by pin gauge. 2. Measurement of diameter of a bore by four ball.	**3**	**CLO1, CLO2, CLO3**
3	Measurement of diameter of recessed hole by two balls. Internal taper measurement by balls and slip gauges.	**3**	**CLO1, CLO2, CLO3**
4	Measurement of internal taper by unequal Balls. Measurement of an external taper by rollers, slip gauges and micrometer.	**3**	**CLO1, CLO2, CLO3**
5	External taper measurements by sine bar and dial gauge. Measurement of angle between centerlines of holes in a shaft.	**3**	**CLO1, CLO2, CLO3**
6	Measurement the angle between two consecutive teeth of a spline using two rollers of equal diameter and slip gauge.	**3**	**CLO1, CLO2, CLO3**

SN	COURSE CONTENT	Hrs	CLOs
	Measurement of angle by using hard steel discs (Balls/Rollers).		
7	Measurement of radius of curvature of a convex surface by using the surface plate & rollers. Measurement of Radius (R) of a concave surface with a roller by dynamical method. Measurement of Radius (R) of a convex surface with a rectangular bar by the dynamical method.	**3**	**CLO1, CLO2, CLO3**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOK

1. Kenneth William Beaumont Sharp, **Practical Engineering Metrology**, Pitman.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home) / Report (%)	Quiz (%)	Board Viva (%)	In class Participation (%)
Remember	10	10	50	50
Understand	20	20	30	50
Apply	35	35	20	
Analyze	35	35		
Evaluate				

8.7.4. ME 4501

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4501 **COURSE TITLE:** Applied Thermodynamics		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 4th year 1st semester	
Exam Hours: 3.0	**CIE Marks:**30%	**SEE Marks:**70%
Prerequisite: ME 1503 **(**Basic Thermodynamics)		

Course Objectives/Summary: This is one of the core course in mechanical engineering department. This course prepares students to deal with different types of conventional and nonconventional power generating systems and energy conversion devices.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** mathematics and science of thermal engineering and know how to model the energy conversion system in reality.
CLO2	**Analyze** the CI, SI Engines and boilers with various configurations used in various thermal power generation systems.
CLO3	**Apply** thermo-fluid equations for measuring the performance of IC engines and the power generation systems.
CLO4	**Evaluate** the characteristics of different power cycles and effectiveness of energy conversion processes in mechanical power generation systems for the benefit of mankind.
CLO5	**Design** large and small size power plants considering all parameters to sustaining energy crisis and think beyond curriculum in the field of conventional as well as alternative and renewable sources of energy.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	√	√										
CLO2		√				√						
CLO3	√				√							
CLO4		√					√					√
CLO5			√		√							

SN	COURSE CONTENT	Hrs	CLOs
1	Internal combustion Engine: Classification of IC engines; testing performance of IC engines; ideal fuel-air cycle and real cycle analysis; use of combustion charts; combustion phenomena in SI and CI engines; Explanation of flame propagation in CI and SI engines.	**4**	**CLO1**
2	Flame propagation; knocking and detonation in IC engines and factors effecting knocking and detonation;	**3**	**CLO1, CLO2**
3	Fuel metering in SI and CI engines. Carburetors and carburetion of fuel with appropriate amount of air, lean and reach mixtures of fuel; A/F Ratios.	**4**	**CLO1, CLO3**
4	Design of Combustion chamber of IC Engines including gas turbine	**3**	**CLO3, CLO4**
5	Volumetric efficiency of IC engine and variables affecting volumetric efficiency;	**3**	**CLO3, CLO4**
6	Heat transfer in IC engines; scavenging; scavenging efficiency; performance of supercharging and unsuper-charging IC engines.	**3**	**CLO3, CLO4**
7	Principle of similitude in IC engine design. Engine friction and engine characteristics. Fuel specification in ICE.	**6**	**CLO3, CLO4**
8	Gas turbine plants modeling; power generation in gas turbine power cycle; Use of open and closed gas turbine cycles; enhancement of power by inter-cooling	**4**	**CLO3, CLO4**

SN	COURSE CONTENT	Hrs	CLOs
	and re-heating and regeneration. Differentiation of Ideal and real cycles; staging in gas turbine and in compressors.		
9	Vapor power plant modeling; steam turbines and vapor power cycles and power plant parameters; detail on reheat and regeneration systems of vapor power cycle; binary vapor power cycles; use of combined cycle analysis and co-generation technology; back pressure and extraction turbine. Flow through nozzles and blades, velocity compounding and pressure compounding in turbines.	**3**	**CLO3, CLO4**
10	Thrust propulsion: Basics of propulsion system; jet propulsion; turbo jet and turbo-propeller systems; effect of different parameters on performance jet propulsion system; thrust augmentation. Rocket propulsion systems; use of different rocket systems and detail on rocket fuels	**2**	**CLO3, CLO4**
11	Introduction to Energy Conversion: Direct energy conversion; solar energy conversion; fuel cells; thermionic converters; thermo-electrical systems; plasma engine; magneto-hydrodynamic (MHD) power generation.	**4**	**CLO4, CLO5**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOK

1. Edward Frederic Obert, **Internal Combustion Engines**, International Textbook Co

REFERENCE BOOKS

1. V. Ganensen, IC Engines, McGraw-Hill
2. Yunus A. Cengel & Michael A. Boles, Thermodynamics: An Engineering Approach, McGraw-Hill

ASSESSMENTPATTERN

CIE-Continuous Internal Evaluation

Category (Using Bloom's Taxonomy)	Class Tests (%)	Class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	30	
Evaluate	20	

SEE-Semester End Examination

Bloom's Category	Final Exam (%)
Remember	05
Understand	15
Apply	10
Analyze	20
Evaluate	30
Create	20

8.7.5. ME 4502

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4502 **COURSE TITLE:** Applied Thermodynamics Sessional		
CREDIT: 0.75 (Sessional)	**TERMS OFFERED:** 4th year 1st	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:**00%

Course Objectives/Summary: This course gives student, hands on experience of dealing with different types of thermal power generating systems and enables them to maintain IC engines properly.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Compare** IC Engines and their various optimized configurations used for thermal power generations systems.
CLO2	**Apply** different thermodynamic phenomena to enhance the performance of IC engines and to protect the environmental from getting pollution effects from all IC engine emissions.
CLO3	**Assess** the effect of engine operating variables (air/fuel ratio, ignition timing, fuel properties etc.) on the performance of the Otto, Diesel engines and gas turbine.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	√											√
CLO2	√						√					
CLO3		√			√							

SN	COURSE CONTENT	Hrs	CLOs
1	Introduction	**3**	**CLO1**
2	Study of Fuel pump, fuel injection and conventional ignition system Study of EFI Ignition System	**3**	**CLO1, CLO3**
3	Mantling and dismantling of SI and CI Engines Demonstration & study of commercial exhaust gas analyzers.	**3**	**CLO1, CLO2**
4	Test on multi-cylinder Petrol/Gas engine for determination of engine performance	**3**	**CLO2,CLO3**
5	Test on diesel engine to determine various efficiencies, SFC and heat balance.	**3**	**CLO2, CLO3**
6	Study of turbojet engine Models Study of unconventional engine like Wankel Engine	**3**	**CLO1**
7	Study of mini power plant module and test the performance. Study and performance test of a multi-stage gas turbine.	**3**	**CLO3**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOK

1. V. Ganensen, **IC Engines**, McGraw-Hill

REFERENCE BOOKS

1. Edward Frederic Obert, **Internal Combustion Engines**, International Textbook Co
2. Yunus A. Cengel & Michael A. Boles, **Thermodynamics: An Engineering Approach**, McGraw-Hill

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home/Report) (%(	Quiz (%)	Board Viva (%)	In Class participation (%)
Remember	10	10	50	50
Understand	20	20	30	50
Analyze	20	20	20	
Apply	30	30		
Evaluate	20	20		

8.7.6. ME 4503

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4503 **COURSE TITLE:** Heat and Mass Transfer		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 4th year 1st semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: This course is designed to introduce a basic study of the phenomena of heat and mass transfer, to develop methodologies for solving a wide variety of practical engineering problems, and to provide useful information concerning the performance and design of particular systems and processes.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** problems involving heat and mass transfer using the fundamental principles from the mass, momentum and energy balances
CLO2	**Analyze** the relationships between heat, mass, and momentum transport phenomenon along with the heat and mass transfer equipment
CLO3	**Apply** the basic concepts of mass transfer models - concentration gradients, diffusion, and dispersion in solving the practical applications
CLO4	**Evaluate** the different types of heat transfer systems (heat exchangers) based on reference data, design codes and standards
CLO5	**Design** appropriate numerical codes to predict heat and mass transfer based on the standard methods

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√	√										
CLO2		√		√								
CLO3	√				√							
CLO4		√				√						
CLO5			√		√							

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Convection: Basic concepts and types; Convective heat transfer coefficient: Factors and its effects; Estimation of convective heat transfer coefficient: General method, Energy transport mechanism; Approximate analysis by integral method;	**3**	**CLO1, CLO2**
2	Analogy between heat and momentum transfer; Forced convection: over a flat plate, inside tubes and ducts, cylinders, spheres and tube-bundles;	**6**	**CLO1, CLO2**

SN	COURSE CONTENT	Hrs	CLOs
3	Fully developed flows and boundary layer developments; Empirical equations based on forced convection;	**3**	**CLO1, CLO2**
4	Free convection from exterior surfaces: vertical plates, horizontal plates, inclined plates, cylinders and spheres;	**3**	**CLO1, CLO2**
5	Heat transfer due to combined effect of conduction, convection and radiation;	**3**	**CLO1, CLO2**
6	Empirical equations based on free convection;	**3**	**CLO5**
7	Application of dimensional analysis in forced and natural convection.	**3**	**CLO5**
8	Boiling: Basic concepts, Different types of boiling and their effects on heat transfer; Boiling curve analysis; Different correlations; Evaporation; Heat pipes.	**3**	**CLO1, CLO2**
9	Condensation: Basic concepts, Different types of condensation and their effects on heat transfer; Different correlations; Analysis of film wise condensation on a vertical plates and horizontal cylinders.	**3**	**CLO1, CLO5**
10	Heat exchangers: Basic concepts and types; Analysis of heat exchanger: LMTD method, effectiveness-NTU method; Fouling and scaling factors of heat exchanger; Techniques of heat transfer augmentation; Performance evaluation criterion; Introduction to heat exchanger design.	**6**	**CLO4, CLO5**
11	Mass transfer: Basic concepts and types; Mechanism of mass transfer: diffusion, Convection and change of phase; Mass-transfer co-efficient: Factors and their effects; Analogy between heat and mass-transfer; Application of dimensional analysis in mass transfer; Empirical equations.	**3**	**CLO3, CLO5**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOKS

1. J. P. Holman, **Heat Transfer**, 10th Edition, McGraw-Hill.
2. Heat and Mass Transfer Hand Book

REFERENCE BOOKS

1. Yunus A. Cengel , **Heat Transfer - A Practical Approach**, McGraw-Hill.
2. Frank P. Incropera& David P. Dewitt, **Fundamental of Heat & Mass Transfer**, 7th Edition. John Wiley & Sons
3. R. K. Rajput , **Heat & Mass Transfer**, Chand (S.) & Co Ltd

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	30	
Evaluate	20	

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	05
Understand	15
Apply	10
Analyze	20
Evaluate	30
Create	20

8.7.7. ME 4504

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4504 **COURSE TITLE:** Heat and Mass Transfer Sessional		
CREDIT: 0.75 (Sessional)	**TERMS OFFERED:** 4th year 1st semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: This course gives student the exposure of different heat and mass transfer related practical experiments and enables them to solve a wide variety of practical problems.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Analyze** the different heat and mass transfer phenomenon along with their relevant equipment used in real life.
CLO2	**Apply** heat and mass transfer models in solving the practical applications.
CLO3	**Judge** performance of heat transfer systems based on reference data, design codes and standards.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	√						√					
CLO2		√		√								
CLO3		√										√

SN	COURSE CONTENT	Hrs	CLOs
1	Introduction	**3**	**CLO1**
2	Experimental study of free and forced convection heat transfer	**3**	**CLO1, CLO2**
3	Experimental study of boiling heat transfer	**3**	**CLO1, CLO2**
4	Experimental study of concentric tube heat exchanger for parallel and counter flow	**3**	**CLO2, CLO3**
5	Experimental study of cross flow heat exchanger	**3**	**CLO2, CLO3**
6	Experimental study of shell and tube heat exchanger	**3**	**CLO2, CLO3**
7	Experimental study of mass transfer	**3**	**CLO1, CLO2**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOKS

3. J. P. Holman, **Heat Transfer**, McGraw-Hill.
4. Heat and Mass Transfer Hand Book

REFERENCE BOOKS

4. Yunus A. Cengel , **Heat Transfer - A Practical Approach**, McGraw-Hill.
5. Frank P. Incropera & David P. Dewitt, **Fundamental of Heat & Mass Transfer**, 7th Edition. John Wiley & Sons
6. R. K. Rajput , **Heat & Mass Transfer**, Chand (S.) & Co Ltd

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home) / Report (%)	Design Project (%)	Board Viva (%)	In class Participation (%)
Remember			50	50
Understand	10	10	30	50
Apply	15	10	20	
Analyze	25	30		
Evaluate	30	20		
Create	20	30		

8.7.8 (a). ME 4101

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4101 **COURSE TITLE:** Aerodynamics		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 4th year 1st semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: This course introduces the student to the basic of jet propulsion, airfoil theory and other related fields of aerodynamics which will help them to enrich their knowledge for aircraft design.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** the principles of inviscid incompressible flow and its interaction with aerodynamic bodies
CLO2	**Analyze** boundary layer: velocity profile, thickness and friction coefficient.
CLO3	**Apply** the basic aerodynamic characteristics for various flow conditions.
CLO4	**Evaluate** the performance of various aerodynamic applications.
CLO5	**Design (i.e. Create) appropriate** the system of aerodynamic capabilities as per demand by maintaining proper safety standards.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√		√									
CLO2	√	√		√								
CLO3	√				√							
CLO4		√			√							
CLO5			√		√							

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Inviscid incompressible flow to include potential function	**4**	**CLO1**
2	stream function; circulation and basic flows.	**4**	**CLO1, CLO2**
3	Kutta Jouko-Wski theorem.	**4**	**CLO1, CLO3**
4	Air foil theory and wing theory.	**7**	**CLO3, CLO5**
5	Drag; aircraft propulsion and propeller;	**4**	**CLO3**
6	static performance problem; special performance problem.	**6**	**CLO4, CLO5**
7	Introduction to stability and control;	**3**	**CLO1, CLO4**

8	Longitudinal stability and control;	**2**	**CLO1, CLO4**
9	lateral and directional stability and control.	**3**	**CLO4, CLO5**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOK

1) John D. Anderson, **Fundamentals of Aerodynamics**, McGraw-Hill

REFERENCE BOOKS

1) John J. Bertin and Russell M. Cummings, **Aerodynamics for Engineers**, Pearson
2) L. M. Milne-Thomson, **Theoretical Aerodynamics**, Dover Publications

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	30	
Evaluate	20	
Create		

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	05
Understand	15
Apply	10
Analyze	20
Evaluate	30
Create	20

8.7.8 (b). ME 4705

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4705 **COURSE TITLE:** Mechatronics		
CREDIT: 3.0 (Theory, Optional)	**TERMS OFFERED:** 4th year 1st semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objective: Mechatronics is the marriage of mechanical engineering with smart electronics and it has vital application at industrial automation and robotics. This course will give framework of knowledge that allows students to develop an interdisciplinary understanding and integrated approach to mechatronic engineering.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** the different Mechatronic systems.
CLO2	**Synthesize** the mechatronic systems to troubleshoot, maintain and repair using industry-standard tools, practices, and procedures
CLO3	**Analyze the s**ystems, process, software-based tools.
CLO4	**Apply** of virtual instrumentation, actuators, sensors, vision systems, AI etc.
CLO5	**Design (i.e., Create)** mechatronic projects for factory, office and home automation.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	✓	✓										✓
CLO2		✓		✓								
CLO3		✓	✓	✓								
CLO4	✓				✓							
CLO5			✓			✓						

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Introduction: Organization structure.	**3**	**CLO1**
2	System concept; mechanical, electrical, electronic and software components.	**7**	**CLO1, CLO2**
3	Process; software-based tools: Virtual instrumentation; CAD; CAM.	**6**	**CLO2, CLO4**
4	Computer integrated systems; Computer interfacing.	**5**	**CLO2, CLO3**
5	Manipulator; Actuator types; Sensors and vision systems.	**6**	**CLO4, CLO5**
6	Smart robots; Artificial intelligence.	**5**	**CLO3,**

			CLO5
7	Factory, Office and Home automation.	**5**	**CLO4, CLO5**
8	Future trend.	**2**	**CLO2, CLO3**

Teaching Learning Strategies: Lecture, multimedia presentation, problem solving, assignment, practical system.

TEXTBOOKS

1. Robart H. Bishop, Mechatronics: An Introduction, CRC Press
2. Devid G. Alciatore, Mechatronics, McGraw-Hill Education

REFERENCE BOOKS

1. M W. Bolton, Mechatronics, Pearson
2. Katsuhiko Ogata, Modern Control Engineering, Pearson

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	20	
Evaluate	30	
Create		

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	05
Understand	15
Apply	10
Analyze	20
Evaluate	30
Create	20

8.7.8 (c). ME 4307

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4307 **COURSE TITLE:** Material Handling and Safety Engineering		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 4th year 1st semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: This course introduces student to the concepts and components that constitute an industrial automation system in manufacturing and the basic knowledge of how to design and select optimal packaging methods for a specific product.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** the mechanisms/principles of material handling systems, packaging and process safety management.
CLO2	**Analyze** the procedures for different material handling technique, packaging methods and risk assessment techniques.
CLO3	**Apply** mechanics, hydraulics, electrical concepts to select suitable material handling and safety equipment for industry or organization.
CLO4	**Evaluate** the causal factors in material handling, packaging and process safety incident case studies.
CLO5	**Design** appropriate material handling and safety equipment with considering appropriate standards.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs)-

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√											
CLO2		√		√								
CLO3	√						√		√			
CLO4		√		√								
CLO5			√		√							

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Introduction to material handling; unit load and bulk load calculation; Efficiency of materials handling system.	**2**	**CLO1**
2	Factors in selecting conveying machines, general theory of conveying machines-capacity of continuous conveying machines; resistance to motion factor, resistance & power in conveying machines with flexible pulling member.	**4**	**CLO1, CLO2**
3	Dynamic phenomenon in chain conveyor; Types of conveyors: descriptions, design, principles, comparative	**4**	**CLO3, CLO5**

SN	COURSE CONTENT	Hrs	CLOs
	merits and demerits and schematic representation of - belt; apron; flight; bucket; V-bucket, overhead; load propelling; car or plat form; roller; oscillating & vibrating; pneumatics & hydraulic and rope conveyors.		
4	Other conveying equipment: cranes, jib, overhead traveling; derrick; electric hoist; witches & capstan; electric lifts: trucks; fork-lifts; hopper; loaders; chutes.	**6**	**CLO2, CLO3**
5	Operation and selection of industrial truck loads. Computer control material handling (AGV, ASRS).	**4**	**CLO3, CLO5**
6	Importance of packaging; factors in packaging;	**2**	**CLO1, CLO4**
7	Packaging materials & methods; visual aids in packaging & materials handling in Bangladesh.	**3**	**CLO3, CLO4**
8	Introduction to safety management, key concepts, terminologies, and safety quantification; safety by design; safety function deployment.	**4**	**CLO1, CLO2**
9	Hazard identification techniques; Fault tree and event tree analysis (qualitative & quantitative); Bow-tie and quantitative risk assessment (QRA).	**3**	**CLO2, CLO3**
10	Safety vs reliability; Systems safety quantification; man error analysis and safety.	**2**	**CLO2, CLO3**
11	Accident investigation and analysis; Application of virtual reality. Fire hazards; Firefighting methods.	**2**	**CLO2, CLO4**
12	Vertical transportation: types of elevators, determination of size and quantity of elevators; Incoming and outgoing traffic handling; Escalators and moving ramps.	**3**	**CLO3, CLO5**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOKS

1. Material Handling, Raymond A. Kulwiec
2. Safety Engineering: Principles and Practices, Frank R. Spellman and Nancy E. Whiting.

REFERENCE BOOKS

1. Materials Handling Equipment, N. Rudenko
2. Materials Handling Handbook, David E. Mulcahy
3. The Package Design Book, Pentawards and Julius Wiedemann
4. Safety and Health for Engineers, Roger L. Brauer

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	30	
Evaluate	20	
Create		

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	05
Understand	15
Apply	10
Analyze	20
Evaluate	30
Create	20

8.7.8 (d). ME 4509

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4509 **COURSE TITLE:** Automobile Engineering		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 4th year 1st semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: This course is ideal for students who would like a career within the automotive industry and to develop a comprehensive range of related skills.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** the basic structure of an automobile, different parts of an automobile, different systems of automobile and their functions
CLO2	**Analyze** the symptoms and diagnose the problems of various parts of electrical systems of an automobile
CLO3	**Evaluate** the practical problems of different systems and diagnosis of these problems
CLO4	**Apply** the engineering principle to design and develop of an automobile

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	√											
CLO2		√		√				√				
CLO3		√			√		√					
CLO4			√				√					

SN	COURSE CONTENT	Hrs	CLOs
1	Introduction to the automobile; Components of an automobile.	**2**	**CLO1**
2	Engine fundamental; Engine types & classification; Components of an engine; Engine construction; Modern developments.	**4**	**CLO1, CLO3**
3	Engines fuel system: Engine fuels, alternative fuels and alternative types of engine; Carburetor fuel systems; Automotive carburetors; Compressed natural gas (CNG) system; Fuel-injection system for gasoline engines, diesel engine; exhaust system;	**6**	**CLO1, CLO4**
4	Lubricating system: Friction in engine and automobile components and its lubrications. Cooling system.	**4**	**CLO1, CLO4**
5	Automotive Electrical Systems: Battery; Generator; Regulator; Cranking motor; Ignition system: Knock, pre-ignition, post ignition; Spark plug; Magneto; Lighting system; Electronic control system; Indication warning devices.	**5**	**CLO1, CLO2**
6	Clutch: Clutch system & function, Manual & automatic transmission; Gear: gear box & differentials.	**4**	**CLO1, CLO4**
7	Final drives: drive lines and universal joints; Axles.	**3**	**CLO1, CLO4**
8	Automotive safety devices & their functions; Brakes and its modern development; wheels & tires.	**4**	**CLO1, CLO4**
9	Springs and Suspension; shock absorbers	**3**	**CLO1, CLO4**
10	Automotive body materials and vehicle shape; Steering systems.	**2**	**CLO1, CLO4**
11	Reduction of injuries; Modern developments for economy speeds.	**2**	**CLO3, CLO4**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOK

1. Automotive Mechanics by William H Crouse & Donald L Anglin (Text Book)

REFERENCE BOOKS

1. Vehicle Dynamics by Thomas D. Gillespie
2. Theory of ground vehicles by J.Y. Wong, Carleton Univ., Canada, J.Wiley

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	25	50
Understand	25	50
Apply	25	
Analyze	25	

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	25
Understand	25
Apply	25
Analyze	25

8.7.9. ME 4000*

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4000 **COURSE TITLE:** Thesis/Capstone Design		
CREDIT: 3.0	**TERMS OFFERED:** 4th year 1st semester	
Exam Hours: NA	**CIE Marks:** 50%	**FA Marks:** 50%

Course Objectives/Summary: This course is designed for the final year mechanical engineering students to deal with complex engineering problems.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** in-depth relevant research or engineering knowledge to solve conflicting technical and engineering issues utilizing diverse resources.
CLO2	**Analyze** literature to identify and formulate problem or research question.
CLO3	**Apply** relevant tools/methods, standards and codes to solve the problem and explore research findings.
CLO4	**Evaluate** alternative solutions to extend beyond experiences.
CLO5	**Design** and implement a solution using engineering principles and research-based creative knowledge in novel way.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	√											√
CLO2		√	√					√		√		
CLO3			√	√	√	√			√	√		
CLO4				√			√	√			√	
CLO5			√		√	√	√	√	√	√	√	√

SN	COURSE CONTENT	Hrs	CLOs
1	Meetings with thesis supervisor (Discussion)	**6**	**CLO1, CLO2, CLO4, CLO5**
2	Independent work	**17**	**CLO1, CLO2, CLO3, CLO5**
3	Project Proposal (Report)	**3**	**CLO2, CLO5**
4	Progress Seminar (Seminar)	**3**	**CLO3**
5	Seminar Participation (Participation)	**2**	**CLO1**
6	Poster and Demonstration (Demonstration)	**3**	**CLO3**
7	Project & Thesis Report Writing	**5**	**CLO3**

REFERENCE BOOKS

1. Randy L. Joyner, William A. Rouse, Allan A. Glatthorn, **Writing the Winning Thesis or Dissertation: A Step-by-Step Guide**, Corwin
2. Relevant books, scientific journals, handbooks, patents and manuals.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Meeting with supervisor, independent work and report and presentation (%)	In class Participation (%)
Understand	10	
Apply	30	
Analyze	30	
Create	30	

SEE- Semester End Examination

Bloom's Category	Presentation to the examination board (%)	Thesis report examination (%)
Understand	10	10
Apply	30	30
Analyze	30	30
Create	30	30

8.8. 4th Year 2nd Semester

8.8.1. ME 4203

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4203 **COURSE TITLE:** Industrial Management		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 4th year 2nd semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: This course emphasis the modern and scientific principles of industrial management by providing the required knowledge of productivity, cost control and optimization, research and development, product manufacturing strategies, sustainability of product are the worthy concerned for mechanical engineers to ensure the industrial advancement and profitability.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** the concept of modern and scientific management principles in different Industrial issues in relation to global world perspectives.
CLO2	**Analyze** the sustainability of a product by concerning research and development under dynamic changeable situations and environments.
CLO3	**Evaluate** the practical problems through the relationship between the different concerned and critical managerial concepts.
CLO4	**Design** sustainable product by research and development and generate creative and innovative ideas under dynamic conditions with other relevant parameters.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	√							√				
CLO2				√			√					
CLO3		√								√	√	
CLO4							√	√				√

SN	COURSE CONTENT	Hrs	CLOs
1	**Management & Organization:** Management functions; principles of management; organization fundamentals; organization structures; span of control.	**8**	**CLO1, CLO2**
2	**Business:** Single proprietorship; partnership; joint stock company; corporation; private & public sector; share, bond, loan; share market, mortgage, bankruptcy, liquidation.	**3**	**CLO1, CLO2**
3	**Financial Planning:** Elements and costs, cost patterns, cost control, classification of capital, capital procurement, budgetary control. Depreciation, depreciation calculation.	**4**	**CLO3**
4	**Personnel Management:** Definition and functions of personnel management, manpower planning, recruitment and development.	**3**	**CLO1**
5	**Wage and Salary Administration:** Job evaluations, techniques of job evaluation, merit rating, salary & wages, wage incentive plans, fringe benefits, working conditions, safety & health measure.	**3**	**CLO3**
6	**Purchases & sales:** Organization & means of market promotion, markets & marketing related to sales and purchases, purchasing procedures.	**3**	**CLO3**
7	**Performance:** Measure of performance, measurement & analytical problems of productivity, costs of management.	**3**	**CLO2**
8	**Research & development:** Technological change, process of innovation, importance of R & D, patent & royalty, product life cycle analysis; development of product creativity.	**6**	**CLO3, CLO4**
9	**Industrial Psychology:** Perception and forming impression on other; Motivation theories, motives & goals; stress, frustrations, anxiety and conflict, leadership.	**6**	**CLO3**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOK

1. Heinz Weihrich, Harold Koontz, Management: A Global Perspective, McGraw-Hill

REFERENCE BOOK

1. John W. Newstrom, Keith Davis, Organizational Behavior: Human Behavior at Work, McGraw-Hill

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	05	50
Understand	15	50
Apply		
Analyze	35	
Evaluate	30	
Create	15	

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	10
Understand	15
Apply	
Analyze	30
Evaluate	30
Create	15

8.8.2. ME 4505

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4505 **COURSE TITLE:** Power Plant Engineering		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 4th year 2nd semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: This course attempts to provide them basic knowledge of the technologies available at plant level and would also acquaint them with the latest technological advances taking place in this sector.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** the basic knowledge about all power plant, their components, the power producing capacity, the basic system of power plant operation depending on different loads, control device, safety and main risks involved in power plants;

CLO2	**Analyze** knowledge trends in the different power sources, world energy scenario, and current trends in different power energy conversion technologies.
CLO3	**Apply** the concept of design, construction, operation and performance of various components of steam, gas and diesel power plant.
CLO4	**Evaluate** the different types of economic factor consideration in power generation and estimate the cost of producing power.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	√											√
CLO2	√					√						
CLO3			√		√		√					
CLO4		√	√									

SN	COURSE CONTENT	Hrs	CLOs
1	**Introduction:** Sources of energy; Types of power plants; Electrical energy scenario; Power stations in Bangladesh;	**3**	**CLO1, CLO2**
2	**Variable Load Problems**: Types of load and load curves; Different factors; Effect of variable load on power plant design & operation; Methods of meeting the variable loads; Forecasting of loads & electrical energy requirements.	**6**	**CLO1, CLO2**
3	**Power plant economics:** General economic problem; Annual operating costs; Methods of economic selection; Plant selection criteria; Energy rate.	**3**	**CLO2, CLO4**
4	**Diesel and gas engine power plants**: Fuel: Diesel, HFO, LNG, NG; Fuel handling and storage; Layout; Working Principles; Auxiliary systems; Heat balance; Performance & controls.	**3**	**CLO3**
5	**Steam power plants:** Fuel: Coal, NG; Fuel handling and storage; Layout; Working Principles; Steam generators and accessories; sub-critical, super-critical and ultra-super-critical steam generators; Combustion equipment; Ash handling system; Performance and controls.	**6**	**CLO1, CLO3**
6	**Gas turbine power plants:** Fuel & fuel handling; Layout; Working Principles; Combined cycle power plant; Performance and controls.	**3**	**CLO1, CLO3**
7	**Nuclear power plants:** Fuel: natural & artificial; Fuel handling and storage; Layout; Reactors: different types & their working principles; Waste disposal & safety measures; Performance and controls; Environmental impact and remedy.	**6**	**CLO1, CLO2**
8	**Hydro-electric power plants:** Water reservoirs and pump storage; Layout; Working principle; Selection &	**3**	**CLO1, CLO2**

SN	COURSE CONTENT	Hrs	CLOs
	sizing of hydraulic equipment; Governing system; Performance and controls.		
9	**Solar based power plants:** Concept of mini and micro grids, working principle of solar photovoltaic power generation; Salient components and their performance analysis; solar thermal electricity.	**3**	**CLO1, CLO2**
10	**Power plant accessories**: Cooling tower; Chimney; Water treatment plant.	**3**	**CLO2, CLO3**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOK

1. G.R. Nagpal, "Power Plant Engineering", Hanna Publishers, 1998.

REFERENCE BOOKS

1) EI- Wakil M.M, "Power Plant Technology", McGraw-Hill 1984.
2) K.K. Ramalingam, "Power Plant Engineering", Scitech Publications, 2002.
3) G.D.Rai, "Introduction to Power Plant Technology", Khanna Publishers, 1995.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	30	
Evaluate	20	
Create		

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	10
Understand	10
Apply	20
Analyze	20
Evaluate	30
Create	10

8.8.3. ME 4507

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4507 **COURSE TITLE:** Refrigeration and Building Mechanical System		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 4th year 2nd semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: This course has been designed specifically for Mechanical engineering students who need a sound understanding of refrigeration, air conditioning and building mechanical systems, their design and applications.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** the principles and laws of refrigeration and air conditioning systems, design, and consideration that influence the design, manufacturing and performance of the systems
CLO2	**Analyze** mathematical, numerical and practical methods used in refrigeration and air conditioning system design, selection, performance evaluation and problem solving
CLO3	**Design** a refrigeration or air conditioning system based on weather and environmental parameters and building structure appropriate for specific commodity preservation or human comfort
CLO4	**Apply** the design, analytical and problem-solving cognitive skills for production, selection, installation and maintenance of refrigeration and air conditioning systems which demonstrate the ability to work effectively as part of a team
CLO5	**Evaluate** the performance parameters like capacity, energy efficiency, life cycle costing and environmental impact of the system for commodity preservation or human comfort

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√							√				√
CLO2		√		√								
CLO3			√		√		√					
CLO4					√				√			
CLO5		√					√					√

SN	COURSE CONTENT	Hrs	CLOs
1	Basic concepts and definitions of refrigeration and its applications.	**1**	**CLO1, CLO2**
2	Different refrigeration methods: Analysis of vapor compression refrigeration system, vapor absorption refrigeration system, air-cycle refrigeration systems, Steam jet refrigeration system, Vortex tube refrigeration system.	**7**	**CLO2, CLO5**
3	Refrigerants- Classification and properties of commonly used refrigerants and modern development; Selection criteria based on global effects;	**1**	**CLO1, CLO4**
4	Refrigeration equipment: - Compressors, evaporators, condensers, expansion devices, other control and safety devices.	**5**	**CLO1, CLO5**
5	Multi-pressure system of refrigeration; Low temperature refrigeration: - Linde, Claude, Cascade and mixed refrigerant systems; Manufacturing of dry ice; Magnetic cooling;	**6**	**CLO1, CLO2**
6	Air Conditioning: Basic concepts, definitions and its applications; Classification of air conditioning systems;	**1**	**CLO1**
7	Psychometric analysis: properties, various processes, analysis and applications;	**4**	**CLO3, CLO5**
8	Load calculation: Design parameters, selection criteria, cooling and heating load calculation;	**4**	**CLO3**
9	Duct design: Design parameters, selection criteria, design methods;	**3**	**CLO3**
10	VRF and VAV systems; Air handling and distribution systems; Air conditioning equipment: Chiller, Cooling tower, AHU, FCU, etc.; Application criteria;	**5**	**CLO4, CLO5**
11	Control systems; Refrigerant charging; Leak detection methods.	**2**	**CLO4, CLO5**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOK

1. W.F. Stocker and J.W. Jones, Refrigeration & Air conditioning, McGraw-Hill

REFERENCE BOOK

1. E.G. Pita, Air conditioning principles and systems, Pearson

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	10	20
Understand	15	30
Apply	10	
Analyze	20	20
Evaluate	10	
Design	35	30

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	10
Understand	15
Apply	10
Analyze	20
Evaluate	10
Design	35

8.8.4. ME 4508

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4508 **COURSE TITLE:** Refrigeration and Building Mechanical System Sessional		
CREDIT: 0.75 (Sessional)	**TERMS OFFERED:** 4th year 2nd semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: This is a much needed practical course for mechanical engineering students as this course teaches about the refrigeration and air conditioning system principle, application, operation, maintenance and control which ultimately helps the students to contribute their skill in the field of human comfort and commodity preservation.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Compare** performance of different refrigeration and air conditioning system design, selection,.
CLO2	**Apply** problem-solving skills for selection, installation and maintenance of refrigeration and air conditioning systems.
CLO3	**Judge** different parameters like capacity, energy efficiency, life cycle costing and environmental impact of the system for commodity preservation and/or human comfort

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	√	√		√								
CLO2					√				√			
CLO3		√					√					√

SN	COURSE CONTENT	Hrs	CLOs
1	Introduction	**3**	**CLO1**
1	Performance evaluation and effects of different parameters on the performance of the Vapor Compression Refrigeration System (VCRS)	**3**	**CLO1, CLO2, CLO3**
2	Study and experiment on multi evaporator VCRS	**3**	**CLO1, CLO2, CLO3**
3	Experimental study on vapor absorption refrigeration system (VARS)	**3**	**CLO1, CLO2, CLO3**
4	Experimental study of psychometric processes using Air conditioning laboratory unit	**3**	**CLO1, CLO2, CLO3**
5	Experiment and performance analysis of evaporative cooler	**3**	**CLO1, CLO2, CLO3**
6	Experimental study of cooling tower	**3**	**CLO1, CLO2, CLO3**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOKS

1. W.F. Stocker and J.W. Jones, Refrigeration & Air conditioning, McGraw-Hill

REFERENCE BOOKS

1. E.G. Pita, Air conditioning principles and systems, Pearson

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home) / Report (%)	Quiz (%)	Board Viva (%)	In class Participation (%)
Remember	10	10	30	30
Understand	10	10	30	30
Apply	25	25	20	10
Analyze	25	25	20	20
Evaluate	30	30		10

8.8.5. ME 4002

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4002 **COURSE TITLE:** Industrial Training & Technical Seminar		
CREDIT: 1.50	**TERMS OFFERED:** 4th year 1st semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Accrue** a knowledge of contemporary issues
CLO2	**Communicate** effectively within the working environment
CLO3	**Work** on multidisciplinary teams
CLO4	**Use** the techniques, skills, and modern engineering tools necessary for engineering practice.
CLO5	**Understand** the professional and ethical responsibilities of an engineer

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√										√	
CLO2										√		
CLO3									√			
CLO4					√							
CLO5							√					

SN	**COURSE CONTENT**	**Hrs.**	**CLOs**
1	Training at industry for three weeks	**--**	**CLO1, CLO2, CLO3, CLO4, CLO5**
2	Meetings with thesis supervisor (Discussion)	**10**	**CLO1, CLO2, CLO4, CLO5**
3	Independent work	**10**	**CLO1, CLO2, CLO4, CLO5**
4	Presentation preparation	**3**	**CLO3**
5	Seminar Participation (Participation)	**6**	**CLO1**
6	Report writing	**10**	**CLO3**

REFERENCE BOOKS

1. Presentation Zen: Simple Ideas on Presentation Design and Delivery by Garr Reynolds
2. Relevant books, scientific journals, handbooks and manuals.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Report (%)	Presentation (%)	Participation (%)
Remember	10	20	50
Understand	20	40	50
Apply	30	20	
Analyze	30	20	
Evaluate	10		
Create			

8.8.6. ME 4004

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4004 **COURSE TITLE:** Mechanical Systems Design		
CREDIT: 1.50 (Sessional)	**TERMS OFFERED:** 4th year 2nd semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: This course is intended to give required basic knowledge of designing and evaluating a proper utility and safety systems based on standards.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Analyze** the structure of individual mechanical systems
CLO2	**Apply** mechanical engineering knowledge to setup different mechanical systems
CLO3	**Evaluate** the designed mechanical systems by comparative economic analysis
CLO4	**Design** several mechanical systems based on industrial standards and policies

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	√	√		√								
CLO2	√		√		√							
CLO3		√			√							
CLO4						√		√				√

SN	COURSE CONTENT	Hrs	CLOs
1	Design of Fire Fighting System	**6**	**CLO1 – CLO4**
2	Design of HVAC System	**6**	
3	Design of Vertical Transportation System	**6**	
4	Design of Plumbing System	**6**	
5	Design of Water Treatment Plant	**6**	
6	Design of Effluent Treatment Plant	**6**	
7	Design of Security System	**3**	

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

REFERENCE BOOKS

1. Dennis P. Nolan, Fire Fighting Pumping Systems at Industrial Facilities, Elsevier Inc.
2. Water Treatment Plant Design, American Water Works Association & ASCE, McGraw-Hill
3. George R. Strakosch and Robert S. Caporale, The Vertical Transportation Handbook, Wiley

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home) / Report (%)	Design Project (%)	Board Viva (%)	In class Participation (%)
Remember			20	50
Understand	10		30	50
Apply	15	10	20	
Analyze	25	30	30	
Evaluate	20	20		
Create	30	40		

8.8.7. ME 4303

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4303 **COURSE TITLE:** Machine Tools and Tool Engineering		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 4th year 1st semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%
Prerequisite: ME 3305 (Manufacturing Process)		

Course Objectives/Summary: This course provides students the required knowledge for selecting and designing proper machine tools, drives and power transmission systems and machine tool control system.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** basic requirements of machine tools, their classifications, elements, different types of drive systems, power transmission systems.
CLO2	**Analyze** different control systems, structural diagram, speed chart, kinematic diagrams of machine tools.
CLO3	**Apply** acceptance test of machine tools, minimization effects of vibration, degrees of freedom, location & clamping methods.
CLO4	**Evaluate** speed range ratio, geometric progression ratio and series of spindle speed.
CLO5	**Create** tools with useful considerations, appropriate gearbox with stepped regulation for a machine tool.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√											
CLO2		√		√								
CLO3	√				√							
CLO4		√										√
CLO5			√		√							

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1.	Requirements to machine tools, machine tools classification, machine tools elements.	**3**	**CLO1**
2.	Mechanical drive, hydraulic drive & electric drive, power transmission systems.	**3**	**CLO1, CLO2**
3.	Development of kinematic diagram, speed range ratio, geometric progression ratio and series of spindle speed.	**3**	**CLO2, CLO4,**
4.	Structural diagram and their analysis, speed chart, study of kinematic diagram of lathes & milling machines.	**3**	**CLO2, CLO4**

SN	COURSE CONTENT	Hrs	CLOs
5.	Functions, requirements & classification, basic elements of machine tools control, mechanical, electrical & hydraulic control	**4**	**CLO2, CLO3**
6.	Adaptive & automatic control system-mechanical automatic control system, electrical automatic control system.	**4**	**CLO1**
7.	Study of milling machines, N-C machine tools.	**3**	**CLO1, CLO2**
8.	Gear making machine, Unconventional machine (viz: spark erosion machine, ultrasonic grinding machine). Transfer lines.	**4**	**CLO1, CLO3**
9.	Installation of machine tools, acceptance test of machine tools.	**4**	**CLO3**
10.	types of vibration in machine tools, effects of vibration and its minimization.	**4**	**CLO3**
11.	Introduction, General considerations in tool design, Degrees of freedom, location & clamping methods, different types of jigs & fixtures.	**4**	**CLO5**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOKS

1. N. K. Mehta, **Machine Tool Design and Numerical Control**, McGraw-Hill
2. N. Chernov, **Machine Tools**, Mir.

REFERENCE BOOKS

1. H. Yusuf and H. El-Hofy, **Non-Traditional and Advanced Machining Technologies**. CRC Press.
2. S. Y. Liang and A. J. Shih**, Analysis of Machining and Machine Tools**, Springer.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	25	
Evaluate	15	
Create	10	

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	10
Understand	15
Apply	10
Analyze	20
Evaluate	25
Create	20

8.8.8. ME 4304

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4304 **COURSE TITLE:** Machine Tools and Tool Engineering Sessional		
CREDIT: 0.75 (Sessional)	**TERMS OFFERED:** 4th year 2nd semester	
Exam Hours: NA	**CIE Marks:** 100%	**SEE Marks:** 00%

Course Objectives/Summary: The primary aim of the course is to provide students with the basic knowledge of appropriate tool material, processing method, kinematic of power flow to the spindle for manufacturing different components.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Compare** the kinematic diagrams of different machine tools.
CLO2	**Demonstrate** working medium flow through the machine tools.
CLO3	**Assess** the cutting forces during machining and grinding.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	√	√										
CLO2	√				√							
CLO3		√							√			

SN	COURSE CONTENT	Hrs	CLOs
1	Introduction	**3**	**CLO1**
2	Study the kinematic diagram of milling machine of model 6P82.	**3**	**CLO1**
3	Analysis model and study the kinematic diagram of engine lathe of model 16K20.	**3**	**CLO2, CLO3**
4	Study the kinematic diagram of vertical drill press of model 2H35	**3**	**CLO1, CLO2**

5	Analysis of the hydraulic circuit diagram of hydraulic shaper	**3**	**CLO2, CLO3**
6	Grinding a surface using surface grinder and evaluation of surface quality.	**3**	**CLO3**
7	Measurement of force applied for drilling and evaluation of quality of operation.	**3**	**CLO2**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOKS

1. N. Acherkan (Vol. 1 – 4). **Machine Tool Design**, MIR
2. N. Chernov, **Machine Tools**, MIR.

REFERENCE BOOKS

1. Machine Tools Lab. Manual

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Assignment (Class and Home) / Report (%)	Quiz (%)	Board Viva (%)	In class Participation (%)
Remember	10	10	50	50
Understand	20	20	30	50
Apply	30	20	20	
Analyze	20	30		
Evaluate	20	20		

8.8.9 (a). ME 4205

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4205 **COURSE TITLE:** Operation Research		
CREDIT: 3.0 (Theory, Optional)	**TERMS OFFERED:** 4th year 2nd semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: This course equips student with the basic knowledge for improving their decision making skill and let them design and compare new strategy aiming to achieve a specific goal.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Discuss** operation research models, concepts and related terminology.
CLO2	**Analyze** and **interpret** statistical data using appropriate probability distributions
CLO3	**Apply** Transportation Model, assignment Model, Dynamic programming, Game theory, appropriate queuing model and others to real-life problems
CLO4	**Justify** the managerial decision based on statistical data and mathematical model.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs)-

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	√	√										
CLO2		√		√								
CLO3	√				√							√
CLO4		√									√	

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Introduction: Origin and development of OR, Art of modeling, assumptions, scope and limitation of OR models.	**6**	**CLO1**
2	Allocation Problem: Linear programming models, mathematical formulation, maximization and minimization, graphical solutions, simplex, degeneracy, duality, interpretation of the dual problem.	**6**	**CLO1, CLO4**
3	Transportation Problem: Cases of balanced and unbalanced supply-demand conditions, north-west corner rule, VAM, Russell's approximation method, Finding optimal solutions.	**6**	**CLO1, CLO3**
4	Linear Assignment Problem: Application areas, Hungarian method.	**4**	**CLO3, CLO4**
5	Waiting Line Models: Application areas, Poisson arrival and exponential service, Analysis of single-server cases, simple multiple-server cases.	**6**	**CLO2, CLO3**
6	Decision Analysis: Risk and uncertainty, criteria for decisions under risk, Decision trees, Criteria for decisions under uncertainty.	**6**	**CLO2, CLO4**
7	Introduction to other OR Models: Non-linear and Integer programming, Dynamic programming, Game theory, Simulation	**5**	**CLO3, CLO4**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXTBOOK

1. Hamdy A. Taha, Operations Research: An Introduction, Pearson

REFERENCE BOOK

1. Frederick S. Hillier. Gerald J. Lieberman, Introduction to Operations Research, McGraw-Hil

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	30	
Evaluate	20	

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	05
Understand	15
Apply	30
Analyze	20
Evaluate	30

8.8.9 (b). ME 4401

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4401 **COURSE TITLE:** Control Engineering		
CREDIT: 3.0 (Theory, Optional)	**TERMS OFFERED:** 4th year 2nd semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: Control engineering is one of the most widely used fields in engineering. The major goal of the Control Systems course is to develop a specific technical expertise in the analysis and design of Feedback Control Systems.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** the mechanical, hydraulic, thermal and pneumatic control systems.
CLO2	**Synthesize** the physical systems for mathematical representation.
CLO3	**Analyze** the problems associated with the control systems and also able to resolve these detected problems.
CLO4	**Modify** control system according to the responses.
CLO5	**Design** appropriate control mechanisms or combine different control mode.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO1	✓											✓
CLO2		✓		✓								
CLO3		✓		✓								
CLO4			✓		✓							
CLO5			✓		✓							

SN	**COURSE CONTENT**	**Hrs**	**CLOs**
1	Theory of control system including open loop and closed loop with emphasis on mechanical, hydraulic, thermal and pneumatic systems.	**4**	**CLO1**
2	Representation of control systems, block diagrams.	**4**	**CLO1, CLO2**
3	Frequency, step function and system responses, transfer functions characteristic functions.	**5**	**CLO2, CLO3**
4	System analysis using polar (Nyquist diagram), Logarithmic plot (Bode diagram), root locus plots; System compensation.	**4**	**CLO3, CLO4**
5	Analogues of control system.	**3**	**CLO2, CLO4**
6	Application of servo mechanism in mechanical Engineering.	**4**	**CLO4, CLO5**
7	Hydraulic control systems, servo control valve arrangements and analysis	**4**	**CLO3, CLO4**
8	Hydraulic pump motor analysis.	**4**	**CLO3, CLO4**
9	Pneumatic control system.	**3**	**CLO1, CLO4**
10	Elements of electro-mechanical and hydraulic controls.	**4**	**CLO4,CLO5**

Teaching Learning Strategies: Lecture, multimedia presentation, problem solving, assignment, practical system.

TEXTBOOKS

1. W. Bolton, Mechatronics, Pearson Education
2. Nise, Nroman S, Control Systems Engineering, Addison-Wesley

REFERENCE BOOKS

1. Katsuhiko Ogata, Modern Control Engineering, Pearson
2. R. C. Dorf, R. H. Bishop, Modern Control Systems, Prentice Hall

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	30	
Evaluate	20	

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	05
Understand	15
Apply	10
Analyze	30
Evaluate	20
Create	20

8.8.9 (c). ME 4309

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4309 **COURSE TITLE:** CAD and CAM		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 4th year 2nd semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: This course concentrates on the standards and utilizations of CAD/CAM in item and producing outline and is exceptionally relevant to future patterns in robotization and producing forms. Moreover, learning this course will help to use of Computer Aided Manufacture techniques in a modern factory.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** the concept of automation and its difference system, automated flow lines and its application, and transfer mechanism theory
CLO2	**Analyze** the different practical problems mechanical system and diagnosis of these problem
CLO3	**Apply** an engineering principles to design and development of CAD/CAM model
CLO4	**Design** appropriate mechanical components using CAD/CAM model

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	✓	✓										
CLO2		✓		✓								
CLO3			✓		✓							
CLO4			✓		✓							
CLO5												

SN	COURSE CONTENT	Hrs	CLOs
1	Fundamental concepts in manufacturing and automation. Transfer mechanism, Automated flow lines.	**7**	**CLO1**
2	Numerical control Co-ordinate systems and machine motion, types of NC systems, NC part programming, APT language; DNC and CNC	**7**	**CLO1, CLO2**
3	CAD, computer graphics CAM, hierarchy of computers in CAM	**6**	**CLO2, CLO3**
4	Computer process planning and monitoring, process control, group technology, parts classification and coding.	**7**	**CLO1, CLO2**
5	Flexible manufacturing system, the automated factory, system software	**6**	**CLO3, CLO4**
6	Robotics-classification, basic concept, point programming, kinematics of robot arm, control.	**6**	**CLO2, CLO3**

Teaching Learning Strategies: Lecture, multimedia presentation, problem solving, assignment, practical system

TEXTBOOK

1. David D. Bedworth et alliances, Computer-Integrated Design and Manufacturing, New York: McGraw-Hill

REFERENCE BOOKS

1. Nanua Singh, Systems Approach to Computer-Integrated Design and Manufacturing, John Wiley & Sons, Inc.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	30	
Evaluate	20	
Create		

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	15
Understand	15
Apply	20
Analyze	20
Evaluate	10
Create	20

8.8.9 (d). ME 4603

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4603 **COURSE TITLE:** Solar Energy Technology		
CREDIT: 3.0 (Theory)	**TERMS OFFERED:** 4th year 2nd semester	
Exam Hours: 3.00	**CIE Marks:** 30%	**SEE Marks:** 70%

Course Objectives/Summary: This course gives student the basic concept of solar energy system and its application, which will help them to enrich their knowledge for solar thermal system design.

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** the principles that underlie the ability of various natural phenomena to deliver solar energy
CLO2	**Analyze** the technologies that are used to harness the power of solar energy
CLO3	**Apply** the aspects of solar energy in relation to natural and human aspects of the environment.
CLO4	**Evaluate** the performance of various solar involved various applications.
CLO5	**Design (i.e. Create)** appropriate system of solar driven equipment as per demand by maintaining proper safety standards.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs)-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	√		√									
CLO2		√		√								
CLO3	√				√		√					
CLO4		√				√						
CLO5			√		√	√						

SN	COURSE CONTENT	Hrs	CLOs
1	Introduction to the sun and solar radiation;	**3**	**CLO1**
2	Solar geometry in details; solar thermal applications, Liquid flat plate collectors; general, performance analysis; Concentrating collectors;	**4**	**CLO1, CLO2**
3	Field of applications of solar thermal energy;	**6**	**CLO1, CLO3**
	industrial process heat, active heating of buildings, passive house heating,	**4**	**CLO3, CLO5**
4	solar greenhouses, solar refrigeration and air-conditioning,	**6**	**CLO3**
5	solar furnaces, solar thermo-mechanical power,	**4**	**CLO3, CLO4**
6	solar thermal water pump;	**3**	**CLO4, CLO5**
7	Solar thermal energy storage;	**6**	**CLO4, CLO5**
8	Solar photovoltaics.	**3**	**CLO4, CLO5**

Teaching-Learning Strategies: Classroom lecture (white board and power point presentation), reading, showing video and solving practical problems, showing practical systems, feedback.

TEXT BOOKS

1. Klaus Jäger, Olindo Isabella, Arno H.M. Smets, René A.C.M.M. van Swaaij, Miro Zeman , **Solar Energy Fundamentals, Technology, and Systems**, UIT Cambridge Ltd

REFERENCE BOOKS

1. Alma Cota, Majid Ghassemi, and Robert Foster, Solar **Energy: Renewable Energy and the Environment,** CRC press.
2. Edward Mazria, **The Passive Solar Energy Book: A Complete Guide to Passive Solar Home, Greenhouse and Building Design,** Rodale Pr

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Class Tests (%)	In class Participation (%)
Remember	15	50
Understand	15	50
Apply	20	
Analyze	30	
Evaluate	20	
Create		

SEE- Semester End Examination

Bloom's Category	Final Exam (%)
Remember	05
Understand	15
Apply	10
Analyze	20
Evaluate	30
Create	20

8.8.10. ME 4000*

DEGREE PROGRAM: B.Sc. in Mechanical Engineering **COURSE CODE:** ME 4000 **COURSE TITLE:** Thesis/ Capstone Design		
CREDIT: 3.00	**TERMS OFFERED:** 4th year 2nd semester	
Exam Hours: NA	**CIE Marks:** 50%	**FA Marks:** 50%

Course Learning Outcomes (CLOs): at the end of the Course, the student will be able to

CLO1	**Understand** in-depth relevant research or engineering knowledge to solve conflicting technical and engineering issues utilizing diverse resources.
CLO2	**Analyze** literature to identify and formulate problem or research question.
CLO3	**Apply** relevant tools/methods, standards and codes to solve the problem and explore research findings.
CLO4	**Evaluate** alternative solutions to extend beyond experiences.
CLO5	**Design** and implement a solution using engineering principles and research-based creative knowledge in novel way.

Mapping of Course Learning Outcomes (CLOs) to Program Outcomes (POs)-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	√											√
CLO2		√	√					√		√		
CLO3			√	√	√	√			√	√		
CLO4				√			√	√			√	
CLO5			√		√	√	√	√	√	√	√	√

SN	COURSE CONTENT	Hrs	CLOs
1	Meetings with thesis supervisor (Discussion)	**6**	**CLO1, CLO2, CLO4, CLO5**
2	Independent work	**17**	**CLO1, CLO2, CLO3, CLO5**
3	Project Proposal (Report)	**3**	**CLO2, CLO5**
4	Progress Seminar (Seminar)	**3**	**CLO3**
5	Seminar Participation (Participation)	**2**	**CLO1**
6	Poster and Demonstration (Demonstration)	**3**	**CLO3**
7	Project & Thesis Report Writing	**5**	**CLO3**

REFERENCE BOOKS

1. Randy L. Joyner, William A. Rouse, Allan A. Glatthorn, **Writing the Winning Thesis or Dissertation: A Step-by-Step Guide**, Corwin
2. Relevant books, scientific journals, handbooks, patents and manuals.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation

Bloom's Category	Meeting with supervisor, independent work and report and presentation (%)	In class Participation (%)
Understand	**10**	
Apply	**30**	
Analyze	**30**	
Create	**30**	

Final Assessment

Bloom's Category	Presentation to the examination board (%)	Thesis report examination (%)
Understand	10	10
Apply	30	30
Analyze	30	30
Create	30	30

Curriculum Alignment/Skill Mapping

Courses	Program Outcomes (POs) (Cross marks indicate that the corresponding course fulfilled the particular PO)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1st year 1st semester												
ME 1101	√	√										
ME 1301	√	√										
ME 1401	√	√										
ME 1501	√	√										
ME 1502	√	√										
ME 1002	√											
ME 1004	√				√							
1st year 2nd semester												
Math 1301	√	√										
Phy 1301	√	√										
Phy 1302	√	√		√	√				√	√		
Ch 1301	√	√		√								
Ch 1302	√	√						√	√	√		
HSS 1301								√	√	√		√
ME 1503	√	√										
ME 1504	√	√		√					√	√		
ME 1006	√	√							√	√		
2nd year 1st semester												
Math 2301	√	√	√									
Phy 2301	√	√	√									
Phy 2302				√					√			
Ch 2301	√	√					√					
HSS 2302									√	√		√
EEE 2103	√	√	√									
EEE 2104	√	√	√		√				√			
ME 2401	√	√	√		√							
ME 2402	√	√	√						√			
ME 2002	√	√	√		√							√
2nd year 2nd semester												
Math 2303	√	√	√									
HSS 2301					√	√	√				√	
EEE 2505	√	√	√		√							
EEE 2506	√	√	√		√				√	√		
ME 2301	√	√	√									
ME 2302	√	√		√	√					√		
ME 2403	√	√	√	√								
ME 2404	√	√	√	√	√					√		
ME 2004	√		√		√							√

3rd year 1st semester												
Math 3301	√	√		√	√							
HSS 3301	√		√			√	√	√				
ME 3101	√	√	√	√	√							√
ME 3102	√	√		√	√							√
ME 3305	√	√	√	√	√							
ME 3306	√	√	√		√					√		
ME 3401	√	√	√	√	√							
ME 3402	√	√			√					√		
ME 3002						√	√	√		√		√
3rd year 2nd semester												
HSS 3303			√			√	√					√
ME 3103	√	√	√	√								
ME 3104	√	√		√	√							
ME 3403	√	√	√	√								
ME 3404	√	√	√	√	√							√
ME 3501	√	√	√	√	√							
ME 3502	√	√	√	√	√							
ME 3601	√	√	√	√	√							√
ME 3602	√	√		√	√							√
4th year 1st semester												
ME 4201	√	√	√		√		√				√	√
ME 4301	√	√	√	√	√							√
ME 4302	√	√	√	√	√				√			
ME 4501	√	√	√		√	√	√					√
ME 4502	√	√			√		√					√
ME 4503	√	√	√	√	√	√						
ME 4504	√	√		√			√					√
ME 4101	√	√	√	√	√							
ME 4705	√	√	√	√	√	√						√
ME 4307	√	√	√	√	√		√		√			
ME 4509	√	√	√	√	√		√	√				
ME 4000	√	√	√	√	√	√	√	√	√	√	√	√
4th year 2nd semester												
ME 4203	√	√		√			√	√		√	√	√
ME 4505	√	√	√		√	√	√					√
ME 4507	√	√	√	√	√		√	√	√			√
ME 4508	√	√		√	√		√		√			√
ME 4002	√				√		√		√	√	√	
ME 4004	√	√	√	√	√	√		√				√
ME 4303	√	√	√	√	√							√
ME 4304	√	√			√				√			
ME 4205	√	√		√	√						√	√

ME 4401	√	√	√	√	√							√
ME 4309	√	√	√	√	√							
ME 4603	√	√	√	√	√	√	√					
ME 4000	√	√	√	√	√	√	√	√	√	√	√	√

Appendix

About The University

Location

The University is located at Gazipur District, 40 km north of Dhaka, the capital city of Bangladesh (about 20 km from Hazrat Shahjalal International Airport, Dhaka). This district town Gazipur is well connected by roads and railway with Dhaka and other cities of Bangladesh.

Campus

DUET, Gazipur has a compact campus with library, auditorium, halls of residence and residential buildings for teachers and employees within walking distance of the academic building. Bank and post office are also located in the premises.

Climate

Bangladesh generally enjoys a sub-tropical climate. The three prominent seasons are winter, summer and monsoon. The warmest days in Dhaka region are between April and June with temperature ranging from 25^0C to 37^0C. Winter temperatures usually vary between 10^0C to 20^0C.

Accommodation

The University believes that campus life is an important aspect in the development process of students. In addition to providing services in assisting students for solving their problems that are affecting their studies, the University aims at creating an environment conducive to the promotion of interaction between faculty and student.

Accommodation is available on campus for about 40% of the student. The University has six halls of residence for accommodation of the students. The total capacity of these halls is around 900. The halls are named after the national heroes, poets and eminent personalities of the world. The names of halls are listed below.

1. Kazi Nazrul Islam Hall
2. Shahid Muktijoddha Hall
3. Dr. Qudrat-E-Khuda Hall
4. Dr. Fazlur Rahman Khan Hall
5. Madam Curie Hall
6. Shahid Tajuddin Ahmed Hall

Non-residential students are also to be attached with a hall, so that administrative control on students becomes hall based. Two to four students has to share a room depending upon the size of the room with common shower and toilet. All rooms are furnished and well-ventilated. All residential halls are equipped with modern recreational facilities like cable TV, common room, prayer room, reading room and library.

Food and Stationeries

Each residential hall has its own cafeteria, which serves two meals per day. Each cafeteria is maintained by each hall authority. Students are also involved for their daily menu. Special menu are provided for different occasions in the hall cafeteria. One annual colorful dinner is also arranged in each hall in honor of outgoing students. Head of the Institute, all Departmental Heads, Provosts, Assistant Provosts and many other faculty members are invited to enjoy dinner. Besides, this residential hall cafeteria, a big central canteen offers breakfast meals and snacks. Moreover, in Gazipur town, there are number of nice restaurants which serve a wide variety of food including oriental and western flavor. A departmental store is also housed in the campus for the benefit of all.

Sports and Entertainment

The physical education centre provides different sports facilities to the students to acquire physical fitness indispensable for healthy mind and body. University has a beautiful playground for football, cricket, badminton, volley ball etc. Central indoor and outdoor sports competition are arranged annually by physical education section. The University also organizes annual cultural competitions and occasional cultural programs on some special events like celebration of different national days. Besides, a number of cultural and social groups are also active in the campus.

Library

The university devotes considerable effort and resources to the development of outstanding library collections to meet the expanding need of teaching and research and to serve as a resource reference centre. The library has over 30,000 books, significant number of journals, thesis, dissertation, magazines, newspapers and reports. Besides these, with the membership of a consortium it has on-line access to many international research journals. Library service includes reading, lending, reference, and photocopying and document delivery service. The library is computerized and most of the information available on the internet. It is open from 8:00 A.M to 8:00 P.M except for certain official holidays. Besides the general library system, each academic discipline maintains rental library from which students can borrow textbooks at a nominal rate for the whole semester. In order to meet the demand of the day, the library has opened up Muktijoddha corner (collection about liberation war) in it.

Computer Centre

The Computer Centre of Dhaka University of Engineering & Technology, Gazipur develops and manages the computing and networking infrastructure of the university. It provides computing support to undergraduate and postgraduate teaching, learning and research works for all departments. In addition, the Compute Centre also looks after the central internet facilities for the students and teachers.

In the Dhaka University of Engineering & Technology, Gazipur; the computing environment is based on distributed client server architecture. The basis is an advanced high speed and fault tolerant switched Ethernet network backbone. A switched fiber optic gigabit Ethernet backbone is under development. 24 hours Internet connection is provided by 10 Mbps line from BTCL. Most of the laboratories and offices are provided with switched Ethernet of fast Ethernet connections.

The Computer Centre operates three dual processor Intel based enterprise servers (one IBM and two HP server) and two small range servers (one mail server and one proxy server) to provide campus wide network services such as internet, E-mail, network printing, file sharing etc. Total file system capacity of these servers exceeds 100 Gigabytes. At present 600 state of the art workstations are connected to the network.

The Computer Centre provides excellent Internet facilities to the students, teachers and staffs. All teachers, students and staffs have their own E-mail address. Software training programs are also organized to assist students to be professional. Multimedia projectors are used in those programs to provide audio visual facilities.

Medical Centre

The university has a well-equipped four bedded medical centre with a number of medical officers and supporting staffs within prescribed limits. Medical centre is situated at ground floor of the central library building. Director (Students' Welfare) and chief medical officer give the valuable advice for the development and improvement of medical centre as well as healthcare services in this university.

The university medical centre provides different healthcare facilities to the residential and non residential students and staffs to meet physical and mental fitness. Students are given free out patient prescription with necessary medicines at the expense of the university. Teachers, Officers, Employees are given only free prescription and disease related valuable advice about various kinds of diseases in the medical centre. All kinds of minor operations are performed under local anesthesia in the medical centre. Medical centre also arranges annual blood donation and vaccination programs. Students are given general knowledge about primary health-care system, preventive and social medicine. Only complicated surgical and medical emergency patients are referred urgently to the district Sadar Hospital, Gazipur and Dhaka Medical College Hospital for investigations and better treatment. The university medical centre does not however bear the cost of treating injuries occurred outside the university.

Transportation

For the convenience of the students, faculties, officers and staffs DUET, Gazipur operates its own shuttle Bus Service between Dhaka city and the campus. In weekends, special services are also provided for meeting the weekend recreational and other needs.

Students' Welfare

The Director of Students' Welfare is responsible for the various activities related to the physical, social, cultural and other aspects of welfare of the students. These include arrangement of supervision for halls of residence, programmes for physical education, games and sports, cultural weeks and other activities of the students through the central students union and the students unions of the various halls of residence.

Central Students' Union

The purpose of the Central Students' Union is to promote the interests and welfare of the student body and to promote awareness of the healthy atmosphere on the university campus. The students' union also help to provide an opportunity for everyone to mix

with fellow students from different parts of the country and appreciate their cultures. All full-time students are members of the Central Students' Union, and are entitled to vote in the election of the unions governing body. The Students' Unions of the various hall of residence also arrange their individual socio-cultural activities, literary competitions etc. and help the hall management to run the halls smoothly.

Administration

University Administration is mostly defined and determined by the University Act (Dhaka University of Engineering & Technology, Gazipur Act, 2003). According to the University Act, Syndicate is the supreme authority in supervising and controlling all the activities of the University and major policy making, approving recommendations of all subordinate bodies. It also exercises its common controlling power through the Vice-Chancellor by formulating and implementing Act, Statutes, Rules and Regulations of the University.

The Finance committee, Planning & development committee, Selection committee and other statutory bodies and committees assist the Syndicate by recommending rules and regulations and other decisions as per need of the University.

The Academic Council is the supreme authority for matters relating to Education and Research. It exercises its common controlling power by formulating Academic Rules & Regulations and controlling all Academic activities and Research through Faculties, Departments, Academic committees, CASR (Committee for Advanced Studies and Research), committee relating to discipline etc. It also recommends necessary Rules and Regulations (Proposed) before the Syndicate for final approval.

Vice-Chancellor is the Chief Executive Officer (CEO) for both Academic and Administrative purposes. He is responsible for all of his activities to the Chancellor (Honorable President, People's Republic of Bangladesh). According to University Act, Vice-Chancellor is the Chairman of Syndicate, Academic Council, Finance Committee, Planning and Development Committee and all Selection Boards. He exercises his common controlling power over all the Faculties, Departments, Directories, Offices, Halls and different Sections through Deans, Head of Departments, Directors, Head of Offices (Registrar, Controller of Examinations, Comptroller, Chief Medical Officer, Chief Engineer, and Librarian etc.), Hall provosts and other Heads of different Sections.

Registrar is the residential Officer of the University. He is the custodian of all records, common seal and assets or property as the Syndicate may commit to his charge. He is the Secretary of the Syndicate & Member Secretary of the Academic Council. He is also the member of the Finance committee. He is mainly responsible for implementing the decisions, made by the Syndicate, Academic Council and Vice-chancellor himself and decision taken from the recommendation of different bodies and committees. Major Human Resource Management (HRM) functions (Manpower acquisition, Training & Development, Placement, Motivation etc.) are performed by the Establishment Section. Student's Enrolment, Registration, all Academic activities, Programme and Schedules are prepared and published by the Academic Section of the Registrar Office. Registrar is also responsible for the security matters of the University. Generally, Vice-Chancellor practices his common controlling power over all the Departments, Offices and Sections through Registrar Office.

Academic Ordinance for Undergraduate Studies

(Approved by the Syndicate on the recommendation of the Academic Council)

1. Definitions

1.1 'University' means the Dhaka University of Engineering & Technology, Gazipur abbreviated as DUET, Gazipur.
1.2 'Syndicate' means the Syndicate of the University,
1.3 'Academic Council' means the Academic Council of the University.
1.4 'Chancellor' means the Chancellor of the University.
1.5 'Vice-Chancellor' means the Vice-Chancellor of the University.
1.6 'Dean' means the Dean of a faculty of the University.
1.7 'Head of the Department' means the Head of a department of the University.
1.8 'Registrar' means the Registrar of the University.
1.9 'Academic Committee' means the Academic Committee for Undergraduate Studies (ACUG) of a degree awarding department of the University.
1.10 'Degree' means the degree of Bachelor of Science in a particular discipline of Engineering offered by the University.
1.11 'Departmental Monitoring Committee' means the Committee for upgrading/changing the Undergraduate Curriculum and the Course system and monitoring the teacher-student activities.
1.12 'Degree Equivalence Committee' means the committee for equivalencing different degrees obtained from home and/or abroad.
1.13 'Teacher' means Professor, Associate Professor, Assistant Professor, Lecturer and any other person approved as a teacher by the University.
1.14 'Student' means Student who has been admitted into the regular academic curriculum of the University.

2. Faculties

The University shall have the following Faculties:

i. Faculty of Civil Engineering is comprised of
   a. Department of Civil Engineering
   b. Department of Architecture
ii. Faculty of Electrical and Electronic Engineering is comprised of
   a. Department of Electrical and Electronic Engineering
   b. Department of Computer Science & Engineering
iii. Faculty of Mechanical Engineering is comprised of
   a. Department of Mechanical Engineering
   b. Department of Textile Engineering
   c. Department of Industrial & Production Engineering
   d. Department of Chemical & Food Engineering
   e. Department of Materials and Metallurgical Engineering
iv. Faculty of Engineering is comprised of
   a. Department of Chemistry
   b. Department of Mathematics
   c. Department of Physics
   d. Department of Humanities & Social Science

3. Departments

The University shall have the following Departments:

3.1 Degree-Awarding Departments

i. Department of Civil Engineering
ii. Department of Electrical and Electronic Engineering
iii. Department of Mechanical Engineering
iv. Department of Computer Science and Engineering
v. Department of Textile Engineering
vi. Department of Industrial & Production Engineering
vii. Department of Architecture
viii. Department of Chemical & Food Engineering
ix. Department of Materials and Metallurgical Engineering
x. Any other department to be instituted by the Syndicate on the recommendation of the Academic Council from time to time.

3.2 Teaching Departments

i. Department of Civil Engineering
ii. Department of Electrical and Electronic Engineering
iii. Department of Mechanical Engineering
iv. Department of Computer Science and Engineering
v. Department of Textile Engineering
vi. Department of Industrial & Production Engineering
vii. Department of Architecture
viii. Department of Chemical & Food Engineering
ix. Department of Materials and Metallurgical Engineering
x. Department of Mathematics
xi. Department of Physics
xii. Department of Chemistry
xiii. Department of Humanities & Social Science
xiv. Any other department that may be instituted by the Syndicate on the recommendation of the Academic Council from time to time.

4. Degrees Offered

The University shall offer courses leading to the award of the following degrees:

i. Bachelor of Science in Civil Engineering abbreviated as B. Sc. Engineering (Civil)
ii. Bachelor of Architecture abbreviated as B. Arch
iii. Bachelor of Science in Computer Science and Engineering abbreviated as B. Sc. Engineering (Computer Science and Engineering)
iv. Bachelor of Science in Electrical and Electronic Engineering abbreviated as B. Sc. Engineering (Electrical and Electronic)
v. Bachelor of Science in Mechanical Engineering abbreviated as B.Sc. Engineering (Mechanical)
vi. Bachelor of Science in Industrial & Production Engineering abbreviated as B.Sc. Engineering (IPE)
vii. Bachelor of Science in Textile Engineering abbreviated as B. Sc. Engineering (Textile)

viii. Bachelor of Science in Chemical & Food Engineering abbreviated as B. Sc. Engineering (CFE)
ix. Bachelor of Science in Materials and Metallurgical Engineering abbreviated as B. Sc. Engineering (MME)
x. Any other degree that may be awarded by a department with the approval of the syndicate on recommendation of the Academic Council from time to time.

5. Student Admission

5.1 The four academic years of study for the degree of B. Sc. Engineering shall be designated as first year class, second year class, third year class and fourth year class in succeeding higher levels of study. Each academic year comprises two semesters, i.e., 1st and 2nd semester. Students shall generally be admitted into the 1st year 2nd semester class. The 1st semester of 1st year class is exempted because of the candidates' completion of minimum 3 or 4 years Diploma in Engineering backgrounds after 10 years of schooling.

5.2 An Admission Committee shall be formed in each academic session by the Academic Council for admission into 1st year B Sc. Engg. program.

5.3 A candidate for admission into the 1st year class must have passed the minimum 3 or 4 years Diploma in Engineering examination from Bangladesh Technical Education Board (after 10 years of schooling) or any examination recognized as equivalent there to and must also Dhaka University of Engineering & Technology, Gazipur fulfill all other requirements as may be prescribed by the Admission Committee. In case of confusion regarding the equivalence the case may be referred to the Degree Equivalence Committee. However, a candidate must fulfill the requirements mentioned below:

Sl. No.	Name of the Department	Entry Requirements
1.	Civil Engineering	Diploma in Engineering (Civil/ Civil with wood specialization/Architecture with special optional subjects/Environmental with special optional subjects, Surveying and Construction Technology.)
2.	Electrical and Electronic Engineering	Diploma in Engineering (Electrical/ Electronics/ Telecommunication/ Electro medical/ Instrumentation & Process Control)
3.	Mechanical Engineering	Diploma in Engineering (Mechanical/ Power/ Chemical/ Automobile/ Refrigeration and Air Conditioning/ Food/ Mechatronics/ Marine Technology)
4.	Computer Science and Engineering	Diploma in Engineering (Computer/ Computer Science & Technology/ Electronics/ Data Telecommunication and Networking Technology)
5.	Textile Engineering	Diploma in Engineering (Textile/Jute/ Garments & Pattern Making Technology)

6.	Industrial & Production Engineering	Diploma in Engineering (Mechanical/ Power/ Chemical/ Automobile/ Refrigeration and Air Conditioning/ Food/ Marine/ Mechatronics/ Ship Building/Instrumentation & Process Control Technology)
7.	Architecture	Diploma in Engineering (Architecture/ Architecture & Interior Design)
8.	Chemical & Food Engineering	Diploma in Engineering (Food/ Chemical/ Mechanical/ Power/ Refrigeration and Air Conditioning/ Instrumentation & Process Control Technology) and Diploma in Agriculture
9.	Materials and Metallurgical Engineering	Diploma in Engineering (Mechanical/ Power/ Automobile/ Refrigeration and Air Conditioning/ Chemical/ Mining & Mine Survey/ Ceramic/ Glass/ Ship Building Technology).

5.4 The rules and conditions for admission into various departments shall be framed by the Academic Council on the recommendation of the Admission Committee in each year.

5.5 All candidates for admission into B. Sc. Engineering programmes must be citizens of Bangladesh unless the candidature is against the seats those are reserved for foreign students. Candidates for all seats except the reserved ones, if any, shall be selected on the basis of merit. The rules for admission into the reserved seats shall be framed by the Academic Council on the recommendation of the Admission Committee.

5.6 No student shall ordinarily be admitted into 1st year after the start of the corresponding classes. The date of commencement of classes for the newly admitted students will be announced in advance.

Prior to admission to the University every student shall be examined by a competent medical officer as prescribed in the admission rules.

5.7 Admission of a newly admitted student in the 1st year class will be cancelled if he/she remains absent without prior permission from University authority for ten working days after the start of class. If any student fails to report due to unavoidable circumstances within the stipulated period, he/she may appeal within the next twenty working days to the Academic Council through the concerned Head of the Department. The decision of the Academic Council will be final.

6. Method of Course Offering and Instruction

The undergraduate curriculum of the University is based on course system. The salient features of the course system are as follows:

i. Generally, number of regular theoretical courses taken by a student will not exceed five in each semester
ii. Continuous evaluation of student's performance
iii. Evaluation by using Letter Grades and Grade Points
iv. Introduction of some additional optional courses and thus enable students to select courses according to his/her interest as far as possible
v. Opportunity for students to choose fewer or more courses than the normal course load depending on his/her capabilities and needs

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

vii. Promotion of teacher-student contact. In the curriculum for the undergraduate programs, besides the professional courses pertaining to each discipline, there is a strong emphasis on acquiring a thorough knowledge in basic sciences of mathematics, physics and chemistry and subjects in humanities and social sciences. Emphasis has been given on introducing courses dealing with professional practices, project planning and management, socioeconomic and environmental aspects of development projects, communicative skills etc. This will help the students to interact more positively with the society.

7. Academic Calendar

7.1 The academic year shall ordinarily be divided into two regular semesters each having duration of ordinarily not less than 13 teaching weeks (65 working days) of classes.

7.2 There shall be final examinations at the end of each semester and the examination will be conducted as per academic regulations.

7.3 The registrar office will announce the academic schedule for each semester ordinarily before the start of the class on the approval of the Academic Council.

7.4 Academic schedule may be prepared according to the following guidelines:

Two alternatives are provided: (i) based on two regular semesters with a provision of a review examination in each semester and (ii) based on two regular semesters and a short semester of about 8-week duration during one academic year whenever possible.

ALTERNATIVE: I

Semester-I	**No. of Weeks 23**
Classes	13
Mid Semester Break	1
Regular & Review examination including preparatory leave*	6.4**
Publication of results	2.3**
Inter-Semester Recess and Preparation for next semester	1
Semester-II	**No. of Weeks 23**
Classes	13
Mid Semester Break	1
Regular & Review examination including preparatory leave*	6.4**
Publication of results	2.3**
Inter-session break and Vacations throughout the session	05
Total =	**52**

* There shall be at least one examination date in a week.
** The digit after the decimal indicates number of days.

ALTERNATIVE: II

Semester-I	**No. of Weeks 21**
Classes	13
Regular examination including preparatory leave*	5.4**

Publication of results	2.3**
Inter-Semester Recess and Preparation for next semester	1
Semester-II	**No. of Weeks 21**
Classes	13
Regular examination including preparatory leave*	5.4**
Publication of results	2.3**
Inter-session break and Vacations throughout the session	09
Total =	**52**

* There shall be at least one examination date in a week.
** The digit after the decimal indicates number of days.

8. Duration of Programme and Course Structure

8.1 The B Sc. Engineering programme shall extend over a period of four academic years, each with a normal duration of one calendar year. Each academic year is divided into two semesters (except the 1st year) for the purpose of academic programme and conduct of examinations.

8.2 The curricula of the B. Sc. Engineering degree in the different departments shall be as proposed by the respective ACUG and approved by the Academic Council on the recommendation of the Executive Committee of the concerned Faculty.

8.3 The ACUG may review the curricula once in every academic year and put forward suggestions to the Academic Council through the Executive Committee of the respective Faculty.

8.4 The courses are reckoned in credits and the credits allotted to various courses will be determined by the ACUG with the following guidelines:

	Nature of Course	Contact Hour *	Credit
(i)	Theory /Lecture	1.0 hour/week	1.0
(ii)	Tutorial	1.0 hour/week	1.0
(iii)	Independent Lab/Sessional/Design	1.5 hours/week	0.75
(iv)	Project/Thesis	3.0 hours/week	1.5
(v)	Field Work/Industrial Attachment	3.0 weeks	1.5
(vi)	Seminar/Special Studies	3.0 hours/week	1.50

* 1.0 Contact hour means a class with a minimum period of 50 minutes.

8.5 The minimum credits for the award of bachelor's degree in engineering will be decided by the respective ACUG and approved by the Academic Council on the recommendation of the Executive Committee of the Faculty. However, at least **140** credits including the specified core courses must be earned to be eligible for graduation.

8.6 The total number of credits for which a student should register shall be from 15 to 24 credits in a semester except the review course. However, a student may be allowed to register for less than 15 credits in a semester if

i. he/she is considered academically weak,
ii. number of credits required for graduation is less than 15 in that semester,
iii. student cannot find appropriate courses for registration subject to the approval of the adviser.

8.7 The total contact hours for students including lecture, tutorial and lab/sessional should be around 30 periods per week, each period being of 50 minutes duration.

8.8 In each degree-awarding department, one of the Assistant Professors or above nominated by the Head of the Department for one Academic year will act as Course Coordinator as well as Member Secretary of ACUG.

8.9 A course plan showing details of lectures for each course, approved by the Head of the department is to be announced at the start of each semester.

8.10 Project and thesis should be of 1.5 credits in each semester. Credit in any theory subject should not exceed 4 and that in sessional subject should not exceed 1.5.

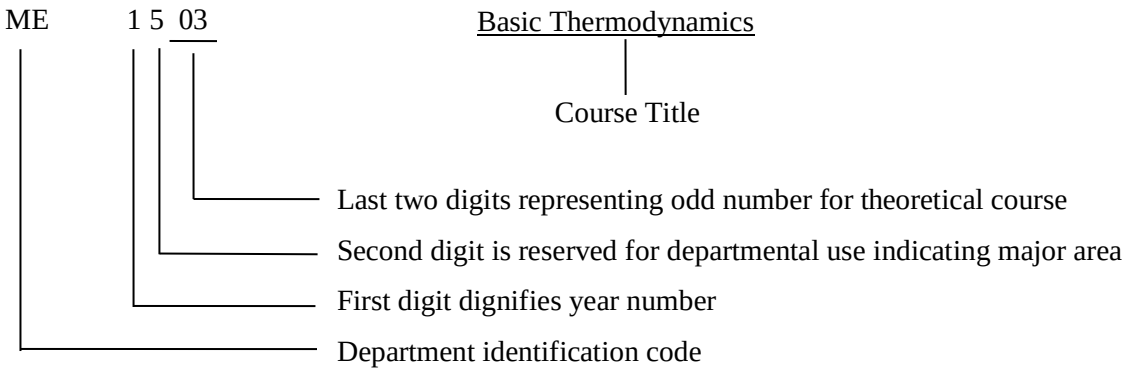
9. Course Designation and Numbering System

Each course is designated by a two to four letter word identifying course offering department followed by a three-digit number with the following criteria:

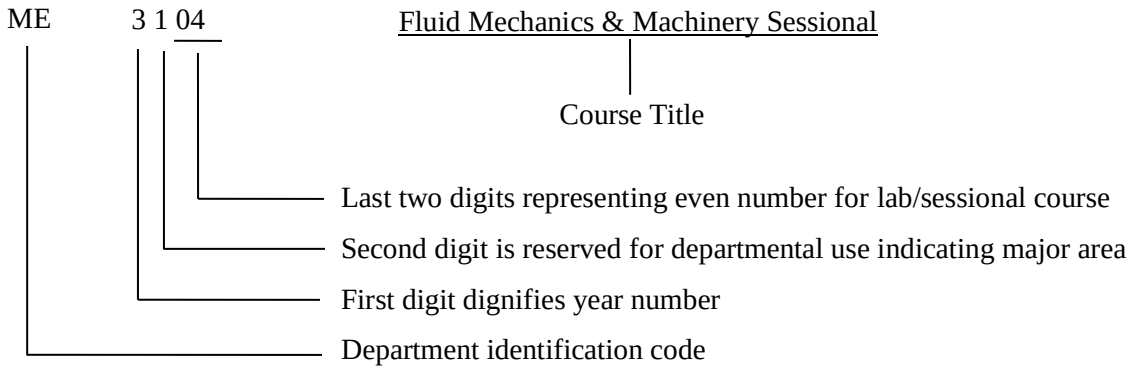
a. The first digit will correspond to the year in which the course is normally taken by the students.
b. The second digit will be reserved for departmental use.
c. The last digit will usually be odd for theoretical and even for laboratory or sessional courses.

The course designation system is illustrated by two examples as shown below:

Example 1:



Example 2:



Major Areas:

0 – Sessional Without Theory

1 – Fluid Mechanics

2 – Management

3 – Manufacturing

4 – Mechanics

5 – Thermal

6 – Computation

10. Type of Courses

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

10.1 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 discipline.

10.2 Pre-requisite Courses

Some of the core 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 semesters.

10.3 Optional Courses

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

10.4 Non-Credit Courses

Non-credit course(s) may be offered to a student to improve his/her knowledge in some specific fields. The credits in these courses will not be counted towards GPA and Cumulative GPA calculation but will be reflected in the transcript as satisfactory

(S)/unsatisfactory (U). Non-credit course(s) may be offered under the following circumstances:

If a student's Thesis/Project supervisor feels that the study/design is highly related to course(s) offered by any other department for its students, he can recommended to the concerned Head of the Department for participation of the student(s) in the course(s). Such registration of course(s) will not affect the normal course registration of the student.

11. Departmental Monitoring Committee and Students' Advisor

11.1 Departmental Monitoring Committee

Consistent with its resilient policy to keep pace with new development in the field of Engineering and Technology, the university will update its course curricula at frequent intervals. Such updating aims not only to include the expanding frontiers of knowledge in the various fields but also to accommodate the changing social, industrial and professional needs of the country. This can be done through deletion and modification of some of the current courses and also through the introduction of new ones.
ACUG of each department will constitute a Departmental Monitoring Committee with three senior teachers of the department as members and Head of the department as chairman. This committee will monitor and evaluate the effectiveness of the Course System within the department. In addition to other teachers of the department, the committee may also propose from time to time to the ACUG any changes and modifications needed for upgrading the Undergraduate Curricula and the Course System.

11.2 Students' Advisor

One advisor will be assigned for a batch of students by the Head of the Department who will advise each student on the courses to be taken by the student. The adviser will discuss with the student his academic programme and then decide the number and nature of courses for which he/she can register. However, it is the student's responsibility to keep contact with his/her adviser who will review and eventually approve the student's specific plan of study and check on subsequent progress. The adviser should generally be of the rank of an Assistant Professor or above from the concerned department. However, in case of shortage of teachers, lecturer may also act as adviser.

For a student of second and subsequent semesters, the number and nature of courses for which he/she can register will be decided on the basis of his/her academic performance during the previous semester. The adviser will advise the students to register for the courses during the next semester within the framework of the guidelines in respect of minimum/maximum credit hour limits. The Adviser is also authorized to permit the student to drop one or more courses based on his academic performance. Special provisions exist for academically weak students with regard to make-up courses.

11.3 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 Advisor and the student is free to discuss with his/her advisor about all academic matters, especially

those related to courses taken and classes being attended by him/ her. Students are also encouraged to meet other teachers any time for help on academic matters.

12. Course Registration and Its Procedure

Any student who wants to study a course is required to register formally. The following steps will be maintained during registration:

i. Student (both resident/attached) will collect registration form from respective office of hall of residence and take the signature of provost to ensure that he has no dues related to the hall.
ii. After collecting registration form, each student will fill up his/her course registration form in consultation with his/her adviser. The advisor will write the number of courses and sign it.
iii. Students will collect the fee deposit form from account section of the university.
iv. After filling up the fee deposit form, students will deposit registration fee in the bank prescribed by the university.
v. Students will submit registration form and the fee deposit form to his/her adviser.
vi. Adviser will submit duly signed registration form along with fee deposit form (copy for accounts section) to the head of the department.
vii. Head of department will send the duly signed course registration form to the academic section.
viii. The requisite number of copies of the course registration form will be made by the academic section for distribution among the adviser, the head and controller of examination.

For Online Course Registration, students have to go at this site:

http://www.duetbd.com/eregistration/

An online course registration manual is available there for the benefit of students.

12.1 Credit Limit in a Semester

A student must be enrolled for the requisite number of credits as mentioned in article 8.6. A student must enroll for the prescribed sessional/laboratory courses in the respective semester within the allowed credit limits.

12.2 Pre-condition for Registration

A student will be allowed to register those courses subject to the capacity constrains and satisfactory completion of prerequisite courses. If a student fails in a pre-requisite course in any semester, the concerned department monitoring committee may allow him/her to register for a course which builds on the pre-requisite course, when his/her attendance and grades in continuous assessment in the said pre-requisite course are found to be satisfactory.

Registration will be done within the first ten working days of each semester. Late registration is, however, permitted under special circumstances within next five working days on payment of late registration fee as decided by the authority. Students having outstanding dues to the University or a hall of residence shall not be permitted

to register. All students have, therefore, to clear their dues prior to complete the course registration procedure.

12.3 Course Adjustment Procedure

A student would have some limited options to add or replace courses from his/her registration list, within the first ten working days from the beginning of the semester. Dropping of a course is allowed within twenty working days from the beginning of the semester. Adjustment of initially registered courses in any semester can be done by duly completing the Course Adjustment Form. These forms will normally be available in the academic section.
Any student willing to add, replace or drop courses will have to fill up a Course Adjustment Form in consultation with his/her adviser. The original copy of the Course Adjustment Form will be submitted to the academic section, and then the requisite number of copies will be made by the academic section for distribution among the concerned adviser, Head, student and controller of examination.

Any changes in courses must be approved by the Adviser and the concerned Head of the department. The Course Adjustment Form will have to be submitted to the academic section after duly filled in and signed by the persons concerned.

12.4 Withdrawal from a Semester

If a student is unable to complete the semester Final Examination due to illness, accident or any other valid reason etc., he/she may apply to the Registrar through the Head of the department for total withdrawal from the semester within five working days after the end of the semester final examination. However, he/she may choose not to withdraw any laboratory/sessional course if the grade obtained in such a course is 'D' or higher and he/she has to indicate that clearly in the withdrawal application. The withdrawal application must be supported by a medical certificate from the University Medical Officer. The Academic Council will take the final decision about such application.

13. Striking off the Names and Readmission

13.1 The names of the students shall be struck off and removed from the student list on the following grounds:

i. Non-payment of University fees and dues within the prescribed period.
ii. Forced to discontinue his/her studies under disciplinary rules.
iii. Withdrawal of names from the University on grounds acceptable to the Vice-Chancellor of the University after having cleared all dues.
iv. Failure to earn the required credits for graduation as outlined in the respective curriculum and/or fulfill the Cumulative GPA requirements within the maximum allowed time of 7 academic years including any period of punishment. On valid medical grounds, the period may be extended by the approval of Academic Council.

13.2 In case a student whose name has been struck off the student list under clause (i) of Article 13.1 seeks re-admission within the session in which his/her name was struck off, he/she shall be re-admitted on payment of all the arrear fees and dues. But if he/she seeks readmission in any subsequent session, the

procedure for his/her readmission will be the same as described under Article 13.3.

13.3 Every student whose name has been struck off the student list by exercise of the clause (ii) of Article 13.1 seeking readmission after expiry of the period for which he/she was forced to discontinue his/her studies, shall submit an application to the Head of the Department in the prescribed form before the commencement of the session to which he/she seeks re-admission. The Head of the department shall forward the application to the Vice-Chancellor of the University with his remarks. In case the re-admission is allowed, the student will be required of payment of all dues to get him/herself admitted not later than one week from the date of permission given by the Vice-Chancellor. All re-admissions should preferably be completed before the session starts. The percentage of attendance of the readmitted students shall be counted from the date of re-admission.

13.4 The application of a student for readmission will only be considered if he/she applies within two academic sessions from the semester of discontinuity in his/her studies in the University. Other than deparment as punishment under ordinance of the University relating to discipline, a student of any kind failing for any other reason whatsoever to become a candidate for a semester final examination in which he/she ought to have had in the usual process of his/her progressive academic activities, shall be considered to have discontinued his/her studies for the relevant semester together with striking the name off from current student list and two such discontinuous periods will be considered equivalent to that for one academic session. The maximum period of discontinuity under no circumstances is to exceed two academic sessions during a student's period of studies for the degree.

13.5 No student who has withdrawn his/her name under clauses (iii) and (iv) of Article 13.1 shall be given re-admission.

13.6 In case any application for re-admission is rejected, the student may appeal to the Academic Council for re-consideration. The decision of the Academic Council shall be final.

14. Grading System, Calculation of GPA and Cumulative GPA, and Conversion of Marks

14.1 Grading System

The letter grade system shall be used to assess the performance of the student and shall be as follows:

Numerical Grade	Letter Grade	Grade Point
80% or above	A Plus	4.00
75% to less than 80%	A Regular	3.75
70% to less than 75%	A Minus	3.50
65% to less than 70%	B Plus	3.25
60% to less than 65%	B Regular	3.00
55% to less than 60%	B Minus	2.75

50% to less than 55%	C Plus	2.50
45% to less than 50%	C Regular	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

A grade 'X' shall be awarded for courses (like project & thesis, etc.) in the odd semester, which will continue through the even semester.

14.2 Calculation of GPA and Cumulative GPA

Grade Point Average (GPA) is the weighted average of the grade points obtained in all the courses passed/completed by a student in a semester. 'F' grades will not be counted towards GPA calculation. GPA of a semester will be calculated as follows:

$$GPA = \frac{\sum_{i=1}^{n} C_i G_i}{\sum_{i=1}^{n} C_i}$$

where n is the total number of courses passed by the student, C_i is the number of credits allotted to a particular course i and G_i is the grade point corresponding to the grade awarded for i -th course.

The overall or Cumulative GPA gives the cumulative performance of the student from first semester up to any other semester to which it refers and is computed by dividing the total grade points ($\sum C_i G_i$) accumulated up to the date by the total credit hours ($\sum C_i$).

Both GPA and Cumulative GPA will be rounded off to the second place of decimal for reporting.

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

Course	Credits	Grade	Grade points
ME 3101	4	A plus	4.0
ME 3102	0.75	B regular	3.0
ME 3501	3	A regular	3.75
ME 3502	0.75	B plus	3.25
ME 3401	4	A minus	3.5

Then his/her GPA for the semester will be computed as follows:

$$GPA = \frac{4(4.0) + 0.75(3.0) + 3(3.75) + 0.75(3.25) + 4(3.5)}{4 + 0.75 + 3 + 0.75 + 4} = 3.68$$

14.3 Conversion of Grade into Marks

a. Marks = 79 + 84 (X – 3.75); $3.75 \leq X \leq 4$

b. Marks = 44 + 20 (X – 2); $2.2 \leq X \leq 3.75$

Where X = Grade (Cumulative GPA) obtained by a student

15. Distribution of Marks

15.1 The distribution of marks for a given course will be as follows

(a) **Theory Courses:**

(i) Continuous Assessment:

Class participation and attendance	10%
Class Tests/spot tests	20%
(ii) Semester Final Examination (3 hours duration)	70%
Total =	**100%**

(b) **Courses on Laboratory/Sessional/Field Work:**

Class participation and attendance	10%
Quizzes/ Viva Voce	40%
Performance/Reports	50%
Total =	**100%**

(c) **Project and Thesis**:

Viva Voce (Conducted by a Viva Voce Committee of minimum 3 members to be constituted by the Examination Committee)	30%
Supervisor (Internal Examiner)	50%
External Examiner (any other teacher of the Department/Examination Committee)	20%
Total =	100%

15.2 Basis for distribution of marks in class participation and attendance will be as follows:

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

15.3 The students whose average percentage of attendance will fall short of 75% in any of the theory, lab/sessional/field work courses for which he/she has registered in one academic year shall not be eligible for the award of any type of scholarship/stipend/grant for the following academic session.

16. Class Tests, Quizzes and Spot Tests

i. For 2, 3 and 4 credit courses 3 best out of 4 class tests may be taken for awarding marks. These may be considered as the minimum recommended number of class

tests for any course. If the number of class tests administered in a course exceeds these suggested minimum numbers, then two-thirds best of all may be considered.

ii. Duration of a class test should not exceed **15-20 minutes** and materials covered should be what were taught in 2 to 4 immediate previous classes or most recent classes.

iii. For the convenience of conducting the class tests, one class period time slot should be kept at the first period of each working day.

iv. The dates for the class tests shall be fixed by the Course Coordinator in consultation with the Head of the Department and shall be announced accordingly.

v. Spot test will be considered as class test and duration of which should not exceed ten minutes. The materials covered should be what were taught in previous immediate class. The maximum number of spot test should not exceed more than four. Maximum 50% spot test will be considered.

vi. All class tests shall ordinarily be of equal value. The result of each individual class test shall be posted for information of the students preferably before the next class test is held.

vii. Quizzes will be held on the basis of sessional/lab/field work classes. Duration of a quiz should not exceed one hour.

17. 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 credit calculation. A student who obtains 'F' grade in any core course in any semester, he/she will have to repeat the course. If a student obtains 'F' in an optional course he/she may choose to repeat the course or take a substitute course, if available. No 'F' grade will be counted for GPA calculation but will stay permanently on the grade sheet and transcript. When a student will repeat a review course in which he/she previously obtained 'F' grade, he/she will not be eligible to get a grade higher than B in such a course. A student obtaining D grade in a course, will be allowed to repeat the course for the purpose of grade improvement if cumulative GPA of the student falls below 2.20. In such case he/she will be awarded the new grade that he/she obtains or retains his/her previous grade if he/she fails.

A student obtaining 'C' or a better grade in a course will not be allowed to repeat the course for the purpose of grade improvement if cumulative GPA of the student falls below 2.20. Absence in semester final examination will result in 'F' grade unless he/she had withdrawn from the semester as per Article 12.4.

18. Measures for Helping Academically Weak Students

The minimum cumulative GPA requirements for obtaining a B.Sc. Engineering degree is 2.20. The performance of a student will be evaluated in terms of two indices, viz. semester grade point average (GPA), and cumulative grade point average (cumulative GPA).

Students will be considered to be making normal progress toward a degree if their Cumulative GPA for all courses attended is 2.20 or higher. Students who regularly maintain semester GPA of 2.20 or higher are making good progress toward their degrees and are in good standing with the University. Students who fail to maintain this minimum rate of progress will not be in good standing rather considered to be

academically weak. This can happen when one or more of the following conditions exist:

i. Semester GPA falls below 2.20 or
ii. Cumulative GPA falls below 2.20 or
iii. Earned credits fall below 15 times the number of semesters attended/studied
All such students can make up deficiencies in GPA and credit requirements by completing 'F' graded course(s) and repeating 'D' graded course(s) in the next semester(s). When GPA and credit requirements are fulfilled, the student is considered to be returned to good standing.

19. Honours, Dean's List and University Gold Medal

19.1 Honours

Candidates for Bachelor's degree in Engineering will be awarded the degree with Honours if their cumulative GPA is 3.75 or above.

19.2 Dean's List

In recognition of excellent performance, the names of students who maintain a GPA of 3.75 or above in regular semester(s) of an academic year may be published in the Dean's List in each Faculty. In this regard Dean will give a certificate to the student confirming his name in the Dean's List. The student will be honored Tk. 2000 for his name in the Dean's List by the approval of academic council. Students who have earned 'F' grade in any course during any semesters will not be considered for Dean's List in that year.

19.3 University Gold Medal

University Gold Medal for outstanding graduates will be awarded to the students who secure the 1st position with cumulative GPA not below 3.75 in each Department. The student must have completed his/her undergraduate course work within four consecutive academic years. Students who have earned 'F' grade in any course during any semesters will not be considered for University Gold Medal.

20. Student Classification

For a number of reasons, it is necessary to have a definite system by which students can be classified as First, Second, Third and Fourth Year. The students are classified according to the number of credit hours earned towards a degree. The following classification applies to the students:

Year	***Earned Credits***
First Year	From 0 to < (T1 – 8)
Second Year	From (T1 – 8) to < (T2 – 12)
Third Year	From (T2 – 12) to < (T3 – 16)
Fourth Year	≥ (T3 – 16)

Where
T1 = total credits prescribed in the 1st Year 2nd Semester
T2 = total credits prescribed up to 2nd Year 2nd Semester
T3 = total credits prescribed up to 3rd Year 2nd Semester

21. Probation and Suspension

Students who regularly maintain semester GPA of 2.20 or above satisfying the minimum credit requirements are making good progress toward their degrees and are in good standing with the University. Students who fail to maintain this minimum rate of progress may be placed on academic probation.
The status of academic probation is a reminder/warning to the student that satisfactory progress towards graduation is not being made. A student may be placed on academic probation when either of the following conditions exist:
i. The semester GPA falls below 2.20, or
ii. The cumulative GPA falls below 2.20
iii. Earned Credits fall below 15 times the number of semester attended/studied.

Students on probation are subject to such restrictions with respect to courses and extracurricular activities as may be imposed by the respective Head of the department. The minimum period of probation is one semester, but the usual period is for one academic year. This allows the academically weak student an opportunity to improve the GPA through the completing 'F' graded course(s) and repeating 'D' graded course(s) during the period. The probation may be extended for additional semesters until the student achieves an overall GPA of 2.20 or above. Once that condition is improved, the student is considered to be returned to good standing.

Academic probation is not to be taken lightly rather to be considered very seriously. A student on academic probation who fails to maintain a GPA of at least 2.20 during two consecutive academic years may be suspended from the University. A student who has been suspended may apply for consideration to the Dean of the faculty, but this application will not be considered until the student remains suspended at least for one full semester.

Petitions for reinstatement must set forth clearly the reasons for the previous unsatisfactory academic record and it must delineate the new conditions that have been created to prevent the recurrence of such work. Each such petition is to be considered individually on its own merits.
After consideration of the petition in consultation with the student, adviser and the respective Head of the department, Dean in some cases, may reinstate the student if this is the first suspension. However, a second suspension will be regarded as final and absolute.

22. Minimum Earned Credits and GPA Requirements for Obtaining Degree

Minimum credit requirements for the award of Bachelor of Science in Engineering degree will be proposed by the Academic Committee for Undergraduate Studies (ACUG) on the recommendation of the respective faculty and approved by Academic Council. The minimum cumulative GPA requirements for obtaining a Bachelor of Engineering degree is 2.20.

A student may take additional courses with the consent of his/her adviser in order to raise cumulative GPA, but he/she may take a maximum of 15 such additional credits beyond respective credit requirements for B. Sc. Engineering degree during his/her entire period of study.

23. Time Limits for Completion of B. Sc. Engineering Degree

A student must complete his/her studies within a maximum period of seven academic years for engineering degree. On valid medical ground, the period may be extended by the approval of Academic Council.

24. Industrial/Professional Training Requirements

Depending on each department's own requirements a student may have to complete a prescribed number of days for industrial/professional training in addition to minimum credit and other requirements, to the satisfaction of the concerned Department.

25. Application for Graduation and Award of Degree

A student who has fulfilled all the academic requirements for Bachelor's degree will have to apply to the Controller of examination through his/ her Adviser by the approval of Head of the Department for graduation. Provisional degree will be awarded on completion of Credit and GPA requirements. Such Provisional degrees will be confirmed by the Academic Council.

26. Absence during Semester

A student should not be absent from lab/sessional, quizzes, class tests, class participation, attendance, etc. during the semester. Such absence will naturally lead to reduction in grade points/marks, which count towards the final grade. Absence in semester final examination will result in 'F' grade.

27. Review Courses

i. Students obtained 'F' Grade in theory course having registered previously will get opportunity for registration of one course in each semester as review. One will be allowed to sit for the review course examination without making any change of previously obtained class test and class performance and attendance marks.
ii. Review course examination will be conducted separately at the end of the regular semester.
iii. Any student who has failed in any sessional course(s) he may be allowed to complete the course(s) by attending the sessional classes with the students of next regular semester(s).

28. Special Examination

A special examination on 'F' graded course(s) may be conducted for the outgoing students who have a maximum of 2 (two) 'F' graded theory courses for completion of degree. The special examination will be arranged at a convenient time by the Controller of Examination within 8 weeks after the publication of results of the 4th year 2nd semester regular examination. If a student repeats 'F' graded theory course(s) in special examination he/she will not be eligible to get a grade higher than B in such course(s). A student who has failed in the special examination may register the course(s) in the regular semester.

ORDINANCE RELATING TO DISCIPLINE

(Approved by the Syndicate on the recommendation of the Academic Council)

General Discipline

1. There shall be a Board of Discipline to supervise and control the discipline of the students of the University.

2. The Board shall consist of the following members:
   i. Vice-Chancellor Chairman
   ii. Two Deans Member (To be nominated by the Academic Council)
   iii. Three Heads (Two from Engineering and Member One from Non Engineering Departments) (To be nominated by the Academic Council)
   iv. Two Provosts of Halls of Residence Member (To be nominated by the Academic Council)
   v. Director (Students' Welfare) Member Secretary

3. At least 50% of the total members of the board shall form a quorum. The term of office of the nominated member shall be two years.

4. All incidents which appear to be acts of indiscipline and misconduct committed by any student, including immediate action taken, if any, shall be reported to the Vice-Chancellor by the respective Provost in respect of indiscipline and misconduct in the Halls of Residence and their premises, and by the Head of Department in respect of indiscipline and misconduct in the class rooms, laboratories, work-shops, all parts of the academic premises and any other place in the campus, and by the Invigilator through the Chief Invigilator in respect of indiscipline and misconduct in the Examination Halls, and by the person concerned (through respective Head/Section Chief) from among the students and employees of the University in respect of misconduct committed outside the University campus.

5. A student, who neglects his studies, disobeys and/or denounces orders, rules and regulations, ordinances, statutes of the University, shows misbehavior towards the employees of the University or commits any other offence which will be deemed by the Vice-Chancellor or Director of Students' Welfare or teachers of the University as misconduct and breach of discipline, will be liable to disciplinary action which may range from warning, imposition of fines, suspension to expulsion for good from the University depending on the magnitude of the offence as will be deemed fit by the authorities competent to take disciplinary action as defined in Section 6.

6. Authorities to take disciplinary action with their respective powers to the extent to which they can impose punishment on any student or group of students are:

Authorities for taking Disciplinary Action	*Power	Appellate Authority
(1)	(2)	(3)

Board of Discipline	(i) Warning (ii) Imposing fine (iii) Suspension from Halls/ University for any length of time and (iv) Expulsion from Halls/ University for good	Academic Council
Vice-chancellor	(i) Warning (ii) Imposing fine and (iii) Suspension up to 2 (two) years from Hall/University (iv) Expulsion from the Hall for good	Board of Discipline
Head of the Department (On students of his Department)	(i) Warning and (ii) Imposing fine up to Tk. 1000/-.	Vice-Chancellor
Director of Students' Welfare	(i) Warning (ii) Imposing fine up to Tk. 1000/- (iii) Suspension from the Halls up to 2 (two) years and (iv) Expulsion from the Hall for good.	Vice-Chancellor
Provosts (on resident or attached students of his Hall of residence)	(i) Warning (ii) Imposing fine up to Tk. 500/- and (iii) Suspension from the Hall for a period of up to 2 (two) years.	Director of Students' Welfare

*Respective authority may impose one or more punishment(s) at a time. Any of the above authority will inform the Director of Students' Welfare for any type of punishment imposed on any student for record.

7. If the Vice-Chancellor feels that the action taken against a student or a group of students (by any of the above authorities other than Board of Discipline) on an offence brought to him is not appropriate or that no action has been taken on any offence observed by him, he will take appropriate disciplinary action against a student or a group of students. If however, in any case of breach of discipline, the Vice-chancellor is of the opinion that a punishment more than a suspension of two years is required, he shall refer the matter to the Board of Discipline for a decision.

8. A student or a group of students against whom an action has been taken by appropriate authority mentioned in column (1) of Section 6 may prefer an appeal to the appropriate appellate authority mentioned in column (3) of Section 6.

9. The Director of Students' Welfare will be responsible for enforcement of the disciplinary action taken against a student or a group of students. He shall maintain a register and shall record therein all actions taken against a student for indiscipline and misconduct and also shall record in all Character Certificates/Testimonials issued by the Director of Students' Welfare to offenders, those actions taken against them if so indicated by the Vice Chancellor and the Board of Discipline, unless allowed to be expunged/condoned by the Vice Chancellor on written prayer from the offenders.

10. Character Certificates/Testimonials issued by the Director of Students' Welfare shall be produced by the students when requested for that certificate.

Discipline of Examinations

11. The Chief invigilator shall be responsible for maintenance of discipline in the examination halls.
12. An Invigilator on duty in Examination Hall shall report to the Chief Invigilator in case of breach of discipline in the examination hall. The Chief invigilator may expel the examinee concerned from the hall debarring him from appearing in that particular examination.
13. Breach of discipline in the examination halls shall be reported by the Invigilator through the Chief Invigilator to the Vice Chancellor.
14. The candidates shall strictly follow the following instructions:
    i. Candidates are forbidden to write their names on the cover or any part of the answer script. If any candidate does so, his answer script will not be assessed.
    ii. Each candidate must write legibly his Examination Student Number on the cover of scripts. If any candidate omits to write his Examination Student Number and Registration Number on the cover of his answer script, the paper may not be assessed.
    iii. When more than one answer script is used, each additional script should be stitched to the first script immediately after it is supplied, and the Examination Student Number and Registration Number should also be written by the candidate on the cover of the additional script or scripts immediately.
    iv. No loose paper will be provided for scribbling, and no paper is to be brought in for this purpose. Any candidate found with loose paper in his possession will be expelled from the examination hall. All works must be done in the scripts provided and pages must not be torn out. The scripts provided must be submitted; it cannot be replaced by another, but, if necessary, additional scripts will be given. All works intended for assessment by the examiner should be written on both sides of the paper.
    v. Candidates are forbidden to write anything whatsoever on the question paper. In any matter not specifically mentioned in these rules, candidates are required to abide by decision of the invigilator in the examination room.
    vi. No candidate will be allowed to leave examination room until one hour has elapsed from the time when the question papers are given out.

15. Disciplinary action will be taken against candidates reported to have violated the instructions under Section 14 or resorted to unfair means and/or acts of indiscipline at the different examinations as follows:
    i. Attempts to communicate with other examinee or examinees in the examination hall: first time warning which may be accompanied by a change of seats; second time- deduction of 5% of the total marks of paper; third time- expulsion from examination hall for that paper.
    ii. Possession of related to the particular subject of examination or copying from any other source: expulsion from examination hall and cancellation of the examination and expulsion from the University for one to two years. Writings in the person of examinee or in his apparels, in papers, drawing instruments, typing in mobile phones and scales etc. found with him or near the desk, bench or chair will be considered as writings in possession of examinee.

iii. Possession of mobile phones, media players etc: Deduction of 5% of the total marks of the paper.
iv. Use of violent language and holding out threats to examiners and invigilators: expulsion from the whole examination and/or expulsion from the University for good.
v. Attempts to get possession of the question paper or examination scripts before the examination: expulsion from the whole examination and expulsion from the University for one to two years.
vi. Writings on loose papers not related to the examination (viz. blotting paper, question paper etc.); seizure of the writings and cancellation of the answer script and expulsion from the examination hall.
vii. Impersonating or causing to impersonate in the examination hall: cancellation of the whole examination and expulsion from the University for good.
viii. Attempts to influence the examiner: cancellation of the paper.
ix. Insertion in the examination script, answer to any question or questions written outside the examination hall: cancellation of the whole examination and expulsion for one to two years.
x. Having a question answered by someone else: cancellation of the whole examination and expulsion for two years.
xi. If a student or outsider appears at the examination for any student: cancellation of the whole examination for both students, expulsion for two years for the student who appears at the examination for any student and one year for other student.

16. The invigilator is empowered to warn a student and deduct his mark up to 5% as mentioned in section l5 (i) above. The Chief Invigilator is empowered to expel students from the examination room/hall if he is satisfied after an on-the-spot enquiry that the student is guilty of misconduct mentioned in section 15, above. In all such cases the matter has to be reported to the Vice-Chancellor with incriminating documents, if any. Decisions for cancellation of the examination and expulsion from the University for a period of not exceeding 2 (two) years will be taken by the Vice-Chancellor. For expulsion for a period more than 2 (two) years, the Vice-Chancellor shall refer the matter to the Board of Discipline provided in Section 6.
17. As the Class Test/Quiz is the part of whole examination, therefore, disciplinary action for any misconduct in this examination will also be applicable as mentioned in section 11 through 16.