

**CURRICULUM**

**DIPLOMA**

**Mechatronics Engineering**

(Three Years Program- Semester System)



Council for Technical Education and Vocational Training

**Curriculum Development Division**

Sanothimi, Bhaktapur

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## **Introduction**

This 3 years Diploma in Mechatronics Engineering curricular programme is designed for producing skilled mechatronics personnel equipped with required knowledge, skills and attitude. **Mechatronics**, which is also called **mechatronic engineering**, is a multidisciplinary branch of engineering that focuses on the engineering of both electrical and mechanical systems, and also includes a combination of robotics, electronics, computer, telecommunications, systems, control, and product engineering. This course of Mechatronics Engineering is based on the job required to perform by Mechanical, electrical and computer technician at different related industries and organizations in Nepal and abroad. The course aims at producing middle level technical human resource equipped with knowledge and skills related to the Mechanical as well as electrical Engineering and computer science. The graduates of Mechatronics Engineering have ample opportunities of employment and self employment in the field of Mechanical as well as Electronics related industries.

Diploma in Mechatronics Engineering program extends over three years. Each year is divided into two semesters. There are six semesters in total within the period of three years. The first year course focuses on foundational subjects like Physics, Chemistry, and Mathematics applicable in the field of mechatronics engineering. It also includes languages like Nepali and English applicable for the communication in the same area. The second year course focuses on the basic disciplinary subjects of Mechatronics Engineering like Electronics Devices and Circuit I, Circuit Analysis and Prototyping, Microprocessor, Manufacturing Technology and so on.

Similarly, third year comprises of the disciplinary subjects like Advance Manufacturing Technology, Industrial Automation, Electronics Devices and Circuit II, Design of Mechatronics System, Industrial Management, Plant Maintenance, Estimation and Costing of Mechatronics System, Robotics and Auto Electronics. The third year courses emphasizes the application of learned skills and knowledge by making the provision of major and minor projects. As per the demand of the market, Specific areas of mechatronics like Micro Controller and PIC, Biomedical Instrumentation, New Product Development, Maintenance Concepts and Fault Finding have been suggested.

The course structure and the subject wise contents reflect the details of this curriculum. In short, this curriculum will guide its implementers to produce competent and highly employable middle level technical workforce in the field of Mechatronics Engineering.

## **Rational of the Curriculum**

A mechatronics engineer unites the principles of mechanics, electronics, and computing to generate a simpler, more economical and reliable system. An industrial robot is a prime example of a mechatronics system; it includes aspects of electronics, mechanics, and computing to do its day-to-day jobs has become the need in the recent world of work. As technology advances over time, various subfields of engineering have succeeded in both adapting and multiplying. The intention of mechatronics is to produce a design solution that unifies each of these various subfields.

Modern production equipment consists of mechatronic modules that are integrated according to a control architecture. The most known architectures involve hierarchy, polyarchy, heterarchy, and hybrid. The methods for achieving a technical effect are described by control algorithms, which might or might not utilize formal methods in their design. Hybrid systems important to mechatronics include production systems, synergy drives, planetary exploration rovers, automotive subsystems such as anti-lock braking systems and spin-assist, and everyday equipment such as autofocus cameras, video, hard disks, and CD players.

Most of the international institutions and universities have currently offered Mechatronics course. Nepal is also advancing the technology over time, various subfields of engineering have succeeded in both adapting and multiplying. The intention of mechatronics is to produce a design solution that unifies each of these various subfields. Nepal is also adapting modern technology that unifies various subfield of engineering. However we don't have such multi-skilled human resources. To fulfil the gap of such multi-skilled human resources, this course is developed.

### **Curriculum Title:**

Diploma in Mechatronics Engineering (DMxE).

### **Aim**

The program aims to produce middle level technical personnel with sound academic knowledge equipped with perfect technical skills that can be faced in real life situation.

### **Program Objectives**

This curriculum has following objectives to:

- Produce middle level competent technical workforces who could serve Mechatronics works.
- Prepare the technicians who are capable for identifying and resolving faults in manufacturing and automated process plants.
- Interpret manufacturing programs used in different platforms of automation, robotics, and manufacturing plants.
- Serve local and foreign industries in operation, maintenance and supervision.
- Prepare technical workforce demonstrating positive attitude and respect for the profession and socio-cultural values.
- Create self-employment opportunities.

### **Group Size**

The group size will be maximum of 48 (forty eight) students in a batch.

### **Entry Criteria**

- SLC Pass or SEE with minimum C grade in Compulsory Mathematics & Science and D+ in English.
- TSLC in Mechanical or Electronics Engineering with minimum 67%.
- Should pass entrance examination as administered by CTEVT.

### **Duration**

The total duration of this curricular program is three academic years. The program is based on semester system. Moreover, one semester consists up to 16 weeks and one academic week consists up to 40 hours excluding evaluation period.

### **Medium of Instruction**

The medium of instruction will be in English and/or Nepali.

### **Pattern of Attendance**

Minimum of 90% attendance in each subject is required to appear in the respective final examination.

## Teachers and Students Ratio

The ratio between teachers and students must be:

- Overall ratio of teacher and student must be 1:12 (at the institution level)
- 1:48 for theory and tutorial classes
- 1:12 for practical/demonstration
- 1:6 for bench work
- 75 % of the technical teachers should be full timer

## Qualification of Teachers and Instructors

- The program coordinator should be a master's degree holder in the related area.
- The disciplinary subject related teacher and demonstrators should be a bachelor's degree holder in the related area.
- The foundational subject related teacher should be master degree holder in the related area.

## Instructional Media and Materials

The following instructional media and materials are suggested for the effective instruction and demonstration.

- *Printed Media Materials* (Assignment sheets, Hand-outs, Information sheets, Individual training packets, Procedure sheets, Performance Check lists, Textbooks etc.).
- *Non-projected Media Materials* (Display, Flip chart, Poster, Writing board etc.).
- *Projected Media Materials* (Opaque projections, Overhead transparencies, Slides etc.).
- *Audio-Visual Materials* (Audiotapes, Films, Slide-tape programs, Videodiscs, Videotapes etc.).
- *Computer-Based Instructional Materials* (Computer-based training, Interactive video etc.)

## Teaching Learning Methodologies

The methods of teachings for this curricular program will be a combination of several approaches such as; illustrated lecture, tutorial, group discussion, demonstration, simulation, guided practice, fieldwork, block study, industrial practice, report writing, term paper presentation, heuristic and other independent learning exercises.

**Theory:** Lecture, discussion, assignment, interaction, seminar, group work.

**Practical:** Demonstration, observation, simulation, guided practice, self-practice, industrial practice and project work.

## Mode of Education

There will be inductive and deductive mode of education.

## Examination and Marking Scheme

### a. Internal assessment

- There will be a transparent/fair evaluation system for each subject both in theory and practical exposure.
- Each subject will have internal assessment at regular intervals and students will get the feedback about it.
- Weightage of theory and practical marks are mentioned in course structure.
- Continuous assessment format will be developed and applied by the evaluators for evaluating student's performance in the subjects related to the practical experience.

### b. Final examination

- Weightage of theory and practical marks are mentioned in course structure.

- Students must pass in all subjects both in theory and practical for certification. If a student becomes unable to succeed in any subject, s/he will appear in the re-examination administered by CTEVT.
- Students will be allowed to appear in the final examination only after completing the internal assessment requirements.

**c. Requirement for final practical examination**

- Professional of relevant subject instructor must evaluate final practical examinations.
- One evaluator in one setting can evaluate not more than 24 students.
- Practical examination should be administered in actual situation on relevant subject with the provision of at least one internal evaluator from the concerned or affiliating institute led by external evaluator nominated by CTEVT.
- Provision of re-examination will be as per CTEVT policy.

**d. Final practicum evaluation will be based on:**

- Institutional practicum attendance - 10%
- Logbook/Practicum book maintenance - 10%
- Spot performance (assigned task/practicum performance/identification/arrangement preparation/measurement) - 40%
- Viva voce :
  - Internal examiner - 20%
  - External examiner - 20%

**e. Pass marks:**

- The students must secure minimum 40% marks in theory and 40% marks in practical. Moreover, the students must secure minimum pass marks in the internal assessment and in the semester final examination of each subject to pass the subject.

### **Provision of Back Paper**

There will be the provision of back paper but a student must pass all the subjects of all semester within six years from the enrollment date; however there should be provision of chance exam for final semester students as per CTEVT rules.

### **Disciplinary and Ethical Requirements**

- Intoxication, insubordination or rudeness to peers will result in immediate suspension followed by the review of the disciplinary review committee of the institute.
- Dishonesty in academic or practical activities will result in immediate suspension followed by administrative review, with possible expulsion.
- Illicit drug use, bearing arms in institute, threats or assaults to peers, faculty or staff will result in immediate suspension, followed by administrative review with possible expulsion.

### **Grading System**

The following grading system will be adopted:

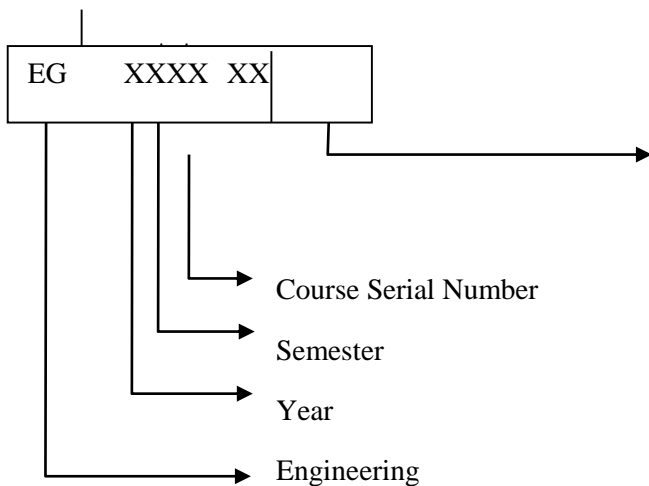
- Distinction: 80% and above
- First division: 65% to below 80%
- Second division: 50 % to below 65%
- Pass division: Pass marks to Below 50%

## Certification and degree awards

- Students who have passed all the components of all subjects of all 6 semester are considered to have successfully completed the program.
- Students who have successfully completed the program will be awarded with a degree of "**Diploma in Mechatronics Engineering**".

## Subjects Codes

Each subject is coded with a unique number preceded and followed by certain letters as mentioned in following chart:



### Offering Departments:

MX: Mechatronics Engineering  
AR: Architecture  
AE: Automobile Engineering  
EE: Electrical Engineering  
ME: Mechanical Engineering  
EX: Electronics Engineering  
CT: Computer Engineering  
CE: Civil Engineering  
SH: Science and Humanities  
MG: Management

## Provision of Specialization:

There will be no provision of specializing but some subjects are offered here with provision of the elective; viz. Micro Controller and PIC, Biomedical Instrumentation, New Product Development and Maintenance Concepts and Fault Finding.

## Career Opportunity

The graduates will be eligible for the position equivalent to Non-gazette 1<sup>st</sup> class/Level 5 (technical) as prescribed by the Public Service Commission of Nepal and other related agencies. The graduate will be eligible for registration with the related council in the grade as provisioned in the related Council Act (if any).



## Question Patterns for Written Exam

The question patterns for written exam are suggested as follows;

### A. For subject with full marks 80

S. N.	Type of questions	No of questions	Weightage marks	Full marks	Time distribution	Optional questions
1	Long	3	8	24	54 minutes	1
2	Short	8	4	32	72 minutes	2
3	Very short	12	2	24	54 minutes	2
	<b>Total</b>	<b>23</b>		<b>80</b>	<b>180 minutes</b>	

### B. For subject with full marks 60

S. N.	Type of questions	No of questions	Weightage marks	Full marks	Time distribution	Optional questions
1	Long	3	6	18	54 minutes	1
2	Short	8	3	24	72 minutes	2
3	Very short	9	2	18	54 minutes	2
	<b>Total</b>	<b>19</b>		<b>60</b>	<b>180 minutes</b>	

### C. For subject with full marks 40

	Type of questions	No of questions	Weightage marks	Full marks	Time distribution	Optional questions
1	Long	2	6	12	27 minutes	1
2	Short	4	4	16	36 minutes	1
3	Very short	6	2	12	27 minutes	1
	<b>Total</b>	<b>12</b>		<b>40</b>	<b>90 minutes</b>	

**Curriculum structure**  
**DIPLOMA IN MECHATRONICS ENGINEERING**

**Year: I**

**Part: I**

Teaching Schedule			Mode					DISTRIBUTION OF MARKS						Total Marks	Remark
SN	Course Code	Course Title	L	T	P	Lab	Total Hour	Theory			Practical				
								Asst. Marks	Final Marks	Time Hours	Asst. Marks	Final Marks	Time Hrs.		
1	EG 1101 SH	Communication Nepali	2	0	0		2	10	40	1.5				50	
2	EG 1102 SH	Communication English	2	0	0		2	10	40	1.5				50	
3	EG 1103 SH	Engineering Mathematics I	4	1	0		5	20	80	3				100	
4	EG 1104 SH	Engineering Physics I	3	1	0	2	6	20	60	3	10	10	1.5	100	
5	EG 1105 SH	Engineering Chemistry I	3	1	0	2	6	20	60	3	10	10	1.5	100	
6	EG 1101 ME	Engineering Drawing I	0	0	4	0	4	0	0		60	40	4	100	
7	EG 1211 CT	Computer Application	2	0	0	2	4	10	40	1.5	30	20	3	100	
8	EG 1102 ME	Workshop Technology	3	0	8	0	11	20	80	3	60	40	4	200	
<b>Total =</b>			<b>19</b>	<b>3</b>	<b>12</b>	<b>6</b>	<b>40</b>	<b>110</b>	<b>400</b>		<b>170</b>	<b>120</b>		<b>800</b>	

**Year: I**

**Part: II**

Teaching Schedule			Mode					DISTRIBUTION OF MARKS						Total Marks	Remark
SN	Course Code	Course Title	L	T	P	Lab	Total Hour	Theory			Practical				
								Asst. Marks	Final Marks	Time Hours	Asst. Marks	Final Marks	Time Hrs.		
1	EG 1201 SH	Engineering Mathematics II	3	1			4	20	80	3	0	0		100	
2	EG 1202 SH	Engineering Physics II	3	1		2	6	20	60	3	10	10	1.5	100	
3	EG 1203 SH	Engineering Chemistry II	3	1		2	6	20	60	3	10	10	1.5	100	
4	EG 1201 ME	Engineering Drawing II	0	0	4	0	4	0	0		60	40	4	100	
5	EG 1205 ME	Applied Mechanics	3	0		1	4	20	60	3	10	10	2	100	
6	EG 1109 CT	Computer Programming in C	3	2		3	8	20	80	3	30	20	3	150	
7	EG 1208 EE	Basic Electrical Engineering	3	0		1	4	20	60	3	10	10	2	100	
8	EG 1201 EE	Safety Engineering	3	1		0	4	20	80	3	0	0		100	
<b>Total =</b>			<b>21</b>	<b>6</b>	<b>4</b>	<b>9</b>	<b>40</b>	<b>140</b>	<b>480</b>		<b>130</b>	<b>100</b>		<b>850</b>	

## DIPLOMA IN MECHATRONICS ENGINEERING

### Curriculum Structure

#### Semester: III

Year: II

Part: I

Teaching Schedule			Mode					DISTRIBUTION OF MARKS						Total Marks	Remark
SN	Course Code	Course Title	L	T	P	Lab	Total Hour	Theory			Practical				
								Asst. Marks	Final Marks	Time Hours	Asst. Marks	Final Marks	Time Hrs.		
1	EG 2101 MX	Material Science	4				4	20	80	3				100	
2	EG 2101 ME	Metrology	4			2	6	20	80	3	30	20	3	150	
3	EG 2102 ME	Computer Aided Drafting	3		3		6	20	80	3	30	20	3	150	
4	EG 2102 MX	Fluid Mechanics, Hydraulics and Pneumatics	3		4		7	20	80	3	30	20	3	150	
5	EG 2121 EX	Electronic Fundamentals	4			3	7	20	80	3	30	20	3	150	
6	EG 2101 EE	Instrumentation I	4			2	6	20	80	3	30	20	3	150	
7	EG 2103 EE	Electrical Workshop	0			4	4	0	0		60	40	4	100	
<b>Total =</b>			<b>22</b>		<b>7</b>	<b>11</b>	<b>40</b>	<b>120</b>	<b>480</b>		<b>210</b>	<b>140</b>		<b>950</b>	

Year: II

Semester: IV

Part: II

Teaching Schedule			Mode					DISTRIBUTION OF MARKS						Total Marks	Remark
SN	Course Code	Course Title	L	T	P	Lab	Total Hour	Theory			Practical				
								Asst. Marks	Final Marks	Time Hours	Asst. Marks	Final Marks	Time Hrs.		
1	EG 2208 ME	Strength of Material	4			1	5	20	60	3	10	10	2	100	
2	EG 2209 ME	Manufacturing Technology	2		8		10	10	40	1.5	90	60	6	200	
3	EG 2221 EX	Electronics Devices and Circuit I	3			2	5	20	60	3	10	10	2	100	
4	EG 2201 EE	Instrumentation II	3			2	5	20	60	3	10	10	2	100	
5	EG 2222 EX	Microprocessor	3			2	5	20	60	3	10	10	2	100	
6	EG 2202 EE	Control System	3			2	5	20	60	3	10	10	2	100	
7	EG 2201 MX	Circuit Analysis and Prototyping	0		5		5	00	00		60	40	4	100	
<b>Total =</b>			<b>18</b>		<b>13</b>	<b>9</b>	<b>40</b>	<b>110</b>	<b>340</b>		<b>200</b>	<b>150</b>		<b>800</b>	

## DIPLOMA IN MECHATRONICS ENGINEERING

### Curriculum Structure

Year: III

Semester: V

Part: I

Teaching Schedule			Mode					DISTRIBUTION OF MARKS						Total Marks	Remark
SN	Course Code	Course Title	L	T	P	Lab	Total Hour	Theory			Practical				
								Asst. Marks	Final Marks	Time Hours	Asst. Marks	Final Marks	Time Hrs.		
1	EG 3101 MX	Advance Manufacturing Technology	3		4		7	20	80	3	30	20	3	150	
2	EG 3102 MX	Industrial Automation	4			3	7	20	80	3	30	20	3	150	
3	EG 3111 EX	Electronics Devices and Circuit II	4		2		6	20	80	3	30	20	3	150	
4	EG 3111 ME	Machine Design	4			2	6	20	80	3	30	20	3	150	
5	EG 3103 MX	Design of Mechatronics System	4		2		6	20	80	3	30	20	3	150	
6	EG 3112 ME	Industrial Management	4				4	20	80	3	00	00		100	
7	EG 3104 MX	Minor Project	0		4		4	00	00		60	40	4	100	
<b>Total =</b>			<b>23</b>		<b>12</b>	<b>5</b>	<b>40</b>	<b>120</b>	<b>480</b>		<b>210</b>	<b>140</b>		<b>950</b>	

Year: III

Semester: VI

Part: II

Teaching Schedule			Mode					DISTRIBUTION OF MARKS						Total Marks	Remark
SN	Course Code	Course Title	L	T	P	Lab	Total Hour	Theory			Practical				
								Asst. Marks	Final Marks	Time Hours	Asst. Marks	Final Marks	Time Hrs		
1	EG 3201 MX	Plant Maintenance	3		3		6	20	80	3	30	20	3	150	
2	EG 3202 MX	Estimation and Costing of Mechatronics System	4	2			6	20	80	3	0	00		100	
3	EG 3201 MG	Entrepreneurship Development	3			2	5	20	60	3	10	10	1.5	100	
4	EG 3203 MX	Robotics and Auto Electronics	3		4		7	20	80	3	60	40	4	200	
5	EG 3204 MX	Major Project	0		8		8	00	00		60	40	4	100	
6	EG 3205 MX	Elective (One of the followings)	3		4		7	20	80	3	60	40	4	200	
		a) Micro Controller and PIC													
		b) Biomedical Instrumentation													
		c) New Product Development													
		d) Maintenance Concepts and Fault Finding													
<b>Total =</b>			<b>16</b>	<b>2</b>	<b>19</b>	<b>2</b>	<b>39</b>	<b>100</b>	<b>380</b>		<b>220</b>	<b>150</b>		<b>850</b>	

**First Year**  
(First and Second Semesters)

## First Semester

### Subjects:

- 1 EG 1101 SH Communication Nepali
- 2 EG 1102 SH Communication English
- 3 EG 1103 SH Engineering Mathematics I
- 4 EG 1104 SH Engineering Physics I
- 5 EG 1105 SH Engineering Chemistry I
- 6 EG 1101 ME Engineering Drawing I
- 7 EG 1211 CT Computer Application
- 8 EG 1102 ME Workshop Technology

# कम्युनिकेसन नेपाली ई.जी. ११०१ एस.एच.

वर्ष : प्रथम  
सेमेष्टर: प्रथम

जम्मा: २ घण्टा/ हप्ता  
प्रवचन: २ घण्टा/ हप्ता

## कोर्षको परिचय

यस विषयमा विद्यार्थीहरूले भावी व्यवसायमा प्रभावकारी ढङ्गले सञ्चार गर्नका लागि आवश्यक पर्ने ज्ञान र सीपसँग सम्बन्धित नेपाली सञ्चारात्मक भाषा, लेखन सीप, र कृति परिचयको ढाँचा गरी जम्मा ३ वटा एकाईहरू सभावेश गरिएका छन् ।

## कोर्षको उद्देश्य :

यस पाठ्यांशको अध्ययनबाट विद्यार्थीहरूले निम्नलिखित भाषिक क्षमता विकास गर्न सक्नेछन्:-

- १ आफ्नो व्यावसायिक कार्य क्षेत्रमा प्रभावकारी सञ्चार गर्न
- २ आफ्नो व्यवसायसँग सम्बन्धित विविध लेखन सीप प्रदर्शन गर्न
- ३ कार्य सम्पादनमा आवश्यक परिस्थितिजन्य संवाद गर्न ।

## पाठ्यांशको विषयवस्तु

एकाइ १:सञ्चारात्मक नेपाली भाषा

(७)

### १.१ भाषिक भेदको परिचय

- मौखिक र लिखित
- औपचारिक र अनौपचारिक
- अमानक र मानक
- सामान्य र प्रयोजनपरक (विशिष्ट) भेदको सोदाहरण परिचय

### १.२ दैनिक कार्यमा प्रयोग हुने भाषाको ज्ञान र प्रयोग

- अनुरोध तथा आदेश/निर्देशन गर्ने भाषाको ज्ञान र प्रयोग
- सोझै गरिने कामहरूमा प्रयोग हुने भाषाको ज्ञान र प्रयोग
- प्रश्नात्मक र वर्णनात्मक भाषाको ज्ञान र प्रयोग

एकाइ २: लेखन सीप

(१८)

### २.१ बोध, शब्दनिर्माण र शब्दभण्डारको ज्ञान र अभ्यास

- क) शब्द भण्डार निर्माण र अभ्यास
- उपसर्ग
  - प्रत्यय, (कृत् तथा तद्धित)
  - समास
  - प्राविधिक तथा पारिभाषिक शब्दहरूको ज्ञान र प्रयोग
- ख) प्राविधिक/पारिभाषिक शब्दहरूको शब्दस्रोत,
- वर्णविन्यास (प्राविधिक शब्दका सन्दर्भमा आवश्यक मात्र)
  - अर्थ र व्युत्पत्तिका लागि शब्दकोशको प्रयोगको अभ्यास

### २.२ बुँदाटिपोट, सङ्क्षेपीकरण

- बुँदा लेखन
- सारांश लेखन

### २.३ अनुच्छेद लेखन /प्रतिवेदन लेखन

### २.४ निबन्ध लेखन

### २.५ पत्र लेखन (निमन्त्रणा पत्र, सूचना, सम्पादकलाई चिठी र निवेदन आदि)

### २.६ संवाद लेखन

एकाइ ३: कृति परिचय : निम्न लिखित ढाँचामा तलका कृतिको परिचय लेख्ने अभ्यास

(५)

### ३.१ कृति परिचयको ढाँचा :

- कृतिको नाम :
- कृतिकारको नाम :

- कृतिका मूल विषयवस्तु : (एक अनुच्छेद)
- कृतिको महत्व : (एक अनुच्छेद )
- कृतिले आफूलाई पारेको प्रभाव : (छोटो एक अनुच्छेद)
- कृतिको भाषा शैली : (छोटो एक अनुच्छेद )
- कृतिको कमी, कमजोरी र सुझाव : (छोटो एक अनुच्छेद)
- निष्कर्ष

### ३.२ कृतिहरू:

- सौर्य उर्जा
- ट्रेड कोर्श (कालिगढ तालिम) : एक परिचय : इ.अ.सं. पश्चिमाञ्चल क्याम्पस पोखरा ।
- भूकम्पबाट सुरक्षित रहन गर्नु पूर्व तयारी: भूकम्प प्रविधि राष्ट्रिय समाज नेपाल ।
- इन्जिनियरिङ नेपाली: लालानाथ सुवेदी ।
- सिंचाई प्रविधि ज्ञान : भोजराज रेग्मी, त्रि. वि. पाठ्यक्रम विकास केन्द्र

### सिकाई सामग्रीहरू

- त्रि. वि. पाठ्यक्रम विकास केन्द्र, अनिवार्य नेपाली शिक्षण निर्देशन, काठमाण्डौं
- लालानाथ सुवेदी, इन्जिनियरिङ नेपाली विद्यार्थी पुस्तक भण्डार, भोटाहिटी, काठमाण्डौं ।
- लालानाथ सुवेदी, नेपाली व्याकरण, बोध/रचना (सम्बन्धित अंश मात्र) विद्यार्थी पुस्तक भण्डार, भोटाहिटी, काठमाण्डौं ।
- गोरखापत्र, कान्तिपुर आदि पत्रिका सम्पादकीय, टिप्पणी र लेखहरू ।
- प्रशिक्षकहरूले आफ्नो पुस्तक तयार गर्न वा बजारमा पाइने सामग्री छानेर पढाउन सक्ने, तर परीक्षा महाशाखालाई यसको पूर्व जानकारी दिनुपर्ने



# Communication English

## EG 1102 SH

Year: I  
Semester: I

Total: 2 hour/week  
Lecture: 2 hours/week

### *Course Description:*

This subject consists of four units related to communicative English; writing skills in English; English sounds and structures; and English conversation practices so as to equip the students with the skills and knowledge of communication in English language in order to have an effective and efficient job performance through occupational communication in the workplace.

### *Course Objectives:*

After the completion of this subject, students will be able to:

1. Familiarize with English sound and basic structures.
2. Communicate in English language at work/job environment
3. Define and use trade related technical terminologies
4. Demonstrate situational/structural conversation essential for job performance
5. Demonstrate various writing skills

### *Course Contents:*

<b>Unit 1. English sound and basic structures:</b>	[2]
1.1. Define with examples: <ul style="list-style-type: none"><li>▪ Phonemes</li><li>▪ Morphemes</li></ul>	
1.2. Introduction to English sounds with examples: <ul style="list-style-type: none"><li>▪ The Vowels</li><li>▪ The Consonants</li></ul>	[2]
1.3. Dictionary skills <ul style="list-style-type: none"><li>▪ Alphabetical order</li><li>▪ Dictionary entry</li><li>▪ Guide words, head words</li></ul>	[3]
1.4. Spellings <ul style="list-style-type: none"><li>▪ British and American English spelling</li></ul>	[1]
<b>Unit 2. Introduction to grammatical units with examples:</b>	
2.1 Grammatical units <ul style="list-style-type: none"><li>▪ The word</li><li>▪ The phrase</li><li>▪ The clause</li><li>▪ The sentence</li></ul>	[2]
2.2 Types of sentence <ul style="list-style-type: none"><li>▪ Forms</li><li>▪ Function</li></ul>	[2]
2.3 Communicative functions <ul style="list-style-type: none"><li>▪ Introducing</li><li>▪ Requests and offers</li><li>▪ Expressing gratuities</li><li>▪ Expressing likes/dislikes</li><li>▪ Asking for permission</li><li>▪ Agreeing/disagreeing</li><li>▪ Encouraging/discouraging</li><li>▪ Inviting/making invites</li><li>▪ Accepting/declining</li><li>▪ Suggesting/advising</li><li>▪ Making and receiving telephone calls</li><li>▪ Group discussing and presentation</li></ul>	[4]

- Unit 3. Reading:** [2]
- Reading comprehension
  - Defining trade related terminologies
- Unit 4. Writing skills in English:** [12]
- 4.1. Writing paragraphs
  - 4.2. Writing dialogues
  - 4.3. Writing precies/summaries
  - 4.4. Writing letters
    - Job application with resumes
    - Leave application
    - Business letters
    - Orders
    - Complains
  - 4.5. Writing essays
  - 4.6. Writing technical reports
  - 4.7. Writing meeting minutes
  - 4.8. Writing notices
  - 4.9. Writing notices
  - 4.10. Writing instructions
  - 4.11. Writing technical proposal

***Learning materials:***

1. Poudel, R.C., A Manual to Communicative English, K.P. Pustak Bhandar, Kathmandu, 1956/57.
2. Shah, B.L., A text book of writing skills in English, First edition Hira Books Enterprises, Kathmandu,
3. Fruehling, R. T. and Oldham N. B., Write to the point, McGraw- Hill, Inc. New York NY 10020
4. Tayior, G., English conversation practice, 1975.
5. Maharjan L. B., A textbook of English sounds and Structures, Vidyarthi Pustak Bhandar, Kathmandu, 2000.
6. Todd, LAN introduction to Linguistics, Longman York press, 1991.
7. Blundell, Jon, Higgens, Jonathan & Middlemiss, Nigel, Function of English, Oxford University Press
8. Naterop, Jean, Reuell, Rod, Telephoning in English, Cambridge University Press,
9. ...., Better English Pronunciation, Cambridge University Press, New edition
10. .... Link English, Central Department of English, Tribhuvan University
11. References to be selected by the related lecturer(s) from among the texts available in the market that meet the content needs of this subject.
12. The related institute may develop its own textbook and approve from the related authority so as to have a prescribed textbook of this subject.

# Engineering Mathematics I

## EG 1103 SH

Year: I  
Semester: I

Total: 5 hour /week  
Lecture: 4 hours/week  
Tutorial: 1 hours/week  
Practical: hours/week  
Lab: hours/week

### **Course Description:**

This subject consists of four units related to trigonometry; coordinate geometry; algebra; and calculus necessary to develop mathematical background helpful for the understanding and practicing the related engineering works.

### **Course Objectives:**

After the completion of this course, students will be able to explain the concepts of the followings and apply them in the field of related engineering area

1. Trigonometric ratios and equations, inverse circular functions and properties of triangles
2. Straight lines, angle between lines, circle and parabola
3. The progressions, permutations and combinations, binomial theorem, exponential and logarithmic series as well as the quadratic and polygonal equations
4. Sets, limit and continuity, derivatives, integration and integrals.

### **Course Contents:**

Unit 1. **Trigonometry:** [12]

- 1.1. Review of trigonometric ratios:
  - Basic trigonometric formulae
  - Identities and conditional identities.
- 1.2. Trigonometric equations:
  - Periodicity of trigonometric functions
  - General solutions of the following equations:
    - $\sin x = k$ ,  $\cos x = k$  and  $\tan x = k$  and using trigonometric equations.
- 1.3. Inverse circular functions:
  - Domain and their graphs
  - Formulae involving inverse circular functions
  - Simple identities and equations involving circular functions
- 1.4. Properties of triangles:
  - The sin law
  - The cosine law
  - The projection law
  - The half angle formulae
  - The area of a triangle
  - The encircles and ex-circles of a triangle

**Coordinate Geometry:** [12]

- 2.1. Straight lines:
  - The three standard forms of equations of a line.
  - The linear equation:  $ax + by + c = 0$ .
  - Any line through the intersection of two lines.
  - Concurrency of lines.
- 2.2. Pair of straight lines:
  - Angle between two lines
  - Bisectors of angles between two lines
  - Pair of lines
  - Homogeneous equation of second degree
  - General equation of second degree representing two lines
  - Angle between a pair of lines
  - Bisectors of the angles for a line pair
  - Lines joining the origin to the points of intersection of a curve and a line
- 2.3. Circle:
  - Standard equation

	<ul style="list-style-type: none"> <li>▪ General form</li> <li>▪ Tangents and normal</li> </ul>	
	2.4. Parabola: <ul style="list-style-type: none"> <li>▪ Standard equation</li> <li>▪ Tangents and normal</li> </ul>	
Unit 2.	<b>Algebra:</b>	<b>[12]</b>
	3.1. Progressions: <ul style="list-style-type: none"> <li>▪ A.P., G.P. and H.P.</li> </ul>	
	3.2. Permutations and combinations	
	3.3. The binomial theorem for any index	
	3.4. Series: <ul style="list-style-type: none"> <li>▪ Exponential &amp; logarithmic</li> </ul>	
	3.4. Equations: <ul style="list-style-type: none"> <li>▪ Quadratic &amp; polynomial</li> </ul>	
Unit 3.	<b>Set relation and function:</b>	<b>[8]</b>
	4.1 Idea of set, set notations, set operations,	
	4.2 Venn diagram,	
	4.3 The set of real members and its subsets.	
	4.4 The absolute value of a real number.	
	4.5 Functions- algebraic and transcendental.	
	4.6 Graphs of simple function.	
Unit 4.	<b>Calculus:</b>	<b>[16]</b>
	5.1. Limit of community.	
	5.2. Derivatives from definition of simple functions like: <ul style="list-style-type: none"> <li>▪ <math>x^n</math>, <math>(ax+b)^n</math>, <math>\sin(ax+b)</math>, <math>e^{ax}</math>, <math>a^x</math>, and <math>\log x</math>.</li> </ul>	
	5.3. Derivatives of sum, difference, product and quotient of functions, chain rule, parametric and implicit functions	
	5.4. Integration, Rules for finding integrals.	
	5.5. Standard integrals and their uses.	
	5.6. Definite integrals- definition and evaluation.	
	5.7. Definite integral as limit of sum.	

***Learning materials:***

1. A Textbook on Engineering mathematics (for Diploma Engineering) part I, Bhim Prasad kafle, Makalu Publicartion House, Dillibazar, Kathmandu
2. A Text book of Statistics – B.C. Bajracharya
3. Elementary Statistics – H. C. Saxena
4. Statistical Methods – Mrigendralal Singh
5. Engineering Mathematics I, Hari Nandan Nath, Parishowar Acharya, Vudhyarthi Publisher and distributors, Bhotahity, Kathmandu
6. References to be selected by the related lecturer(s) from among the texts available in the market that meet the content needs of this subject.
7. The related institute may develop its own textbook and approve from the related authority so as to have a prescribed textbook of this subject

# Engineering Physics I

## EG 1104 SH

Year: I  
Semester: I

Total: 6 hour /week  
Lecture: 3 hours/week  
Tutorial: 1 hours/week  
Practical: hours/week  
Lab: 2 hours/week

### *Course Description:*

This subject consists of four units related to mechanics, heat and thermodynamics, optics, and magnetism necessary to develop background in physics that supports for the understanding and practicing the related engineering works.

### *Course Objectives:*

After the completion of this course, students will be able to explain the basic concepts related to the followings and apply them in the field of the related engineering area.

1. Mechanics.
2. Heat and thermodynamics.
3. Optics.
4. Magnetism.

### *Course Contents:*

#### **Unit 1. Mechanics:**

[15]

- 1.1 Basic units and measurements:
  - Measurement of physical quantities
  - Introductory ideas about dimensions of physical quantities.
  - Scalar and Vector: definitions and examples, dot and cross product of two vectors
  - Composition and resolution of vectors (Triangle law and parallelogram law of vectors)
- 1.2 Newton's laws of motion:
  - Newton's laws of motion (First, second and third laws)
  - Principle of conservation of linear momentum
  - Solid friction: Dynamic and rolling friction, laws of solid friction and its verification
- 1.3. Uniform circular motion:
  - Angular displacement and velocity.
  - Centripetal force and acceleration.
  - Motion of bicycle rider
- 1.4. Gravitation:
  - Newton's law of universal gravitation.
  - Gravitational attraction of earth:
  - Acceleration due to gravity.
  - Variation of acceleration due to gravity with height, depth, and latitude.
  - Motion of satellites:
    - Orbital velocity,
    - Geostationary satellites.
  - Weightlessness, motion of lift
- 1.5. Work, energy, and power:
  - Definition and units of work, energy and power.
  - Potential and kinetic energy.
  - Conservation of energy.
  - Conservative forces.
- 1.6. Simple harmonic motion (SHM):
  - Simple harmonic motion and its characteristics.
  - Energy of simple harmonic motion.
  - Simple pendulum.
- 1.7. Equilibrium and rotation of rigid bodies:
  - Forces in equilibrium, torque, couple, C.G. and center of mass.

- Moment of inertia.
- Angular momentum and
- Its conservation.
- Work done by torque.

**Unit 2. Heat and thermodynamics:**

[12]

- 2.1 Heat Phenomena and Quantity of Heat:
- Concept of temperature and thermal equilibrium.
  - Temperature of scales.
  - Quantity of heat gain or heat loss.
  - Specific heat capacity.
  - Determination of heat capacity by the method of mixtures.
  - Newton's law of cooling.
- 2.2 Change of Phase:
- States of matter.
  - Fusion and vaporization.
  - Evaporation and boiling.
  - Specific latent heats of fusion and vaporization.
  - Melting and boiling points.
  - Introduction of Saturated and unsaturated vapors.
  - Variation of melting and boiling points with pressure.
  - Triple point and critical point.
  - Dew point and humidity.
- 2.3 Thermal Expansion:
- Coefficients of linear, superficial and cubical expansions of solid and relation between them.
  - Cubical expansion of liquids.
  - Real and apparent expansions.
  - Variation of density due to expansion.
- 2.4 Heat Transfer:
- Thermal conduction and thermal conductivity
  - Convection
  - Radiation.
  - Perfectly black body.
  - Stefan-Boltzman's law of black body radiation.
- 2.5 Gas Laws:
- Boyle's law,
  - Charles law and ideal gas equation.
  - Universal gas constant,
  - Avogadro number and Boltzman constant.
  - Volume and pressure coefficients of ideal gas.
- 2.6 Kinetic Theory of Gases:
- Pressure in an ideal gas from molecular point of view.
  - RMS speed, mean energy of a molecule of an ideal gas.
- 2.7 Thermodynamics:
- First law of thermodynamics.
  - Different thermodynamic process:
    - Adiabatic (equation and work done)
    - isothermal (equation and work done)
    - Isobaric and Isochoric
  - Specific and molar heat capacities for different thermodynamic processes,  $C_p - C_v = R$ .
  - Second law of thermodynamics.
  - Efficiency of heat engine

**Unit 3. Optics:**

[8]

- 3.1 Reflection by plane surfaces
- Nature of light, sources of light
  - Review of reflection by plane surfaces
  - Deviation due to reflection
    - Deviation of light due to plane mirror

- Deviation of light due to rotating mirror
- 3.2 Refraction by plane Surfaces:
  - Review of refraction by plane surfaces.
  - Lateral shift
  - Total internal reflection, critical angle
  - Real and apparent depth.
- 3.3 Reflection by Spherical Surfaces:
  - Review of reflection by spherical surfaces.
  - Construction of image by ray diagrams and nature of images
  - Real and virtual images.
  - Nature of images formed by spherical mirrors.
  - Mirror formula for concave and convex mirror
- 3.4 Refraction through Prisms and Lenses:
  - Deviation due to prism and minimum deviation.
  - Refraction through lenses.
  - Lens maker equation.
  - Lens formula for converging lens, diverging lens
  - Formation of images by lenses.
  - Combination of lenses.
  - Magnification,
  - Power of a lens.

**Unit 4. Magnetism:**

**[10]**

- 4.1 Magnets and Magnetic fields:
  - Magnetic poles, magnetic moment, magnetic axis, and magnetic meridian.
  - Magnetic field.
  - Coulomb's law for magnetism.
  - Magnetic field due to magnetic poles and bar magnets.
  - Intensity and flux density of magnetic field.
  - Neutral point.
  - Tangent law.
- 4.2. Earth's Magnetism:
  - Horizontal and vertical components of earth's magnetic field.
  - Declination and angle of dip.
- 4.3. Magnetic properties of materials;
  - Molecular and modern theory of magnetism.
  - Para magnetism and diamagnetism:
    - Permeability and
    - Susceptibility.
  - Intensity of magnetization.
  - Domain theory of ferromagnetism.
  - Hysteresis

**Engineering Physics Practical I**

**[30]**

1. Determine volume of hollow cylinder by using vernier calipers.
2. Determine density of a steel / glass ball by using screw gauge.
3. Determine thickness of glass plate using spherometer and calculate the area by using millimeter graph paper.
4. Determine the acceleration due to gravity by using simple pendulum.
5. Determine the magnetic movement of a bar magnet by using deflection magnetometer.
6. Determine the refractive index of the material of prism.
7. Determine specific heat capacity of solid by the method of mixtures.
8. Determine specific latent heat of ice by the method of mixtures.
9. Determine specific gravity of different solids by up thrust method.
10. Determine focal length of a converging lens by displacement method.

**Learning materials:**

1. Advanced level physics by Nelkon and Parker

2. A textbook of physics, part I and part II by Gupta and Pradhan
3. Numerical problems in Engineering Physics for Diploma in Engineering I & II, Pankaj Sharma Ghimire & Krishna Shrestha, S.K. Books, Dhapasi, Kathmandu
4. Engineering Physics I, Diploma in Engineering (first Year, First part) by Dhan Prasad Poudyal, Khemnath Poudyal, Suresh Prasad Gupta, Binaya Devkota, Laxmi Pustak Bhandar
5. Physics Practical Guide by U.P. Shrestha, RPB

***Other learning materials:***

1. References to be selected by the related lecturer(s) from among the texts available in the market that meet the content needs of this subject
2. The related institute may develop its own textbook and approve from the related authority so as to have a prescribed textbook of this subject.



# Engineering Chemistry I

## EG 1105 SH

Year: I  
Semester: I

Total: 6 hour /week  
Lecture: 3 hours/week  
Tutorial: 1 hours/week  
Practical: hours/week  
Lab: 2 hours/week

### Course Description:

This subject consists of three units related to general chemistry, language of chemistry, and system of classification necessary to develop background in chemistry that supports for the understanding and practicing related engineering works.

### Course Objectives:

After the completion of this subject, students will be able to explain the basic concepts related to the followings and apply them in the field of related engineering works:

1. General chemistry
2. Language of chemistry
3. System of classification

### Course Content:

#### Unit: 1: Language of chemistry:

[4]

- 1.1 Symbol:
  - Definition
  - Significance (qualitative and quantitative)
- 1.2 Formula:
  - Definition
  - Significance (qualitative and quantitative)
  - Concept of valency in terms of combining capacity with H<sub>2</sub>, O<sub>2</sub>, and Cl<sub>2</sub>
  - Variable valency (ref. Fe, Sn, Pb, Cu, Hg, S and N)
  - Radicals (electro- positive and electro - negative)
  - Writing a formula
- 1.3 Chemical equation:
  - Definition
  - Types requisites
  - Significance and limitation
  - Balancing of chemical equation by hit and trial method and Partial equation method

#### Unit: 2: General chemistry:

[8]

- 2.1 Atom and molecule:
  - Definition
  - Dalton's atomic theory and modern position of the theory
- 2.2 Atomic weight:
  - Definition
  - Determination of atomic weight by Dulong and Petit's method and Related numerical problems
- 2.3 Molecular Weight:
  - Definition
  - Avogadro's hypothesis
  - Application of Avogadro's hypotheses ( Mol. Wt=2×V.D., in the deduction of atomicity of elementary gases H<sub>2</sub>, Cl<sub>2</sub>, O<sub>2</sub>, and N<sub>2</sub>)
  - Molecular weight determination by Victor Meyer's method and Related numerical problems
- 2.4 Equivalent weight:
  - Definition
  - Equivalent weight of element, acid, base and salt
  - Equivalent weight determination by hydrogen displacement method and oxide method.
  - Numerical relation between equivalent weight, atomic weight and valency

- Some related problems of equivalent wt. (From Hydrogen displacement method and oxide method)
- 2.5 Simple mole concept:
- Mole of an atom
  - Mole of a molecule
  - Molar volume and
  - Simple calculation on mole concept

**Unit: 3: System of classification:**

[33]

- 3.1 Acid, Base and Salt:
- Arrhenius concept of acid and base
  - Lowry and Bronsted concept of acid and base
  - Conjugate acid and base
  - Amphoteric nature of water
  - Lewis concept of acid and base
  - Properties of acid and base.
  - Definition of Salt
  - Types of salt (normal, acidic and basic)
  - Concept of hydrogen ion concentration, pH value and pH Scale
  - Buffer solution.
- 3.2 Volumetric analysis:
- Definition of titration (acidimetry and alkalimetry),
  - Indicator
  - End-point (neutralization point)
  - Standard solution (primary and secondary standard solution), Normal, Decinormal, Molar, Molal solution
  - Requisites of primary standard substance
  - Volumetric equation,
  - Express the strength of solution Normality, Molarity, Molality, gram per litre and percentage and related numerical problems
- 3.3 Periodic table:
- Mendeleef's periodic law
  - Mendeleef's periodic table
  - Characteristics of groups and periods in the table
  - Advantages and anomalies of the periodic table
  - Modern periodic law
- 3.4 Electronic theory valency:
- Assumptions
  - Types
  - Electrovalency eg. NaCl, MgO, CaS
  - Covalency eg. H<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>, CH<sub>4</sub>, H<sub>2</sub>O, NH<sub>3</sub>, C<sub>2</sub>H<sub>2</sub>
  - Coordinate co-valency eg. H<sub>2</sub>O<sub>2</sub>, SO<sub>2</sub>, O<sub>3</sub>, SO<sub>3</sub>)
  - Electronic dot structure of some compounds eg. H<sub>2</sub>SO<sub>4</sub>, CaCO<sub>3</sub>, K<sub>2</sub>SO<sub>3</sub>
- 3.5 Electrolysis:
- Definition of electrolyte, non-electrolyte and electrolysis
  - Faraday laws of electrolysis,
  - Application of electrolysis (electroplating and electro refining)
  - Electrolysis of acidulated water
- 3.6 Oxidation and reduction:
- Classical definition
  - Electronic interpretation
  - Oxidizing agent: Definition and eg O<sub>2</sub>, O<sub>3</sub>, oxyacids, halogens, K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>, KMnO<sub>4</sub>
  - Reducing agent: Definition and eg. H<sub>2</sub>, H<sub>2</sub>S with some examples,
  - auto-oxidation eg. H<sub>2</sub>O<sub>2</sub>, HNO<sub>2</sub>, SO<sub>2</sub>
  - Idea of oxidation number
  - Balancing chemical equation by oxidation number method
- 3.7 Atomic structure:
- Subatomic particles (electron, proton and neutron)
  - Classical  $\alpha$  - rays scattering experiment

- Rutherford's atomic model and its drawbacks
  - Bohr's atomic model (postulates only)
  - Composition of nucleus
  - Mass number and atomic number
  - Isotopes and isobar
  - Arrangement of electron (Bohr - Bury Scheme)
  - Concept of shell and sub shell,
  - Electronic Configuration and atomic structure of Some elements (Atomic no. 1 to 30)
  - Hund's rule
  - General idea of quantum number and Pauli's exclusion principle
- 3.8 Corrosion:
- Definition
  - Types
  - Direct and indirect method and prevention against corrosion
- 3.9 Activity and electrochemical series:
- Definition
  - Action of water, acid and oxygen on metals.

### Engineering Chemistry Practical I

[30]

1. Simple Glass Working [6]
  - a. to cut the glass tube into three equal parts and round up their shape edges
  - b. to bore a hole through a cork
  - c. to bend the glass tubing into acute, obtuse and right angle
  - d. to draw a jet and capillary tube
  - e. to fit up a wash bottle
2. To separate sand and copper sulphate crystals in pure and dry state from the mixture of sand and copper sulphate [2]
3. To separate sand and calcium carbonate in pure and dry state from the mixture of sand and calcium carbonate [2]
4. To prepare pure water from supplied impure water by distillation and to test the purity of the sample prepared [2]
5. To neutralize dilute sulphuric acid with sodium carbonate solution, and to recover crystals of sodium sulphate [2]
6. To obtain pure and dry precipitate of barium sulphate by treating excess of dilute sulphuric acid with barium chloride solution [2]
7. To investigate the composition of water by electrolysis by using Hofmann's apparatus [2]
8. To determine the equivalent weight of reactive metal by hydrogen displacement method. [2]
9. To determine the pH of different unknown solution and using pH paper and universal indicator [2]
10. To prepare primary standard solution of sodium carbonate and to use it to standardize an approximate decinormal acid solution [2]
11. To standardize given unknown acid (Approx N/10) solution by preparing standard alkali solution. (Expression of strength in different ways) [2]
12. To standardize given unknown alkali (approximately N/10) solution with the help of by preparing standard acid solution. (Expression of strength in different ways) [2]
13. To carry out conductivity experiments on solids and liquids (CuSO<sub>4</sub>, Zn, Mg, Al, Fe, CCl<sub>4</sub>, C<sub>6</sub>H<sub>6</sub>, C<sub>2</sub>H<sub>5</sub>OH) [2]

#### Text books:

1. A Text book of Chemistry, Jha and Guglani
2. Foundations of Chemistry, Vol. 1, M.K. Sthpit and R.R. Pradhananga

#### Reference books:

1. Fundamentals of Chemistry, K.R. Palak
2. Inorganic Chemistry, Bahl and Tuli
3. A Text book of Engineering Chemistry, R.S. Sharma
4. A Textbook of Inorganic Chemistry, L.M. Mitra
5. Elementary practical chemistry, M.K Sthapit
6. Engineering Chemistry, M.L. Sharma, K. M. Shrestha, PN, Choudhary

7. A Textbook of Engineering Chemistry, Prakash Poudel

***Other learning materials:***

1. Other references to be selected by the related lecturer(s) from among the texts available in the market that meet the content needs of this subject
2. **Note:** The related institute may develop its own textbook and approve from the related authority so as to have a prescribed textbook of this subject.

# Engineering Drawing I

## EG 1101 ME

**Year: I**  
**Semester: I**

**Total: 4 hours /week**  
**Lecture: hour/week**  
**Tutorial: hours/week**  
**Practical: 4 hours/week**  
**Lab: hours/week**

### Course description:

This course is designed to provide knowledge and skills on geometrical shapes, and its construction procedure, and interpretation of the views of objects by orthographic projection.

### General objectives:

After the completion of this course students will be able to:

1. Handle drawing instruments and materials;
2. Identify Geometrical construction and shape;
3. Describe the scale, its type and construction;
4. Draw different types of engineering curves and
5. Draw and interpret the multi view of solids with scale and dimensioning.

### Course Contents (Orientation for Lab)

#### Unit 1: Introduction of Engineering Drawing:

- 1.1. Types of drawing i. e. Engineering drawing and Artistic drawing and Engineering drawing define as Graphical language or universal language of engineering technical persons.
- 1.2. Introduction of drawing material i.e. drawing as drawing paper, drawing board, adhesive tape
- 1.3. Pencil, eraser, sharpener etc.
- 1.4. Drawing tools like set square, compass divider etc.
- 1.5. Conventional line and its type and their uses and line weight
- 1.6. Drawing paper size and simple graphical symbols of civil works (at least 10 symbols).
- 1.7. Practical exercise of horizontal , vertical, inclined line using the Drawing tools and material with symbols and paper sizes.(Sheet No. 1)

#### Unit 2: Lettering scales and dimensions:

- 2.1. Lettering
  - 2.1.1. Introduction of single stroke letter and their ratio between height and breadth.
  - 2.1.2. Introduction of upper and lower case letter.
  - 2.1.3. Introduction of Vertical and inclined (italic) letter (with inclined angle).
  - 2.1.4. Practical exercise of letter writing using the guide lines of vertical and italic letter,
  - 2.1.5. (Sheet No 2).
- 2.2. Scale
  - 2.2.1. Introductions of scale and importance
  - 2.2.2. Types of scale (full, reducing and enlarge)
  - 2.2.3. Construction of scale using the representative factor.
- 2.3. Dimensioning

- 2.3.1. Introduction of dimensioning.
- 2.3.2. Terminology of dimensioning i. e. Dimension line, extension line leaders line etc.
- 2.3.3. Termination of dimension line using arrowhead, slash and dot.
- 2.3.4. Dimensioning system-Aligned system, unidirectional system and base line dimensioning.
- 2.3.5. Principles of dimensioning.
- 2.3.6. Dimensioning pictorial views and orthographic view

### **Unit 3: Geometrical constructions:**

- 3.1. Geometric primitives (line, triangle, quadrilateral, regular polygons and circle and its name of its parts).
- 3.2. Division
  - 3.2.1. Division of line – Bi-section of line, tri-section of line, division of line in
  - 3.2.2. Any number of parts and division of the line in proportionally
  - 3.2.3. Division of circle- Division of circle in three, four, five, six, seven and eight parts.
  - 3.2.4. Division of angle- bi-section and trisection.
  - 3.2.5. Division of triangle and trapezium in any number of equal parts of area.
- 3.3. Construction of triangle, square and regular polygons.
- 3.4. Inscribing and describing of circle in/on triangle or polygons.
- 3.5. Tangency- open and crossed line tangent, Arc tangent –internal, external and combined Arc tangent.

### **Unit 4: Engineering Curve:**

Introduction of following curves:

- 3.1. Involute
- 3.2. Spiral
- 3.3. Cycloid
- 3.4. Helices

### **Unit 5: Conic- Section**

- 5.1. Cone and its parts name
- 5.2. Introduction of sectional plane
- 5.3. Definition of conic section
- 5.4. Terminology of conic section after the cut by sectional plane
- 5.5. (As ellipse, Parabola and Hyperbola)

### **Unit 6: Orthographic Projection:**

- 6.1. Introduction of orthographic projection
  - 6.1.1. Theory of projection
  - 6.1.2. Four quadrant, plane of projection
  - 6.1.3. Introduction of co-ordinate or three dimensional axis
  - 6.1.4. System of orthographic projection
  - 6.1.5. Making of orthographic view
  - 6.1.6. Analysis of object and its view
- 6.2. Point and line projection
  - 6.2.1. Notation system on HP, VP and PP
  - 6.2.2. Location of point /line i, e. where it is and projection on plane of projection

6.2.3. Position of line:- Perpendicular to one plane and parallel to the other, parallel to both plane and inclined to one or both planes

6.3. Plane projection

6.3.1. Perpendicular to one plane and parallel to the other, perpendicular to both planes, perpendicular to one plane and inclined to the other

6.4. Projection of solids

6.4.1. Orthographic projection of geometrical solid i.e. prism, cylinder and cone in simple Position.(simple position means axis- perpendicular to one plane(HP) and parallel to (VP) axis parallel to both planes

6.4.2. Orthographic projection of different model or work pieces. (at least 10 to 15 model pieces)

**Practical (Class work sheet)**

**Sheet No: 1**

**[6 Hours]**

1. Draw horizontal, vertical, inclined ( $45^\circ$ ,  $135^\circ$ ,  $30^\circ$ ,  $60^\circ$ ,  $120^\circ$ ,  $150^\circ$ ,  $75^\circ$ ,  $105^\circ$  degree) line and circle using the drawing tools,
2. Draw line type-visible (boarder), construction, dashed, (thick and thin), centre line, dimension, extension, leader line, section line, wavy line, continuous or short/break up line.

**Sheet No: 2**

**[6 Hours]**

1. Practice free hand lettering exercise on upper and lower case vertical letter using horizontal and vertical guide line (at least one set).
2. Practice free hand lettering exercise on upper and lower case inclined letter with numerical using the horizontal and vertical guide line (at least one set).
3. Practice free hand lettering exercise on upper case letter using horizontal guide line of different height letter of 10 to 3mm height.
4. Draw symbols of general civil /electrical/ plumbing work.
5. Perform paper size scheduling work (A0 to A4 size).

**Sheet No: 3**

**[3 Hours]**

1. Perform dimensional practicing exercise on aligned, unidirectional and base line dimension
2. Perform scale construction

**Sheet No: 4**

**[9 Hours]**

1. Perform Line- bisection, trisection, line division any number of parts, with proportional division, circle division in three, four five, six, seven and eight parts, area of triangle and trapezoid division any number of equal parts.
2. Construct triangle by given sides, making equilateral triangle/square and regular Polygons (pentagon, hexagon, heptagon etc.)
3. Find the centre of Arc, making the circle touching the three points. Describing the circle on triangle, inscribe the circle in right angle triangle, Equilateral triangle, and scalene triangle and inscribing the circle in a sector.
4. Draw tangent from any point on circle, open and crossed line (belt) tangent. Arc Tangent-Internal, External and combined.

**Sheet No: 5****[6 Hours]****Draw:**

1. Involutess- Line, triangle and circular involutes with tangent.
3. Spiral construction (mentioning the pole, vector radius, vector angle and Convolution)
4. Cycloid – Cycloidal curve with tangent
5. Helices- Cylindrical helix with pitch angle, conical helix.

**Sheet No: 6****[6 Hours]****Draw:**

1. Ellipse-Concentric circle, oblong (Rectangle), Foci and Eccentricity method.
2. Parabola-Rectangle, offset, Tangent and Eccentricity method.
3. Hyperbola- Rectangle and Transverse axis method.

**Sheet No: 7****[6 Hours]****Perform/draw:**

1. Point projection- Point projection by given location by first and third angle projection (At least two exercise)
2. Line projection-perpendicular to one plane and parallel to other plane, parallel to both planes, parallel to both plane inclined to one or both planes.

**Sheet No: 8****[3 Hours]****Perform/draw:**

1. Plane of projection-Perpendicular to one plane and parallel to other, perpendicular to both the planes, perpendicular to one plane and inclined to other(At least three exercise)

**Sheet No: 9****[3 Hours]****Perform/draw:**

1. Solid projection-Orthographic projection of simple geometrical solid in first and third angle projection.

**Sheet No: 10****[12 Hours]**

1. Analyze the view and draw orthographic projection of flat, inclined and circular surfaced model (At least 15 exercises) of the given objects.

**References:**

1. Luzzadar W. I Fundamental of Engineering drawing. Prentice-Hall of India
2. S. Bogolyubov and A. Voinov, Engineering drawing. Mir Publishers, Moscow.
3. S. K Bogolyubov, Exercises in Machine Drawing. Mir publishers, Moscow.
4. K. Venugopal Engineering Drawing and Graphics, New age international (p) Ltd. India
5. Gill. P. S. Engineering Drawing, S. K. Kataria and sons India.
6. M. B. Shah and B.C. Rana, Engineering Drawing, Pearson India,
7. N. D. Bhatta and Panchal V.M. Engineering Drawing Charotar publishing House India.



# Computer Application

## EG 1211 CT

**Year: I**  
**Semester: I**

**Total: 4 hours/week**  
**Lecture: 2 hours/week**  
**Tutorial: hours/week**  
**Practical: 2 hours/week**  
**Lab: hours/week**

### Course description:

This course deals with the history of computer development, hardware components, Operating systems, Software applications, Computer networks and Internet. Students will learn classifications of computers, its architecture and software application installations, Peripheral devices installation, computer networks, internet and their use in various purposes.

### Course objectives:

On completion of this course the students will be able to:

1. Understand the basic architecture of Computer;
2. Identify major components of computer and their role;
3. Know the different Operating Systems like MS-DOS, Windows etc;
4. Use the different Software applications and
5. Understand the basic networking and internet concept.

### Course Contents: (Theory)

#### Unit 1: Introduction to Computers:

[2 Hours]

- 1.1. History of computers
- 1.2. Generation and type of computers
- 1.3. Computer hardware and software

#### Unit 2: Hardware Components:

[6 Hours]

- 2.1. Major blocks of a digital computer
- 2.2. Input devices like keyboard, mouse, joystick, scanner, light pen etc.
- 2.3. Output devices like monitor, printer, plotter, sound card, speaker etc.
- 2.4. Central Processing Unit
- 2.5. Memory Unit: RAM, ROM, PROM, EPROM
- 2.6. Auxiliary storage devices:
- 2.7. Magnetic storage like floppy disk, hard disk, magnetic tape etc.
- 2.8. Optical storage like CD-ROM, DVD
- 2.9. Pen drive, flash memory card etc.

#### Unit 3: Introduction to Operating System Software: [6 Hours]

- 3.1. Importance and use of operating systems (OS)
- 3.2. Type of OS: MS-DOS, Windows, Unix, Linux
- 3.3. File management, device management and memory management by OS
- 3.4. MS-DOS system files: io.sys, msdos.sys, command.com, config.sys, autoexec.bat
- 3.5. MS-DOS internal and external commands
- 3.6. Windows Operating System: Graphical User Interface and windows environment, file/folder management
- 3.7. Linux: GNU open source operating system

#### Unit 4: Application Packages: [7 Hours]

- 4.1. Text Editors (edit in DOS, notepad in Windows, vi editor in Linux)

4.2. Word Processing Package: Microsoft Word

4.3. Spreadsheet Package: Microsoft Excel

- Entering data
- Using formula
- Basic calculations
- Financial calculations
- Charts

4.4. Concept of Database management system

4.5. Database management package: Microsoft Access

4.6. Presentation Package: Microsoft PowerPoint

### **Unit 5: Utility Programs: [2 Hours]**

5.1. Computer virus and its removal (antivirus programs)

5.2. Multimedia: Audio, Video and Graphics

### **Unit 6: Networks and Internet: [7 Hours]**

6.1. Brief Introduction of LAN, MAN, WAN

6.2. Topologies: Bus, Ring and Star

6.3. Hub, Switch, Modem

6.4. Network Cabling

6.5. NIC

6.6. Network OS

6.7. Client and server concept

6.8. File and print sharing

6.9. Email/Internet

- World Wide Web (WWW)
- ISP
- Search Engines
- Internet Client: Web browsers like Internet Explorer, Netscape Navigator, Mozilla Firefox etc.,
- Email clients like Outlook Express, Netscape Mail etc.

## **Practical [30 Hours]**

1. Identification of major components of computer (1 session)
2. Internal and External DOS commands (1 session)
3. Windows Graphical User Interface and file/folder management (1 session)
4. Microsoft Word (2 sessions)
  - a. Editing text
  - b. Formatting document
  - c. Creating tables
  - d. Creating graphics and word art
5. Microsoft Excel (3 sessions)
  - a. Editing worksheet
  - b. Data formatting and manipulation
  - c. Analysis of data (use of functions for calculation)
  - d. Charts/Data presentation
  - e. Import/Export data
6. Microsoft Access (2 sessions)
  - a. Creating and manipulating data tables
  - b. Query
  - c. Forms/Reports
7. Using Multimedia and Internet/Email (1 session)
8. Creating effective presentation using Microsoft PowerPoint (1 session)
9. Project Work (3 sessions)

*The students will be assigned (individually or in group) a project work based on Microsoft Excel or Access. The students are required to prepare a short report in MS Word and prepare a short presentation in PowerPoint.*

### **Textbooks:**

1. Rajaraman, "Fundamentals of Computers", Prentice-Hall of India

### **References:**

1. B Ram, "Computer Fundamentals", Willey Eastern Publishers
2. S Saxena, "A First Course in Computers", Vikash Publishing
3. Winn Rosch, "Hardware Bible"
4. Noel Kalicharan, "Introduction to computer Studies", Cambridge Low Price Edition
5. P.K Sinha, "Computer Fundamentals"

# Workshop Technology

## EG 1102 ME

**Year: I**  
**Semester: I**

**Total: 11 hours /week**  
**Lecture: 3 hours/week**  
**Tutorial: hours/week**  
**Practical: 8 hours/week**  
**Lab: hours/week**

### Course Description:

This subject deals with the identification of basic hand tools, measuring instruments, power tools, along with their uses, care and safety in the mechanical engineering sector.

### Course Objectives:

After the completion of this course, the student will be able to:

1. Apply the safety rules in the workshop.
2. Identify the tools measuring instrument, power tools.
3. Hold the hand tools and operating power tools for the marking, measuring and cutting the metal in shape.
4. Joining the metal by different processes by hand.
5. Maintenance and care the measuring instrument, hand tools and power tools.

### Course Contents (Theory)

#### Unit 1: Safety in the workshop

[2 hrs]

- 1.1. Rules in the mechanical workshop
- 1.2. Cause of accident and prevention
- 1.3. Types of safety (personal safety, tools, equipment and machine safety)

#### Unit 2: Layout and fitter's Tools

[3 hrs]

- 1.4. Identification, use, care, and maintenance of Layout tools (scriber, punch, divider,
- 1.5. surface plate, V-block and Vernier height gauge)
- 1.6. Identification, uses, and care, of various types of hammer (ball pin, cross, straight, claw and soft)
- 1.7. Wrenches types (single, double, pipe and adjustable) and use
- 1.8. Types, uses and care of Vices (bench, machine, pipe and chain vices)

#### Unit 3: Metal removing tools and methods

[12 hrs]

##### 3.1. Chisels

- 3.1.1. Types and angle of the chisels and removing metal from the surface.
- 3.1.2. Holding the hammer and chisel and chipping processes.
- 3.1.3. Uses the chipping guard, care and maintenance the work place and tools.

##### 3.2. Handsaw and sawing

- 3.2.1. Hand saw parts
- 3.2.2. Method of the holding the work piece and rules of sawing.

##### 3.3. Files and filing

- 3.3.1. Identify the parts, shapes, sizes, cuts of the files
- 3.3.2. Method of the holding, balancing and the direction of the filing
- 3.3.3. Clean and store the files

##### 3.4. Reamer and reaming

- 3.4.1. Types of the reamers (hand, taper and adjustable)
- 3.4.2. Select the holding device, reamer, drill speed
- 3.4.3. The method of the reaming on the metal
- 3.4.4. Care of reamers.

### **3.5. Thread and threading**

3.5.1. Nomenclature, types and use of thread

3.5.2. Thread making methods (Taps and dies, lathe machine, rolling, pressing)

3.5.3. Care of threading tools

### **3.6. Scraper and scraping**

3.6.1. Types, use and care of scraper (flat, three side and curve)

3.6.2. Methods of the scraping and the qualities of the surface

## **Unit 4: Measuring instrument [2 hrs]**

4.1. Linear and angular measuring tools with their uses (scale, tape, vernier caliper, count, micrometer, try square, bevel protractor)

4.2. Types of gauges (wire, and filler, radius and thread)

4.3. Rules of the measuring and using the measuring instrument.

4.4. Care and store of measuring instrument.

## **Unit 5: Rivet and riveting [2 hrs]**

5.1. Types, use and size of rivets

5.2. Types of riveted joints

5.3. Riveting process and tools

## **Unit 6: Solder and soldering [2 hrs]**

6.1. Soldering accessories (iron, solder, cleaning tools and the fluxes)

6.2. Process of cleaning and joining

6.3. Care and of the storing of accessories.

## **Unit 7: Shear and shearing [2 hrs]**

7.1. Types and use of shearing tools (hand and press)

7.2. Different process involved in shearing (of sheet, bars, flat, angle)

7.3. Safety rules and care of the tools

## **Unit 8: Bend and bending [2 hrs]**

8.1. Bending devices (vice pliers, range, hand bar and fork)

8.2. Method of bending the metal bar, flat and the plate

8.3. Safety rules and care of the tools

## **Unit 9: Drill and Drilling [2 hrs]**

9.1. Drill machines: Use and Types (hand, bench, gang, column and radial)

9.2. Drill bits: Types, Bit size, purpose and angle

9.3. Drill and work holding devices

9.4. Speed and bit selection for different work material

9.5. Operation on drill machine using coolant

9.6. Safety rules and care of the tools

## **Unit 10: Sheet metal works [12 hrs]**

10.1. Types and thickness of different metal sheet (mild steel, galvanized steel, Copper, brass, aluminum)

10.2. Marking tools: types and uses (scriber, rules, try square, punch, divider, trammel and depth gauge)

- 10.3. Hand tools (snipes, stacks, punch plat, hatchet, blow horn, hand punch, pop riveter's fork devices, hammers, fly cutter, groove, seaming tools)
- 10.4. Power tools: Working and use (Bending, rollers, folders, and edge forming, sawing, crimping, spot welding and polishing)
- 10.5. Development of sheet
  - 10.5.1. Types of development (rectangular, conical, triangular)
  - 10.5.2. Marking and cutting to produce patterns templates (sheet boxes, Book stand, scoop, tool box, funnel pipe and machine guards)
- 10.6. Sheet metal joining
  - 10.6.1. Types and use of joints (lap, butt, seam)
  - 10.6.2. Steps on sheet metal joining
- 10.7. Safety precautions in sheet metal workshop

### **Unit 11: Introduction to foundry practice**

**[2 hrs]**

- 11.1. Introduction
- 11.2. Pattern Making
- 11.3. Foundry Tools
- 11.4. Core Making
- 11.5. Melting Furnace – Cupola
- 11.6. Sand Casting Process

### **Unit 12: Introduction to forging practice**

**[2 hrs]**

- 12.1. Introduction
- 12.2. Forging tools
- 12.3. Operations – Upsetting, Drawing, Cutting, Bending, Punching
- 12.4. Forging Presses and Hammers
- 12.5. Advantages and Limitations

### **Practical [120 hrs]**

The tasks listed below are performing during the project work provided on next page.

1. Marking : straight, curve, dot
2. Measuring: rules, vernier caliper, gauge
3. Hammering by ball, cross, soft straight pin
4. Sawing by hand saw power
5. Filing with single , double and rasp cut
6. Chiseling by the flat, cross, concave, power chisel
7. Ream ring: Hand and adjustable
8. Threading: Tap and dies
9. Scrapping: Flat and curve on the metal surface
10. Riveting: Riveting sets pup riveter
11. Soft soldering: Solder, heat joint metal
12. Shearing: Snip, press folds
13. Bending by pliers, range, hand, bar, fork and power tools
14. Holding: Bend, machine pipe and the devices
15. Power tools operating: Drill, folding, rolling, radius bending, spot welding, grinding,

16. beading, crippling, edge forming, hacksaw machines
17. Drilling: Counter sink, counter boring, reaming, thread cutting
18. Sheet metal working: Hands pipe bend plot, blow horn, groove and seaming
19. Sheet Developing: Patterns, templates, for the sheet boxes, book stand, scoop funnel,
20. Pipe and the machine guards
21. Thread cutting on pipes
22. Maintenance: Cleaning and storing, working place

### Project List

S.N.	Project	Skill	Metal	Mm size/	Time hrs
1	Hammer	Measuring, marking, sawing, filing, drilling, thread cut	Tool steel 1 pc	25x25x155	8
2	Paper height	Measuring, marking, sawing, Filing	M. S. rod 1 pc	Ø 30x30	11
3	G. Clamp	Measuring, marking, dot, punching, drilling, chiseling, sawing, filing		10x100x70	9
4	Bottle opener	Measuring, marking, sawing, radius filing, drilling	M.S. flat 1 pc	2x3x110	6
5	Dove tail	Measuring, marking, drilling, sawing, fitting, male and female, Scrapping	M.S. flat 2 pc	6x30x51	8
6	Hammer handle	Measuring, marking, filing, thread cutting	M.S. rod	Ø 2x210	4
7	Corn seller	Measuring, marking, Sawing, bending, riveting, soldering	Pipe Ø 65x70 G.I. wire Ø 3x100	65x70 Ø 3x100	6
8	Hacksaw frame	Measuring, marking, cutting, Bending	M.S. flat	3x600	8
9	Hanger	Measuring, marking, bending, Joining	G. I. wire	Ø 3x800 or 1000	2
10	Candle light Stand	Measuring, marking, cutting, filing, bending, drilling, thread Cutting	M.S. flat	10x100x150 3x25x300	8
11	Try square	Measuring, marking, cutting, filing, riveting, drilling	M.S. flat M.S. sheet	10x20x80 2x15x120	8
12	Hand vice	Measuring, marking, cutting, filing, drilling, counter sink, reaming, thread cutting	M.S., M.S. rod	16x16x200 Ø 12x70 Ø 8x80	10
13	G.I. box	Measuring, marking, cutting, hem, seaming, folding, riveting, soldering	G.I. sheet 22 gauge	200x200	5
14	Funnel	Measuring, marking, rolling, seaming, soldering	G.I. sheet 22 gauge	100x300	5
15	Store box	Measuring, marking, heming, seaming, cutting, folding, riveting	G.I. sheet 22 gauge	400x500	5
16	Hand tool box	Measuring, marking, heming, seaming, cutting, folding, riveting	Block sheet	1.5 600x1000	10
17	Practical test	Evaluate all the bench work Sharpening the hand tool and power tool	As per need	As per need	7
	Total (hrs.)				120

## Second Semester

### Subjects:

- 1 EG 1201 SH Engineering Mathematics II
- 2 EG 1202 SH Engineering Physics II
- 3 EG 1203 SH Engineering Chemistry II
- 4 EG 1201 ME Engineering Drawing II
- 5 EG 1205 ME Applied Mechanics
- 6 EG 1109 CT Computer Programming in C
7. EG 1208 EE Basic Electrical Engineering
8. EG 1201 EE Safety Engineering



# Engineering Mathematics II

## EG 1201 SH

Year: I  
Semester: II

Total: 4 hour /week  
Lecture: 3 hours/week  
Tutorial: 1 hours/week  
Practical: hours/week  
Lab: hours/week

### **Course Description:**

This subject consists of five units related to vectors; algebra; calculus; geometry; and statistics necessary to develop mathematical background helpful for the understanding and practicing the related engineering works.

### **Course Objectives:**

After the completion of this course, students will be able to:

1. Explain the concepts of vectors in plain and vectors in space and apply them in the field of the related engineering area
2. Explain the concepts of the complex numbers, linear inequalities and programming apply them in the field of the related engineering area.
3. Explain the concepts of determinants and matrices and apply them in the field of the related engineering area
4. Explain the concepts of determinants and matrices and apply them in the field of the related engineering area
5. Explain the concepts of applications of derivatives and areas of curves and apply them in the field of the related engineering:
6. Explain the concepts of coordinates in space and planes and apply them in the field of the related engineering area
7. Explain the concepts of statistics and apply them in the field of the related engineering area.

### **Course Contents:**

- Unit 1. Vectors:** [9]
- 1.1. Vectors in plane, addition and subtraction.
  - 1.2. Composition and decomposition of vectors.
  - 1.3. Vectors in space.
  - 1.4. The unit vectors  $i, j, k$
  - 1.5. Product of two vectors-
    - dot product,
    - cross product,
  - 1.6. Simple applications.
- Unit 2. Algebra:** [15]
- 2.1. Complex number in the form  $A+ ib$ .
    - Algebra of complex numbers.
    - Polar representation of complex numbers.
  - 2.2. De Moivre's theorem and its applications
  - 2.3. Linear inequalities and their graphs.
    - System of linear inequalities in two variables,
    - System of linear inequalities in two variables,
    - Linear programming: Problems involving two variables under given linear constraints
  - 2.4. Determinants and matrices,
    - Algebra of matrices,
    - Properties of determinants,
    - Ad joint and inverse of matrices.
    - Solution of linear equations using crammers' rule
    - Row equivalent matrices
    - Idea of polynomial equations
- Unit 3. Calculus:** [9]
- 3.1. Applications of derivatives-
    - Tangents and normal to a curve taking slope as derivative
    - Maxima and minima of a function
    - Derivative as rate of change
  - 3.2. Areas under curves:

- Use of definite integral as limit of a sum to find areas under curves
  - Areas of closed curves and
  - Areas between curves.
- 3.3 Ant derivatives:
- Curve tracing, maxima and minima
  - Rieman sums & integral
  - Application of fundamental theorem
- Unit 4. Geometry:** [6]
- 4.1. Coordinates in space,  
4.2. Coordinates in planes.
- Unit 5. Statistics:** [6]
- 5.1. Statistics:
- Introduction to statistics
  - Measures of Central Tendency
  - Measures of Dispersion
  - Moments, Skewness and Kurtosis
  - Correlation and Regression
- 5.2. Probability:
- Concept of Probability
  - Concept of conditioned probability
  - Concept of independent and dependent events
  - Concept of mutually exclusive events

***Learning materials:***

1. A Textbook on Engineering mathematics (for Diploma in Engineering) part II, Bhim Prasad kafle, Makalu Publicartion House, Dillibazar, Kathmandu
2. A Text book of Statistics – B.C. Bajracharya
3. Elementary Statistics – H. C. Saxena
4. Statistical Methods – Mrigendralal Singh
5. Engineering Mathematics I, Hari Nandan Nath, Parishowar Acharya, Vudhyarathi Publisher and distributors, Bhotahity, Kathmandu
6. References to be selected by the related lecturer(s) from among the texts available in the market that meet the content needs of this subject.
7. The related institute may develop its own textbook and approve from the related authority so as to have a prescribed textbook of this subject

# Engineering Physics II

## EG 1202 SH

Year: I  
Semester: II

Total: 6 hour /week  
Lecture: 3 hours/week  
Tutorial: 1 hours/week  
Practical: hours/week  
Lab: 2 hours/week

### *Course Description:*

This subject consists of four units related to electricity, waves, properties of matter, and modern physics necessary to develop background in physics that supports for the understanding and practicing the related engineering works.

### *Course Objectives:*

After the completion of this course, students will be able to:

1. Explain the basic concepts related to the electricity and apply it in the field of the related engineering area
2. Explain the basic concepts related to the waves and apply it in the field of the related engineering area
3. Explain the basic concepts related to the properties of matter and apply it in the field of the related engineering area
4. Explain the basic concepts related to the modern physics and apply it in the field of the related engineering area.

### *Content Contents:*

#### **Unit 1. Electricity:**

[16]

##### 1.1. Electrostatics:

- Elementary charge, charging and induction.
- Faraday's ice-pail experiment.
- Idea of electric field
- Lines of forces.
- Coulomb's law.
- Intensity of electric field.
- Electrostatic potential, equipotential.
- Surfaces.
- Potential and field strength.
- Potential gradient.
- Action of point.
- Van de Graaf generator.
- Capacitors.
- Different types of arrangement of capacitors.
- Energy storage.
- Action of dielectrics

##### 1.2. Current electricity:

- Basics:
- D.C. Current.
- Strength of Current.
- Potential difference across a conductor.
- Ohm's law and its verification.
- Resistance and resistivity.
- Electrical measurements:
- Galvanometer, Ammeter and voltmeter
- Conversion of Galvanometer into Ammeter and voltmeter
- Potentiometer and comparison of emf and measurement of internal resistance
- Kirchhoff's law and their use to analyze simple circuits, Wheatstone bridge
- Heating effect of current:
- Joules law and its verification, electric power, maximum power theorem
- The rate of heating from the concept of p.d.
- Thermoelectricity:
- See-beck effect, variation of thermo e.m.f. with temperature

- Peltier effect and
  - Thomson effect.
- 1.3. Magnetic effect of current and electromagnetism:
- Magnetic forces and magnetic field of current:
  - Force experienced by charge moving in magnetic field.
  - Maxwell's corkscrew rule.
  - Force applied by magnetic field on current carrying conductor.
  - Torque on current carrying coil in magnetic field.
  - Theory of moving coil galvanometer.
  - Biot-Savart's Law
    - Field due to a long straight conductor and due to circular coil.
    - Force between two parallel conductors carrying current.
  - Ampere's law
    - Magnetic field due to the solenoid and long straight conductor.
  - Electromagnetic induction:
  - Faraday's law of electromagnetic induction and Lenz's law.
  - Phenomenon of self-induction.
  - A.C. generator.
  - D.C. generator.
  - Transformer.
- 1.4 Alternating current:
- Instantaneous and effective values of current and voltage.
  - Phase between current and voltage across different elements of circuit.
  - Capacitive and inductive reactance.
  - Impedance.
  - Resonance.
  - Power in a.c. circuit

**Unit 2. Waves:**

[9]

- 2.1. Wave motion:
- Wave motion.
  - Types of wave motion
  - Characteristics of wave motion
  - Wavelength, frequency and speed of waves
  - Speed of waves in different media.
  - Velocity of sound in air.
- 2.2. Wave phenomena:
- Sound waves.
  - Beats and their formation.
  - Progressive waves.
  - Stationary waves.
  - Waves in strings and pipes: fundamental vibrations and overtones.
  - Intensity of sound.
  - Intensity level.
  - Inverse square law.
- 2.3. Physical optics:
- Interference of light waves and coherent sources.
  - Phase difference and path difference. Young's double slit experiment.
  - Introduction of Diffraction of light waves.
  - Introduction of Huygen's principle.
  - Polarization and unpolarized lights, polarization by reflection(Brewster's law)

**Unit 3. Properties of matter:**

[10]

- 3.1 Elasticity:
- Elasticity, Hook's law, Young's modulus, Bulk modulus
  - Elasticity of shear.
- 3.2 Surface tension:
- Intermolecular attraction in liquid, surface tension.
  - Cohesion and adhesion, angle of contact, capillary action

- Coefficient of surface tension and surface energy (Only introduction).
- 3.3 Viscosity:
- Stream line and turbulent flows.
  - Idea of liquid layer, Velocity gradient, Viscosity and its coefficient.
  - Comparison of viscosity with solid friction, Viscous forces, Stoke's law, Terminal velocity, determination of coefficient viscosity

**Unit 4. Modern physics: [10]**

- 4.1 Atomic physics:
- Photons, Photoelectric effect, Einstein's photoelectric equation and stopping potential for photoelectrons.
  - Motion of charged particles in simultaneously applied electric and magnetic fields,  $e/m$  for electron, Milliken's oil drop experiment. Bohr model for hydrogen atom. Energy level diagrams and spectral series.
  - X-rays: Production, nature and uses.
  - Laser (introduction only)
- 4.2 Semiconductors:
- Energy states of valent electrons in solids, energy bands.
  - Semiconductors, intrinsic and doped, p-type and n-type semiconductors.
  - Majority and minority carries.
  - Acceptors and donors, p-n junction, diode and depletion layer, forward and reverse bias.
  - Rectifying property of diode
  - Transistor and it's uses
- 4.3 Nuclear physics:
- Laws of radioactive disintegration: half life, mean life, and decay constant.
  - Stable and radioactive nuclei.
  - Binding energy and mass defect
  - Fission and fusion.

**Engineering Physics Practical II: [30]**

1. Determine specific resistance of a wire.
2. Determine the frequency of A.C. mains.
3. Study current voltage characteristics of a junction diode.
4. Determine speed of sound by resonance air column method.
5. Determine Young Modulus.
6. Verify Ohm's law.
7. Determine force constant of a helical spring oscillation method.
8. Compare Emfs of two cells by using potentiometer.
9. Study characteristic curves of npn transistor.
10. Determine unknown resistance by Wheatstone bridge method.

**Learning materials:**

**Text books:**

1. Advanced level physics by Nelkon and Parker Vth and later editions
2. A textbook of physics, part I and part II by Gupta and Pradhan
3. Numerical problems in Engineering Physics for Diploma in Engineering I & II, Pankaj Sharma Ghimire & Krishna Shrestha, S.K. Books, Dhapasi, Kathmandu

**Text book for laboratory work:**

1. Physics Practical Guide by U.P. Shrestha, RPB

**Other learning materials:**

3. References to be selected by the related lecturer(s) from among the texts available in the market that meet the content needs of this subject
4. The related institute may develop its own textbook and approve from the related authority so as to have a prescribed textbook of this subject.

# Engineering Chemistry II

## EG 1203 SH

Year: I  
Semester: II

Total: 6 hour /week  
Lecture: 3 hours/week  
Tutorial: 1 hours/week  
Practical: hours/week  
Lab: 2 hours/week

### Course Description:

This subject consists of three units related to nonmetals and their compounds; metals and their compounds; and organic compounds and synthetic materials necessary to develop background in chemistry that supports for the understanding and practicing related engineering works.

### Course Objectives:

After the completion of this subject, students will be able to explain the basic concepts related to the followings and apply them in the field of related engineering works:

1. Nonmetals and their compounds
2. Metals and their compounds
3. Organic compounds and synthetic materials

### Course Content:

**Unit: 1: Non-metals and their compounds:** [20]

- 1.1 Water:
  - Source of water
  - Hard and soft water
  - Removal of temporary and permanent hardness of water
  - Water treatment of domestic and industrial purpose
- 1.2 Ammonia:
  - Lab preparation
  - Manufacture by Haber's process
  - Properties and uses
- 1.3 Nitric acid:
  - Manufacture by Ostwald's process
  - Properties and uses.
  - Nitrogen cycle
  - Fixation of Nitrogen
  - Chemical fertilizers
  - Oxides of nitrogen as pollutant (general concept)
  - Acid rain (due to oxides of nitrogen and oxide of Sulphur "Sulphur dioxide")
- 1.4 Halogens (Chlorine):
  - Lab preparation
  - Properties and uses
- 1.5 Hydrochloric acid:
  - Lab preparation
  - Properties and uses
- 1.6 Hydrogen Sulphide:
  - Lab preparation
  - Properties and uses
- 1.7 Sulphuric acid:
  - Manufacture by contact process)
  - Properties and uses
- 1.8 Carbon and its compounds:
  - Allotropes of carbon (reference of diamond & graphite & their structure).
  - Oxides of carbon (Ref. carbon dioxide & carbon mono oxide as pollutants)- general idea only

**Unit: 2: Metals and their compounds:** [15]

- 2.1 General study of metals and their components:
  - Difference between metal and non metal
  - Combined & free state of metals
  - Chemistry of Metallic Carbonates, Sulphates, Chlorides and Nitrates

- 2.2 Alkali metals:
  - General characteristics of Alkali metals
  - Properties & uses of sodium
- 2.3 Alkaline earth metals:
  - General characteristics of the Alkaline earth metals
  - Properties & uses of calcium
- 2.4 Aluminum:
  - Properties and uses
- 2.5 Coinage metals:
  - General properties of coinage metals
  - Properties and uses of copper
- 2.6 Zinc:
  - Properties & uses
- 2.7 Iron:
  - Properties & uses
- 2.8 Lead:
  - Properties & uses
- 2.9 Alloys:
  - Definition
  - Purpose of making alloys
  - Types of alloys

**Unit: 3: Organic compounds and synthetic materials:**

[10]

- 3.1. Organic compounds
  - Organic compounds:
    - Historical background, classification, and nomenclature
    - Functional groups and homologous series
  - Saturated hydrocarbon: Properties of Methane
  - Unsaturated hydrocarbon: Properties of Ethylene and Acetylene
  - Aromatic compounds:
    - Definition
    - Comparison of aliphatic and aromatic compounds
    - Properties of Benzene
- 3.2. **Synthetic materials:**
  - Polymer and polymerization
    - Definition
    - Types of polymer
  - Rubber:
    - Types (Natural and Synthetic )
    - Preparation and uses.
  - Polyvinyl chloride (PVC):
    - Preparation and uses
  - Polythene:
    - Preparation and uses

**Engineering Chemistry Practical II:**

1. To compare the hardness of different types of water [2]
2. To prepare Bakelite (resin) in the laboratory [2]
3. To determine the condition in which corrosion takes place [2]
4. To investigate the action of acids on some metals (Zn, Mg, Fe, Al, Sn & Cu) (acids: HCl, H<sub>2</sub>SO<sub>4</sub>(dil.)& HNO<sub>3</sub> (dil) [2]
5. To prepare and study the properties of hydrogen gas [2]
6. To prepare and study the properties of ammonia gas [2]
7. To prepare and study the properties of hydrogen Sulphide gas. (This gas should not be prepared individually in a Woulf bottle but in Kipp's apparatus commonly) [2]
8. To detect the acid radicals (Cl<sup>-</sup>, NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, CO<sub>3</sub><sup>2-</sup>) by dry and wet ways (4)
9. To detect the basic radicals (Cu<sup>++</sup>, Al<sup>+++</sup>, Fe<sup>+++</sup>, Zn<sup>++</sup>, CO<sup>++</sup>, Ni<sup>++</sup>, Ca<sup>++</sup>, Ba<sup>++</sup>, Mg<sup>++</sup>) by wet ways [6]
10. To detect the acid and basic radicals (complete salt analysis) [6]

***Textbooks:***

1. Foundations of chemistry, Vol-2, M.K. Sthapit and R.R. Pradhananga
2. A text Book of chemistry, Jha & Guglani
3. A text Book of Organic Chemistry, B.S. Bahl & Arun Bahl
4. Elementary qualitative analysis, M.K.Sthapit and C.B.Tuladhar
5. Elementary practical chemistry, MK.Sthapit

***Reference books:***

1. Inorganic chemistry, Bahl & Tuli
2. Elementary Organic Chemistry, P.N. Bargava
3. Fundamentals of chemistry, K.R. Palak
4. A text Book of Inorganic Chemistry, L.M. Mitra
5. Engineering Chemistry, M.L. Sharma, K.M. Shrestha, P.N. Choudhary
6. A Text book of Engineering Chemistry, Prakash Poudel



# Engineering Drawing II

## EG 1201 ME

**Year: I**  
**Semester: II**

**Total: 4 hours /week**  
**Lecture: hours/week**  
**Tutorial: hours/week**  
**Practical: 4 hours/week**  
**Lab: hours/week**

### Course description:

This course is designed to impart knowledge and skills on drawing pictorial view (in isometric and oblique) of the solid, surface development and intersection between two elements. Instructors are requested to manage and deliver the related theoretical contents at drawing room just before conducting the specific practical work. All the theoretical and practical classes should be conducted with in total time of 60 Hours as allotted.

### Course objectives:

After the completion of this course, students will be able to:

1. Analyze/ draw the different orthographic projections;
2. Analyze/draw the different pictorial projections;
3. Draw surface development and
4. Analyze/ draw intersection.

### Course Contents (Theory)

#### Unit 1: Axonometric Projection:

**[0.5 Hour]**

- 1.1. Types of axonometric projection,
- 1.2. Introduction of axonometric projection
- 1.3. Isometric and oblique projection.

#### Unit 2: Oblique Drawing:

**[0.5 Hour]**

- 2.1. Oblique drawing
- 2.2. Measurement in receding axis
- 2.3. Rules for placing object in oblique (box method)
- 2.4. Cavalier and Cabinet projection
- 2.5. Making of Angle, Circular arc in oblique drawing

#### Unit 3: Isometric Drawing:

**[0.5 Hour]**

- 3.1. Isometric scale
- 3.2. Angle of receding axis
- 3.3. Isometric drawing and isometric projection
- 3.4. Isometric and Non isometric line
- 3.5. Making of angle, circular arc in isometric view

#### Unit 4: Projection of True length and shape of oblique line and shape:

**[0.5 Hour]**

- 4.1. Introduction of oblique line
- 4.2. True length and angle to HP/VP of oblique line
- 4.3. True shape of oblique plane

4.4. Revolving method

4.5. Replacing Method

**Unit 5: Projection of intersection of line and plane: [1 Hour]**

5.1. Method of finding of intersection point

5.2. Method of finding the seen and hidden part of line

5.3. Method of finding the angle between plane and line

**Unit 6: Projection of Intersection plane and plane: [0.5 Hour]**

6.1. Line of intersection

6.2. Seen and hidden part of plane

6.3. Finding the dihedral angle between two planes

**Unit 7: Projection of points and line on the surface of geometrical solids: [0.5 Hour]**

7.1. Finding the points and lines by generating method

7.2. Finding the points and line by cutting plane method

**Unit 8: Projection of intersection between line and geometrical solids:**

8.1. Projection of piercing point by generating method

8.2. Projection of piercing point by cutting plane method

**Unit 9: Section : [1 Hour]**

9.1. Introduction of section and its needed

9.2. Sectional plane and sectional views

9.3. Projection of sectional views

9.4. Type of section- Longitudinal and cross section- Full section, half section, offset section, detail section etc.

**Unit 10: Projection of intersection between planes and simple geometrical solids and its surface development with true shape of cut portion: [0.5 Hour]**

10.1 Introduction sectional plane and solid

10.2 Understanding the development of surfaces

10.3 Method of development

10.4 Method for development of cut surfaces

**Unit 11: Projection of intersection between surfaces of solids: [1.5 Hour]**

11.1 Introduction about surfaces of solids

11.2 Type of cutting plane (Vertical/Horizontal projecting plane)

11.3 Determination of line/curve of intersection

11.4 After the intersection of two solids that shape will be occurring of touched at touched portion

## **Practical (Class work sheet)**

### **Sheet No. 1**

**[10 Hours]**

1. Make the oblique view using by models or work pieces.
2. Make oblique view by six models on flat or inclined surfaces.
3. Make oblique view by six models on round and inclined/ flat surfaces.

### **Sheet No 2**

**[10 Hours]**

1. Make the isometric view by models or work pieces.
2. Make oblique view by six models on flat or inclined surfaces.
3. Make oblique view by six models on round and inclined/ flat surfaces.

### **Sheet No 3**

**[3 Hour]**

1. Find the true length of oblique line by revolving method. (At least three exercise on true length by revolving method)
2. Find the true shape of oblique plane (Triangle) by replacing (Auxiliary view) method

### **Sheet No 4**

**[3 Hours]**

1. Perform projection drawing of intersection of line a triangular plane showing the point of intersection,
2. Draw true shape of plane and angle between plane and line on the edge of given plane (At least two exercises should be done).

### **Sheet No 5**

**[3 Hours]**

1. Perform projection drawing of intersection plane and plane (two triangular planes) showing line of intersection and dihedral angle between two planes. (At least three exercises should be done).

### **Sheet No 6**

**[1 Hour]**

1. Perform projection drawing of pyramid and cone with line(s) and point(s) of the surface finding in HP or VP as missing in one plane.

### **Sheet No 7.**

**[3 Hours]**

1. Perform projection drawing of full section and half sectional view of model which has through hole (At least two exercises should be done of this topic).

### **Sheet No 8**

**[2 Hours]**

1. Draw intersection between line and cylinder, pyramid cone, and sphere, showing the piercing points.

### **Sheet No 9.**

**[10 Hours]**

1. Perform/draw square prism, pentagonal prism, hexagonal prism, cylinder and cone cut by a vertical projecting plane (Inclined to HP and perpendicular to VP) with true shape.
2. Perform/draw square, pentagonal, hexagonal, base pyramid, cone and sphere cut by a vertical projecting plane (inclined to HP and perpendicular to VP) with true shape.
3. Exercise on above mentioned pyramid and cone cut by a horizontal projecting plane (inclined to VP and perpendicular to HP)
4. Perform/draw surface development of prism (Triangular, square, pentagonal, hexagonal base), cylinder at simple position (uncut state).
5. Perform/draw surface development of pyramid and cone after the cut by sectional plane (truncated solid).

**Sheet No 10****[8 Hours]**

Perform/draw projection drawing of intersection of two surfaces of two solids (intersection of two solids) on:

1. Vertical (right) prism and horizontal prism of different size.
2. Vertical (right) cylinder and horizontal cylinder of different size.
3. Vertical (right) cylinder and horizontal prism.
4. Vertical (right) cone and prism.
5. Vertical (right) cone and cylinder.
6. Vertical (right) pyramid and prism.

**References:**

1. Luzzadar W. I Fundamental of Engineering drawing. Prentice-Hall of India.
2. S. Bogolyubov and A. Voinov , Engineering drawing. Mir Publishers, Moscow.
3. S. K Bogolyubov, Exercises in Machine Drawing. Mir publishers, Moscow.
4. K. Venugopal Engineering Drawing and Graphics, New age international (p) Ltd. India.
5. Gill P. S. Engineering Drawing, S. K. Kataria and sons India.
6. M. B. Shah and B.C. Rana, Engineering Drawing, Pearson India.
7. N. D. Bhatta and Panchal V.M. Engineering Drawing Charotar publishing House India.

# Applied Mechanics

## EG 1205 ME

**Year: I**  
**Semester: II**

**Total: 4 hours /week**  
**Lecture: 3 hours/week**  
**Tutorial: 0 hour/week**  
**Lab: 1 hour/week**

### Course Description:

Knowledge of mechanics is essential of every discipline of engineering. This subject provides the initial base of engineering and students get the fundamentals of basic theories of engineering. Students develop their ability in analysis and introduce them to synthesis.

### Course Objective:

After completing the course students are able to solve problems

1. On concurrent force system
2. Involving the principle of moment equilibrium
3. Dealing with centre of gravity and Centroid
4. Involving friction, energy in simple machines.

### Course Content (Theory)

#### Unit 1: Vectors

**[2 Hr]**

- 1.1 Scalar and vector quantities
- 1.2 Vector representation, examples
- 1.3 Addition and subtraction of vectors for resultant
- 1.4 Drawing vectors from given information

#### Unit 2: Forces

**[8 Hr]**

- 2.1. Units and effect of forces on a body
- 2.2. Addition and subtraction of forces
- 2.3. Resultant of forces acting on a body
- 2.4. Triangle, parallelogram, and polygon law of forces
- 2.5. Equilibrium condition and equilibrant
- 2.6. Lami's theorem
- 2.7. Resolution of forces and finding resultant.

#### Unit 3: Moments

**[8 Hr]**

- 3.1. Moment of force
- 3.2. Magnitude of moment
- 3.3. Moment equilibrium
- 3.4. Couple
- 3.5. Levers having perpendicular and inclined forces
- 3.6. Torque : magnitude of torque
- 3.7. Force and radius calculation from a given torque.

**Unit 4: Center of Gravity and Centroid** [5 Hr]

- 4.1. Relation between mass, weight, volume and density
- 4.2. Centre of mass and centre of gravity
- 4.3. Centroid of a lamina
- 4.4. Position of the centre of gravity and Centroid of symmetrical bodies

**Unit 5: Friction** [7 Hr]

- 5.1. Static and Dynamic friction
- 5.2. Angle of friction and angle of repose
- 5.3. Coefficient of friction, factors affecting friction
- 5.4. Advantages and disadvantages of friction, application
- 5.5. Problems on screw jack, wedge, ladders like machines
- 5.6. Methods of reducing and increasing friction

**Unit 6: Energy** [8 Hr]

- 6.1. Definition of work, power and energy – its units
- 6.2. Work done by a constant force and variable force
- 6.3. Potential and kinetic energy
- 6.4. Conservation of energy
- 6.5. Kinetic energy of rotation
- 6.6. Efficiency with respect to work and power

**Unit 7: Machines and Drives** [7 Hr]

- 7.1. Working principles of mechanism and machines
- 7.2. Definition of Mechanical advantage, velocity ratio, efficiency
- 7.3. Mechanical advantage, velocity ratio, efficiency of simple machines such as inclined plane, wheel and axle, lever, Pulleys, gear wheel train.
- 7.4. Types of Mechanical Drives
  - Direct Shaft
    - 7.4.1 Coupling
    - 7.4.1 Chain drive
    - 7.4.1 Belt and Pulley drive (Speed Reduction or Increase Calculation)

**Laboratory Works: [15 Hr]**

1. Verification of the law of parallelogram and polygon of forces
2. Verification of the principle of moments
3. Determination of coefficient of friction between two surfaces
4. Determination of M A , V R, and efficiency of simple machines considered
5. Determination of M A , V R, and efficiency of different system of pulleys

**References:**

1. Engineering Mechanics by R.C. Hibbeler
2. Engineering Mechanics by R.S. Khurmi
3. Applied Mechanics by Rajput

# Computer Programming in C

EG 1109 CT

Year: I  
Semester: II

Total: 8 hour /week  
Lecture: 3 hours/week  
Tutorial: 2 hours/week  
Practical: 3 hours/week

## Course Description:

This course deals with the computer fundamentals, problem solving method. It covers basic input and output, structured programming fundamentals, functions, arrays, strings, pointers, structures and file handling using C programming language.

## Course Objective:

After the completion of this course the students will be able to:

- 1 Describe basic programming concepts and terms.
- 2 Explain and apply various data types and operators used in C.
- 3 Develop the working knowledge of problem solving by using the computer methods, systems and languages.
- 4 Apply conditional and looping statements while developing programs.
- 5 Create modular programs using function.
- 6 Make and apply programs using array, strings, structure and union.
- 7 Apply pointers in developing programs.
- 8 Operate Read and write mode to data file in C.

## Course Contents:

### UNIT 1 Computer Programming Basics

[3hrs]

- 1.1. Program, Programming, Programming language and its types
- 1.2. Language translators (Assembler, Compiler, Interpreter)
- 1.3. Program Design Tools (Algorithm, Flowchart and pseudo code)

### UNIT 2 Introduction to C

[6hrs]

- 2.1 History
- 2.2 Character Set, Tokens, Keywords, Identifiers
- 2.3 Constants and its types, Variables, Rules for naming Variables
- 2.4 Operators and its types
- 2.5 Expression
- 2.6 Data types
- 2.7 Precedence and Associativity
- 2.8 Escape Sequence

### UNIT 3 Basic Input and Output

[3 hrs]

- 3.1 Formatted Input/ Output functions (scan (), print ())
- 3.2 Unformatted Input / Output functions (getchar (), putchar (), gets (), puts())

### UNIT 4 Structured Programming Fundamentals

[10hrs]

- 4.1 Control Structure (Sequence, Selection, Loop)
- 4.2 Conditional Statements (if, if...else, if...else if, nested if...else, switch)
- 4.3 Loop (for, while, do – while)
- 4.4 Nested loop
- 4.5 Break and continue statement

### UNIT 5 Functions

[4 hrs]

- 5.1 Introduction
- 5.2 Function Components (Function Prototypes, Call and Definition)

- 5.3 Types of function on the basis of return type and arguments
- 5.4 Call by value and call by reference
- 5.5 Recursion

**UNIT 6 Arrays and Strings** [8hrs]

- 6.1 Introduction to Array
- 6.2 Types of Array (One Dimensional, Multi Dimensional, Static)
- 6.3 Dynamic Array (Introduction only)
- 6.4 Passing Array to Function
- 6.5 Introduction to String
- 6.6 Handling Functions (strcpy(), strlen(), strcmp(), strrev(), strlwr(),strupr())

**UNIT 7 Pointer** [4hrs]

- 7.1 Introduction to pointer
- 7.2 Pointer Arithmetic
- 7.3 Relation between pointer and Array
- 7.4 Dynamic Memory Allocation

**UNIT 8 Structure and Union** [4 hrs]

- 8.1 Introduction to Structure
- 8.2 Declaring and Defining Structures
- 8.3 Accessing Structure member
- 8.4 Introduction to Nested Structure
- 8.5 Arrays of Structures
- 8.6 Union: Declaring and defining Union, Accessing Union member
- 8.7 Difference between Structure and Union

**UNIT 9 Files and Files Handling in ‘C’:** [3 hrs]

- 9.1 Introduction to data file
- 9.2 Opening and closing sequential files
- 9.3 Modes of opening file (r, w, a)
- 9.4 Processing file

**Practical** [45hr]

Perform the following tasks using C:

1. Write programs to implement sequential structure.
2. Write programs to implement conditional and iterative structure.
3. Write programs using array and strings.
4. Write programs using pointer.
5. Write programs using structure and union.
6. Write programs using functions.
7. Write programs to read from and write to data file.

**Reference books:**

- Kanetkar, Y. P. (2008). *Let us C* 8<sup>th</sup> Ed, New Delhi, BPB Publication
- Baral, D.S., Baral, D. & Ghimire S. K, *The secretes of C programming language*. Kathmandu, Bhundi Purana Prakasan.
- Balagurusamy, E. (2007). *Programming in ANSI C*. New Delhi, India: Tata McGraw-Hill.
- Raman, R. (1984). *Computer programming in C*, New Delhi, PHI. India
- B.S. Gottfried(2001), *Schaum’s Outline Series for Programming with C*, Second Edition, Tata McGraw Hill Publishing Company, New Delhi
- Bhatta, R.D (2015), *A Text Book of C Programming*, Vidyarthi Prakashan



# Basic Electrical Engineering

## EG 1208 EE

Year: I  
Semester: II

Total: 4 hours /week  
Lecture: 3 hours/week  
Tutorial: hours/week  
Practical: 1 hours/week

### Course Description:

This course provides a basic framework for understanding the fundamental concept of Electric circuits. The course deals with circuit fundamentals, machines and basic electrical control system.

### Course Objectives:

After completing this course the students will be able to:

1. Understand the fundamental concept of electric circuits
2. Understand the fundamental principles of electricity, magnetism
3. Analyze AC circuits.
4. Understand the DC and AC machines.
5. Understand the basic electrical control system.

### Course Contents (Theory)

#### Unit 1: Introduction

[3 Hrs]

- 1.1. Concept of generation, transmission and distribution system of electricity in Nepal
- 1.2. Concept of electric charge, current and potential difference
- 1.3. Comparison between AC and DC
- 1.4. Concept of resistance, inductance and capacitance

#### Unit 2: Electric Circuit

[4 Hrs]

- 2.1. Electric circuit & Ohm's law
- 2.2. Factors affecting resistance and temperature variation of resistance
- 2.3. Series and parallel combination of resistance
- 2.4. Kirchhoff's Laws
- 2.5. Electrical Power & Energy
- 2.6. Related numerical

#### Unit 3: Magnetism & Magnetic Circuit

[3 Hrs]

- 3.1. Definition of magnetic field, magnetic flux and magnetic flux density
- 3.2. Ferro- magnetic, Dia-magnetic and para-magnetic materials
- 3.3. Faraday law of electromagnetic induction and lenz's law.
- 3.4. Comparison between electric circuit and magnetic circuit

#### Unit 4: AC circuit analysis

[9Hrs]

- 4.1. Generation of 1 $\phi$  voltage and current, mathematical equation and waveforms.
- 4.2. Terminologies: Cycle, frequency, time period, amplitude, average and r.m.s values, phase and phase difference
- 4.3. AC in pure resistance, inductance and capacitance
- 4.4. AC in RL, RC and RLC series circuit with resonance & related numerical
- 4.5. Types of power, power triangle and effects of power factor & related numerical
- 4.6. Generation of 3  $\phi$  voltage and current, mathematical equation and waveforms
- 4.7. Voltage and currents in star and delta connection, Advantages of 3  $\phi$  system & related numerical

#### Unit 5: DC machines

[6 Hrs]

- 5.1. Construction and operating principle of DC machines
- 5.2. Types of DC generators and DC motors

- 5.3. Speed control of DC motor
- 5.4. Losses and efficiency of DC machines.

**Unit 6: AC machines**

**[8 Hrs]**

- 6.1. Construction, operating principles and emf equation of transformer, Concept of Ideal transformer & related Numerical
- 6.2. Losses and efficiency of transformer.
- 6.3. Knowledge of auto transformer and 3 $\phi$  transformer
- 6.4. Construction & operating principle of 3  $\phi$  induction motor.
- 6.5. Losses and efficiency of induction motor
- 6.6. Construction of synchronous machine.

**Unit 7: Electrical Measurement**

**[4 Hrs]**

- 7.1. Electrical measuring units and instruments
- 7.2. Classification of measuring instrument
- 7.3. Working principle of MI (Moving Iron) and MC (moving coil) ammeter and Voltmeter
- 7.4. Basic concept of energy meter and meggar.

**Unit 8: Electric Wiring & Safety**

**[3 Hrs]**

- 8.1. Types of wiring and application with accessories.
- 8.2. Electric shock, preventive method and first aid to be taken in electrical
- 8.3. Accident
- 8.4. Earthing and need of earthing

**Unit 9: Concept of Control system [5]**

- 9.1. Control system with examples
- 9.2. Types of control system with block diagram.
- 9.3. Control system components such as sensors, transducer, stepper motor, and servo motor
- 9.4. Basic knowledge of PID & PLC controller

**Practical:**

**[15 hrs]**

1. Use of ammeter and voltmeter to measure current and voltage
2. Verify ohm's law.
3. Verify KCL and KVL.
4. Demonstrate resonance analysis of RLC series circuit.
5. Phase and live voltage measurements in 3  $\phi$  system with power measurement.
6. Demonstration of various parts of AC and DC machine.
7. Demonstration of PID Controller

**References:**

1. Fundamentals of Electrical Engineering & Electronics by S. K. Sahdev
2. A text book of electrical technology by B L Thareja & A. K. thareja
3. Fundamentals of Electrical Engineering and Electronics by J.B. Gupta
4. Electrical Estimating & Costing by Surjit Singh
5. A course manual on safety engineering by A. K. Mishra

# Safety Engineering

## EG 1201 EE

**Year: I**  
**Semester: II**

**Total: 4 hour /week**  
**Lecture: 3 hours/week**  
**Tutorial: 1 hours/week**  
**Lab: hours/week**  
**Practical: hours/week**

### **Course Description:**

The course deals with the possible basic damages and safety precaution while working with the mechanical as well as electrical equipment and circuits.

### **Course Objectives:**

After completing this course the students will be able to know:

1. Apply the safety rules in the workshop.
2. Identify the tools measuring instrument, power tools.
3. The damages to human due to electric shocks and precautions to be taken care of
4. The cause of fire hazards due to electricity and fire fighting techniques

### **Course Content (Theory)**

#### **Unit 1: Safety in the workshop**

**[2 Hrs]**

- 1.1. Rules in the mechanical workshop
- 1.2. General Safety Considerations
- 1.3. Cause of accident and prevention
- 1.4. Types of safety (personal safety, tools & equipment and machine safety)

#### **Unit 2: Safe use of Mechanical component**

**[2 Hrs]**

- 2.1. Safe use and maintain of mechanical tools
- 2.2. General layout of Machine
- 2.3. Machine installation techniques
- 2.4. First aids for mechanical injury
- 2.5. Explain safety for different metal handling

#### **Unit 3: Layout and fitter's Tools**

**[5 Hrs]**

- 3.1. Identification, use, care, and maintenance of Layout tools (scriber, punch, divider, surface plate, v-block and Vernier height gauge)
- 3.2. Identification, uses, and care, of various types of hammer (ball pin, cross, straight, claw and soft)
- 3.3. Types (single, double, pipe and adjustable), use and care of Wrenches
- 3.4. Types, uses and care of Vices (bench, machine, pipe and chain vices)

#### **Unit 4: Safe use of Electrical components**

**[6 Hrs]**

- 4.1. Safe use of electrical tools
- 4.2. Static charge in high voltage equipment
- 4.3. Electrical insulation techniques
- 4.4. Safety tools

#### **Unit 5: Electric shocks**

**[10 Hrs]**

- 5.1. Possible damages due to electric shocks
- 5.2. Reason behind electric shocks

- 5.3. Bio-physical characteristics of human body against electric current
  - Typical value and characteristics of electrical resistance of human body
  - Effect of environmental factors
  - Effect of state of the organism
- 5.4. Safe value of electric current and voltage through human body
- 5.5. First Aid for electric shock
- 5.6. Cardiopulmonary Resuscitation (CPR)
- 5.7. Safety precautions and regulations
- 5.8. Occupational health and Safety and Standardization
  - Introduction
  - National standard
  - International standard

**Unit 6: Equipment earthing**

**[8 hrs]**

- 6.1. Definition
- 6.2. Types of equipment earthing
- 6.3. Concept of 3-pin plug for high rating equipments
- 6.4. Touch and step potential
- 6.5. Various types of electrodes used for earthing
- 6.6. Earthing mat
- 6.7. Concepts of instruments used for earth resistance measurement

**Unit 7: Fire hazards and fire fighting techniques in electrical equipment**

**[10 hrs]**

- 7.1. Causes of fire hazards due to electricity
- 7.2. Fire classification
  - Ignition of dusts
  - Electrostatic charges in liquids
  - Batteries
  - Insulating oils
- 7.3. Fire Fighting Techniques

**Unit 8: Basic First Aid in workplace**

**[2 hrs]**

- Meaning
- Requirements
- Equipment
- Tools

**References:**

1. F.W. Cooper: Electrical Safety Engineering, Butterworths, London, UK, 1986
2. R. J. Fleming: Seminar on Safety Engineering, IOE, TU, Nepal, August 1995
3. A. K. Mishra: A Course manual on Safety Engineering, IOE, TU, Nepal, 1999
4. NEA act 2050 [1993], Latest Amendment

## **Second Year**

(Third and Fourth Semesters)

### **Third Semester**

#### **Subjects:**

1. EG 2101 MX Material science
2. EG 2101 ME Metrology
3. EG 2102 ME Computer Aided Drafting
4. EG 2102 MX Fluid Mechanics, Hydraulics and Pneumatics
5. EG 2121 EX Electronic Fundamentals
6. EG 2101 EE Instrumentation I
7. EG 2103 EE Electrical Workshop

# Material Science

EG 2101 MX

**Year: II**  
**Semester: I**

**Total: 4 hours/week**  
**Theory: 4 hours/week**  
**Practical: 0 hours/week**

## Course Description:

This course deals various problems regarding materials and machining should be solved by technicians with their introductory knowledge about materials. It also describes the knowledge for material selection, substitution, property evaluation and various materials types.

## Course Objectives:

After completing this course the students will be able to:

1. Understand about different properties of materials and their application
2. Understand about the principle of iron and steel production.
3. Develop knowledge for material selection.
4. Identify and explain different types of electronics components.

## Course contents (Theory)

### Unit 1: Introduction to materials

[6 Hrs]

- 1.1. Classification of materials.
- 1.2. Metals and non-metals.
- 1.3. Relationship between structure and properties.
- 1.4. Thermal, chemical, magnetic, electrical, mechanical properties of various materials.
- 1.5. Selection criteria for use in industry.

### Unit 2: Structure of Metals and their Deformation [8]

- 2.1. Metal Structure, Relation of metal structure to its properties.
- 2.2. Arrangement of atoms in metals (Basic idea).
- 2.3. Crystalline structure of metals.
- 2.4. Crystal imperfections.
- 2.5. Deformation of metal.
- 2.6. Impact of cold and hot working on metal structure
- 2.7. Corrosion, its cause and prevention.

### Unit 3: Testing of Metals

[8 Hrs]

- 3.1. Types of testing
- 3.2. Non-destructive testing (X-ray, ultrasonic, magnetic tests) and their uses
- 3.3. Destructive testing
- 3.4. Tensile test
- 3.5. Fatigue test
- 3.6. Hardness test (Brinell and Rockwell)
- 3.7. Impact test (Charpy and Izod)

### Unit 4: Ferrous materials & Non-ferrous materials

[8 Hrs]

- 4.1. Ferrous materials
- 4.2. Common ferrous materials and their engineering characteristics
- 4.3. Industrial applications
- 4.4. Corrosion: cause, effect and methods of prevention
- 4.5. Non-ferrous materials
- 4.6. Common non-ferrous materials and engineering characteristics
- 4.7. Some non-ferrous alloy (copper, aluminum, brass, bronze, silver, gold) and their Industrial application

- 4.8. Carbon as an electrical material, its product (brushes) and application
- 4.9. Chemical/corrosion characteristics of some commonly used non-ferrous metals

### **Unit 5: Steels and cast iron**

**[8 Hrs]**

- 5.1. Difference between steels and cast iron
- 5.2. Types of steels (HSLA steel, stainless steel, tool steel)
- 5.3. Types of cast iron (grey, white, malleable, ductile)
- 5.4. Various steel making processes (Bessemer, Open hearth, Electric, Duplex)

### **Units 6: Non Metals**

**[6 Hrs]**

- 6.1. Introduction to non-metals
- 6.2. Lubricants: properties, classification and uses
- 6.3. Fuels: properties, classification and uses
- 6.4. Polymers: properties, classification and uses
- 6.5. Rubber: properties and uses
- 6.6. Ceramics: properties, classification and uses
- 6.7. Glass: properties, classification and use

### **Unit 7: Electronic Passive components**

**[8 Hrs]**

#### **7.1. Resistors**

- Carbon film, metal film, carbon composition, wire wound and variable types
- Construction & application

#### **7.2. Capacitors**

- Types of capacitors, connection & application
- Constructional details and testing specifications

#### **7.3. Inductors**

- Transformer, inductors and RF coils construction & application
- Methods of manufacture, testing, Need of shielding & application

#### **7.4. Surface Mounted Devices (SMDs)**

### **Unit 8: Semiconductor materials [8]**

- 8.1. Definition, elements of semi-conductor materials, electrical nature.
- 8.2. Band structure of semiconductor, energy gap.
- 8.3. Intrinsic and Extrinsic semiconductor, concept of doping
- 8.4. N type semiconductor
- 8.5. P type semiconductor
- 8.6. Semiconductor active components (Diode, Transistor & IC) fabrication. Hybrid IC technology.
- 8.7. Introduction to Superconductivity and piezoelectric transducer elements

### **Reference/Text Books:**

1. Electronic Components and Materials by Grover and Jamwal; Dhanpat Rai and Sons, New Delhi
2. Basic Electronics and Linear Circuits by NN Bhargava and Kulshreshta; Tata McGraw Hill, New Delhi
3. Electrical and Electronic Engineering Materials by SK Bhattacharya, Khanna Publishers, New Delhi
4. H. S. Bawa, Material and Metallurgy, TMG edition, New Delhi, India
5. A. K Gupta, R.C Gupta, Material Science, S. Chand and Co. Ltd, New Delhi, India
6. Donall R. Askelad, "The Science and Engineering of Materials", Chapman and Hall, Madras, India

# Metrology

## EG 2101 ME

<b>Year: II</b> <b>Semester: I</b>	<b>Total: 6 hours/week</b> <b>Theory: 4 hours/week</b> <b>Lab: 2 hours/week</b>
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### Course Description:

Metrology is the science of measurements. Engineering metrology mainly deals with the measurements of different measurable quantities both in mechanical and electronics engineering. It is mainly concerned with establishing units of measurements, developing methods of measurements, analyzing errors, accuracy of measurements, principle of measurements.

### Course Objectives:

After the completion of this course, the student will be able to:

1. Describe the principles of different types of measuring instruments
2. Understand the uses of various kinds of measuring instruments
3. Understand the use of oscilloscope, function generator and counter
4. Use properly linear, angular and surface measuring instruments
5. Carry out alignment tests with machine tools
6. Use of basic electronics parameter measuring instruments

### Course Contents (Theory)

#### Unit 1: Introduction to metrology

[4 hrs]

- 1.1. Definition, types and scope of Metrology
- 1.2. Measurement and its types
- 1.3. Metrological terminology (precision, accuracy, sensitivity, resolution)
- 1.4. Errors (types and sources of errors)
- 1.5. Classification of standards
- 1.6. Standards and it's classification

#### Unit 2: Linear measuring instruments

[10 hrs]

- 2.1. Construction, working principle, type, range of measurement, scale division value, precision, accuracy, sensitivity, application and care of:
- 2.2. Non-precision type (steel rule, calipers, divider, telescopic gauge, depth gauge, screw pitch gauge)
- 2.3. Precision type (micrometer, Vernier caliper, radius and feeler gauge, slip gauges or gauge blocks, comparator, dial indicator)

#### Unit 3: Angular measuring instruments

[8 hrs]

- 3.1. Construction, working principle, type, range of measurement, scale division value, precision, accuracy, sensitivity, application and care of:
- 3.2. Non precision type (engineering square, combination set, protractor, adjustable bevel)
- 3.3. Precision type (universal bevel protractor, spirit level, sine bar, indexing head, angle dekkar, clinometer, autocollimator, angle gauges)



**Unit 4: Surface measuring instruments** [2 hrs]

4.2. Construction, working principle, type, range of measurement, scale division value, precision, accuracy, sensitivity, application and care of:

- 7.4.1 Straight edge
- 7.4.1 Try square
- 7.4.1 Surface plate, surface gauge

**Unit 5: Machine tool testing** [4 hrs]

5.1. Introduction , Measuring instruments used for machine tool testing

5.2. Common geometrical tests to be carried out with

- Lathe
- Drilling machine
- Milling Machine

5.3. Practical test

**Unit 6: Bridge Measurement** [10 Hours]

6.1. Electronic Instruments for Measuring Basic Parameters: Amplified DC meter, AC Voltmeter, True- RMS responding Voltmeter, Electronic multi-meter

6.2. DC bridges Wheatstone bridge, AC bridges – Kelvin, Hay, Maxwell, Schering and Wien bridges

**Unit 7: Oscilloscopes** [7 Hours]

7.1. Cathode Ray Oscilloscope (CRO), Specification of an Oscilloscope. Oscilloscope measurement Techniques, Digital storage Oscilloscope (DSO), Sampling Oscilloscope.

**Unit 8: Signal Generators** [5 hrs]

8.1. Sine wave generator, Frequency – Synthesized Signal Generator, Sweep frequency Generator. Pulse and square wave generators.

8.2. Function Generators.

**Unit 9: Signal Analysis** [10 hrs]

9.1. Wave Analyzer, Spectrum Analyzer. Frequency Counters: Simple Frequency Counter; Measurement errors; extending frequency range of counters

9.2. Transducers: Types, Strain Gages, Displacement Transducers.

**PRACTICAL LAB** [30 hrs]

1. Demonstrate construction, working principle, handling and care of various Linear, angular and surface measuring instruments.
2. Perform measurement test
  - linear measurements
  - angular measurements
  - surface measurements
3. Measure gap using slip gauges.
4. Measure angle of small and large components using sine bar and slip gauge
5. Perform alignment test with
  - Lathe 84

- Milling machine
  - Drilling Machine
6. Measure different electric parameters using multimeter ( resistance, voltage, current, continuity, silicon junction diode)
  7. Perform circuit analysis of DC bridge (Wheatstone, Hay, Maxwell)
  8. Demonstrate basic function and front panel control of CRO.
  9. Measure different waveform/signal parameters on the screen of the oscilloscope;
    - Measure the dc-voltage of a source;
    - Measure the peak-to-peak voltage and frequency of a sinusoidal waveform;
    - Measure the phase difference between two sinusoidal waveforms
  10. Demonstrate controls of Function generator and set function generator to output of 1khz sinusoidal wave
  11. Measure the frequency of the oscillation in circuit.
  12. Measure the strain using strain gauge.

### **Reference Books:**

1. R. K. Jain, “Engineering Metrology”, Khanna Publishers.
2. J. F. W. Gayler and C. R. Shotbolt, “Metrology for Engineers”, Cassell, London. SI Edition.
3. Manohar Mahajan, “A Text book of Metrology”, Dhanapat Rai & Co. (P) Ltd., Delhi,
4. R. K. Rajput, “Engineering Metrology and Instrumentation”, S. K. Kataria and Sons, Delhi.
5. Publications from Nepal Bureau of Standards and Metrology (NBSM).
6. M. S. Mahajan A text book of Metrology
7. Modern Electronics Instrumentation & Measurement Techniques, by Albert D.Helstrick and William D.Cooper, Pearson Education.
8. Selected portion from Ch.1, 5-13. 2. Elements of Electronics Instrumentation and Measurement-3rd Edition by Joshph J. Carr. Pearson Education.
9. Selected portion from Ch.1,2,4,7,8,9,13,14,18,23 and 25. Reference Books: 3. Electronics Instruments and Instrumentation Technology – Anand, PHI 4. Doebelin, E.O., Measurement systems, McGraw Hill, Fourth edition, Singapore, 1990
10. Instrumentation and Measurement in Electrical Engineering by Roman Malaric.
11. Electronics Instruments and Instrumentation Technology – Anand, PHI
12. Doebelin, E.O., Measurement systems, McGraw Hill, Fourth edition, Singapore, 1990

# Computer Aided Drafting

## EG 2102 ME

**Year: II**  
**Semester: I**

**Total: 6 hours /week**  
**Lecture: 3 hours/week**  
**Tutorial: hours/week**  
**Practical: 3 hours/week**  
**Lab: hours/week**

### Course Description:

This course provides students with a broad introduction into 2-dimensional Computer-Aided Drawing and Drafting (CADD) with a focus on civil engineering drawings. This course is an intensive introduction to the use of a Computer Aided Design and Drafting (CADD) system for the development of construction drawing and documentation.

### Course Objectives:

After the completion of this course student will be able to:

1. Learn to use popular CAD software programs (Autodesk Auto CAD) to model construction projects and
2. Create basic Civil and Architectural drawings

### Course Contents (Theory)

#### **Unit 1: Introduction to the course and Hardware: [4 Hours]**

- 1.1. Overview about Fundamental of computer. (Hard ware, software etc.)
- 1.2. Introduction application software (specially CADD, Land Development software)
- 1.3. Overview of a PC, peripherals e.g. printers and plotters, system settings and the Windows environment.

#### **Unit 2: Starting a New Drawing/Opening an Existing Drawing: [4 Hours]**

- 2.1. Setting up a drawing, starting from scratch, using a Wizard, using and creating a template file.
- 2.2. Opening an existing drawing
- 2.3. Screen layout, pull-down menus, screen icons, command line and dialogue boxes, status bar toggles,
- 2.4. Setting preferences (Setting Units and Scale, managing drawing area by using MV setup and Limits, setting and use of drafting aids.

#### **Unit 3: Computer Graphics: [4 Hours]**

- 3.1. Computer graphics fundamentals (raster object and vector application) data storage and retrieval , hierarchical storage system ,introduction to basic graphical application, drawing exchange .

#### **Unit 4: Drawing Commands: [10 Hours]**

- 4.1. Co-ordinate input methods (directive, absolute, relative and polar)
- 4.2. Point, Lines, Polyline, Multiline, Construction Lines
- 4.3. Circle, Arc, Ellipse, Donut
- 4.4. Polygon, Rectangle, Spline, solids etc.
- 4.5. Hatching
- 4.6. Text (multi-line & single line / true type fonts

#### 4.7. Dimensions

### **Unit 5: Modify Commands: [6 Hours]**

- 5.1. Object selection
- 5.2. Erase, Trim, Break
- 5.3. Copy, Mirror, Offset, Array,
- 5.4. Move, Rotate, Scale, Stretch,
- 5.5. Lengthen, Extend,
- 5.6. Chamfer, Fillet, etc.

### **Unit 6: Features: [7 Hours]**

- 6.1. View tools,
- 6.2. Layers concept, match and change properties.
- 6.3. measure and divide
- 6.4. inquiry commands (Id, Distance, Area, List, Mass property etc
- 6.5. Working with Block, W-block and External References.
- 6.6. Drawing Exchange ( convert to other format from drawing format and into drawing format)
- 6.7. Using drawing attributes, uses of pre defined objects etc.
- 6.8. Uses of script files.

### **Unit 7: Use of CADD in Civil Engineering Field: [5 Hours]**

- 7.1. Land development and surveying,
- 7.2. CADD and Highway Engineering
- 7.3. CADD and Building Drawing
- 7.4. CADD with water supply and sanitary drawings

### **Unit 8: Plotters and Plotting the Drawing: [5 Hours]**

## **Practical [45 hrs]**

### **Unit 1: Starting a New Drawing/Opening an existing drawing [5 Hours]**

- 1.2. Setting up a drawing starting from scratch, using a Wizard, using and creating a template file, drafting aids.
- 1.3. Opening an existing drawing
- 1.4. Screen layout, pull-down menus, screen icons, command line and dialogue boxes, toggles keys, Screen organization.
- 1.5. Setting preferences (Setting Units and Scale, managing drawing area by using MVsetup and Limits.)

### **Unit 2: Drawing Commands [5 Hours]**

- 2.1. Co-ordinate input methods (directive, absolute, relative and polar)
- 2.2. Point, Lines, Polyline, Multiline ,Construction Lines
- 2.3. Circle, Arc, Ellipse, Donut
- 2.4. Polygon, Rectangle, Spline, , solids etc
- 2.5. Hatching
- 2.6. Text (multi-line & single line / true type fonts

## 2.7. Dimensions

### **Unit 3: Modify Commands**

**[5 Hours]**

- 3.1. Object selection
- 3.2. Erase, Trim, Break
- 3.3. Copy, Mirror, Offset, Array,
- 3.4. Move, Rotate, Scale, Stretch,
- 3.5. Lengthen, Extend,
- 3.6. Chamfer, Fillet, etc.

### **Unit 4: Features**

**[5 Hours]**

- 4.1. Layers concept, match and change properties.
- 4.2. Measure and divide
- 4.3. Inquiry commands
- 4.4. Model Space Viewports and Template Drawings
- 4.5. Uses of Script files
- 4.6. Drawing Exchange ( convert to other format from drawing format and into drawing format)

### **Unit 5: Use of CADD in Civil Engineering Field**

**[20 Hours]**

Following drawings are to be prepared by using CADD software.

- 5.1. Architectural drawing of one storey residential building.
- 5.2. Cross section of Foundation - masonry wall, RCC columns (isolated)
- 5.3. Different types of staircases
- 5.4. Concept drawing of rebars of footing, slab, beam etc.
- 5.5. Symbol drawing of sanitary and water supply, electrical and communication etc.
- 5.6. Contour plotting with the help of Land development.

### **Unit 6: Plotters and plotting the drawing in different scale**

**[5 Hours]**

#### **References:**

1. AutoCAD 2007 Textbooks (also above version )
2. AutoCAD Land Development (latest Version )
3. Mastering AutoCAD 2013 and AutoCAD LT 2013 by George Omura

# Fluid Mechanics, Hydraulics and Pneumatics

## EG 2102 MX

<b>Year: II</b>	<b>Total: 7 hours/week</b>
<b>Semester: I</b>	<b>Theory: 3 hours/week</b> <b>Practical: 4 hours/week</b>

### Course Description:

This course deals with the basic fundamentals of hydraulics and pneumatics and provides general concept associated with hydraulics and pneumatics equipment.

### Course Objectives:

After completing this course the student will be able to:

1. describe the uses of various kinds of hydraulic and pneumatic equipment
2. explain the operation of various kinds of hydraulic and pneumatic equipment
3. demonstrate basic knowledge of service, check, maintenance, diagnosis and testing of hydraulic and pneumatic equipment

### Course Contents

#### THEORY

- Unit: 1 Properties of fluid** [2 hrs]
- 1.1 General introduction of fluid
  - 1.2 Density, specific volume, specific weight and specific gravity
  - 1.3 Fluid viscosity
  - 1.4 Surface tension and capillarity
  - 1.5 Compressibility and Bulk modulus
  - 1.6 Related Problems
- Unit 2: Fluid static** [4 hrs]
- 2.1 Fluid pressure, fundamental equation of fluid static and pressure head
  - 2.2 Absolute pressure, gauge pressure and atmospheric pressure
  - 2.3 Pressure measuring devices and manometer
  - 2.4 Force on plane and curved submerged bodies
  - 2.5 Buoyancy, flotation and stability
  - 2.6 Related problems
- Unit 3 Fundamental of hydraulics and pneumatics** [4 hrs]
- 3.1 Introduction
  - 3.2 Development stage of hydraulic and pneumatic equipment
  - 3.3 Introduction of hydrostatics and hydrodynamics
  - 3.4 Basic principles of hydraulics and pneumatics
  - 3.5 Advantages and disadvantages
- Unit 4. Industrial hydraulics** [12 hrs]
- 4.1 Hydraulic system
    - 4.1.1 Types of hydraulic system and their properties: Open center system, closed center system
    - 4.1.2 Major and auxiliary components and their purposes

- 4.2 Hydraulic Fluid
  - 4.2.1 Function of hydraulic oil
  - 4.2.2 Types of hydraulic fluids: Petroleum base fluids, Synthetic base fluids, Water
  - 4.2.3 Properties of hydraulic oil
  - 4.2.4 Basic requirements of hydraulic oil
- 4.3 Hydraulic Components
  - 4.3.1 Pumps: Introduction to hydraulic pumps and their types
  - 4.3.2 Gear pump, principle, uses, troubleshooting
  - 4.3.3 Vane pump, principle, uses, troubleshooting
  - 4.3.4 Piston pump, principle, uses, trouble shooting
- 4.4 Hydraulic Cylinders
  - 4.4.1 Introduction to hydraulic cylinders and its types
  - 4.4.2 Piston types: single and double acting
  - 4.4.3 Vane type cylinder
  - 4.4.4 Miscellaneous cylinder
- 4.5 Hydraulic Valves and its types
  - 4.5.1 Purpose and function of Pressure control valves, flow control valve and direction control valve
- 4.6 Hydraulic Motor
  - 4.6.1 Introduction to hydraulic motor and types
  - 4.6.2 Gear motor
  - 4.6.3 Vane motor
  - 4.6.4 Piston motor
- 4.7 Accumulator
  - 4.7.1 Purpose and functions of accumulator
  - 4.7.2 Spring loaded accumulator
  - 4.7.3 Weight loaded accumulator
  - 4.7.4 Pneumatic accumulator
- 4.8 Hydraulic Filters
  - 4.8.1 Purpose and functions
  - 4.8.2 Contaminants
  - 4.8.3 Types of filters
- 4.9 Reservoir
  - 4.9.1 Function
  - 4.9.2 Basic features of reservoir
- 4.10 Oil Cooler
  - 4.10.1 Functions
  - 4.10.2 Types of oil cooler

## **Unit 5. Industrial Pneumatics**

**[12 hrs]**

- 5.1 Pneumatic system
  - 5.1.1 Introduction and types of pneumatic system
  - 5.1.2 Components of pneumatic system
- 5.2 Compressed air
  - 5.2.1 Properties of compressed air
  - 5.2.2 Preparation of compressed air
- 5.3 Compressors
  - 5.3.1 Piston type compressors
  - 5.3.2 Vane type compressors
  - 5.3.3 Helical compressors

5.3.4 Centrifugal compressors

5.4 Air Cylinder and Air Motors

5.4.1 Introduction

5.4.2 Types

5.5 Valves

5.5.1 Pressure control valve

5.5.2 Flow control valve

5.5.3 Direction control valve

5.6 Working principle of After Coolers

5.7 Working principle of Dryers

5.8 Working principle of Receiver

5.9 Filters

5.9.1 Purpose

5.9.2 Contaminants in a pneumatic system

5.9.3 Types

5.9.4 Selection of filters

**Unit 6. Industrial application of Hydraulics and Pneumatics**

**[4 hrs]**

6.1 Industrial application of Hydraulic

6.2 Industrial application of pneumatics

**Unit 7. Hydraulic and pneumatic circuits**

**[4 hrs]**

7.1 Hydraulic and pneumatic symbols

7.2 Drawing of hydraulic and pneumatic circuits

**Unit 8. Introduction to general maintenance of hydraulic system and pneumatic system**

**[5 hrs]**

8.1. Preventive Maintenance

8.1.1 Lines cleaning

8.1.2 Preventive overhauling

8.1.3 Preventing leaks, air-in-oil problems

8.2. Diagnosis and Testing of Hydraulic system and Pneumatic system

8.2.1 Introduction

8.2.2 Basic steps

**Practical/Lab**

**[60 Hrs]**

1. Perform experimental works on hydrostatics
2. Develop understanding of basic Hydraulic System
3. Develop understanding pump operation system
4. Develop understanding compressor operation system
5. Identification of hydraulic and pneumatic symbols
6. Control pneumatic actuators, Direct command/Indirect command
7. Perform speed control of cylinder
8. Perform electro-pneumatic control of linear actuators
9. Perform automatic reciprocation and sequential operations
10. Control cylinders with Relays and Limit Switches
11. Perform circuit design problem
12. Perform demonstration of complete hydraulic system and familiarization with associated



components.

13. Perform demonstration of complete pneumatic system and familiarization with associated components.
14. Perform demonstration of hydraulic motors.

**References:**

1. Andrew Parr, Hydraulics and Pneumatics: A Technicians and Engineers Guide, Butterworth-Heinemann; 2<sup>nd</sup> edition (March 8, 1999) ISBN-10:0750644192
2. Anthony Esposito, Fluid Power with Applications, 6<sup>TH</sup> edition, Prentice Hall
3. Hydraulics-John Deere service publications, Molino, Illinois
4. G. P. Gorkhali, First Course in Hydraulics
5. S. Ilango, V. Soundarayan, Introduction to Hydraulics and Pneumatics, latest edition

# Electronic Fundamentals

EG 2121 EX

Year: II  
Semester: I

Total: 7 hours/week  
Lecture: 4 hours/week  
Tutorial: Hour/week  
Lab: 3 hours/week

## Course Description:

This subject deals with both analog and digital electronics. Diploma holders must have basic knowledge about working principle of analog and digital electronic devices. Keeping in view with this need, the electronics course has designed to provide practical and theory about modern components used in analog and digital electronics.

## Course Objectives:

On completion of this course, the student will be able to

- Understand the fundamentals of analogue and digital electronics.
- Provide practical and essential theory on the modern electronic components.
- Understand the applications of analogue and digital electronics devices in industry.

## Course Contents (Theory)

### Unit 1: Introduction to Electronics

[8 hrs]

- 1.1. Definition of electronics, Branch of electronics, Importance of electronics in modern society and Its component
- 1.2. Resistor and Resistance: Types of resistor, Resistor color code calculation, Combination of resistors, application of resistors
- 1.3. Capacitor and Capacitance: Types of capacitor, Combination of capacitors, application of capacitors
- 1.4. Inductor and Inductance: Types of inductor, Combination of inductor and application of inductor.

### Unit 2: Semiconductors

[4 hrs]

- 2.1. Introduction to semiconductor, Atomic structure and crystalline structure of semiconductor
- 2.2. Energy band in conductors, semiconductors and insulators
- 2.3. Types of semiconductor: Intrinsic and Extrinsic semiconductor.

### Unit 3: Semiconductor Diode

[7 hrs]

- 3.1. Introduction to PN junction diode, Biasing, Types of biasing and V-I characteristics of P-N junction diode
- 3.2. Types of diode and its applications: Zener diode, Photo diode, Light emitting Diode, Varactor diode, Tunnel diode and Schottky diode
- 3.3. Zener diode: Basic construction, operational principle, V-I characteristics of zener diode and Zener diode as a voltage regulator

### Unit 4: Transistors

[5 hrs]

- 4.1. Bipolar Junction Transistor: Physical structure and modes of operation, Types of BJT
- 4.2. Transistor configuration (CE, CB, CC), Comparison between three configurations

- 4.3. Transistor as a switch
- 4.4. Construction and working principle of MOSFET

**Unit 5: Introduction to Number System** [10 hrs]

- 5.1. Decimal, Binary, Octal and Hexa-Decimal number system
- 5.2. Conversion of Number System
- 5.3. Binary Addition, Subtraction, Multiplication and Division
- 5.4. Binary Coded Decimal Number and ASCII Code

**Unit 6: Logic Gates and Boolean algebra** [10 hrs]

- 6.1. Introduction to Logic Gates (AND, OR, NOT, NAND, NOR, X-OR, X-NOR)
- 6.2. Laws of Boolean algebra, De-Morgan's Theorem, Universal Gate Conversion and minimization of logical expression using Boolean algebra
- 6.3. Karnaugh Map (K-Map): Two variables, Three Variables and Four Variables for minimization of Logical Expressions.

**Unit 7: Introduction to Combinational Logic Circuits** [6 hrs]

- 7.1. Encoder, Decoder, Multiplexer and De-Multiplexer
- 7.2. Seven Segment Display Decoder
- 7.3. Parity Generator and Checker
- 7.4. Half Adder, Full Adder and Subtractor

**Unit 8: Sequential Logic Circuit** [10 hrs]

- 8.1. Latches and Flip-Flop
- 8.2. SR (using NOR and NAND), D Flip-Flop
- 8.3. JK Flip-Flop, T Flip-Flop and Master-Slave Flip-Flop
- 8.4. Shift Registers: Shift Left and Shift Right
- 8.5. Serial and Parallel Register (SISO, SIPO, POSO, PIPO)
- 8.6. Counter: Synchronous and Asynchronous Counter, Ring Counter
- 8.7. Application of Counter: Digital Clock and Frequency Counter

**Practical/Lab** [45 hrs]

- 1. Introduce Laboratory Equipment
- 2. Demonstrate resistor color code and measure the different values of resistor using analog and digital multi-meter experimentally
- 3. Measure equivalent resistance connected in Series and parallel circuits
- 4. Plot P-N junction diode and Zener diode characteristics
- 5. Testing of BJT transistors characteristics
- 6. Verify truth table of AND, OR, NOT, NAND, NOR, X-OR
- 7. Verify De-Morgan's theorem
- 8. Realize universal gates using basic gates
- 9. Construct and verify of encoder, decoder and flip-flops

**Reference Text Books**

- 1. Basic Electronics by Bernard Grob, Latest Edition
- 2. Electronic Fundamentals by Floyd, Latest Edition
- 3. Digital Electronics by Malvino, Latest Edition

# Instrumentation I

EG 2101 EE

**Year: II**  
**Semester: I**

**Total: 6 hrs/w**  
**Lecture: 4 hrs/w**  
**Tutorial: hrs/w**  
**Lab: 2 hrs/w**

## Course description:

This course deals with the basic fundamentals of measurements. Students will understand and basic principles of various electrical instruments.

## Course objectives:

After the completion of this course, students will be able to:

1. Select the importance of measurement in electronic engineering
2. Apply SI units
3. Identify types of electrical measurements & explain their working principle

## Course Contents (Theory)

### Unit 1: Introduction to electrical Measurements

[10hrs]

- 1.1. Measurement & measurement system
  - 1.1.1 Measurements
  - 1.1.2 Measurement terms
  - 1.1.3 Instrumentation system
- 1.2. System of international units(SI) & symbols
- 1.3. Electrical instruments
  - 1.3.1 Types
  - 1.3.2 Schematic symbols
  - 1.3.3 Basic characteristics
  - 1.3.4 Application
- 1.4. Extension of Instrument range
  - 1.4.1 Ammeter shunts
  - 1.4.2 Construction of shunts
  - 1.4.3 Voltmeter Multiplier

### Unit 2: Galvanometers, Ammeters & Voltmeters

[12 hrs]

- 2.1. Galvanometers
  - 2.1.1 Galvanometer damping mechanism
  - 2.1.2 Galvanometer constant
  - 2.1.3 Galvanometer selection
  - 2.1.4 Galvanometer shunts
  - 2.1.5 Vibration Galvanometer
  - 2.1.6 Ballistic Galvanometer
- 2.2. Ammeters & Voltmeters
  - 2.2.1 Types of instruments
  - 2.2.2 Moving iron instruments
  - 2.2.3 Moving coil instruments
  - 2.2.4 Permanent Magnet moving coil (PMMC Instruments)

- 2.2.5 Dynamometer type instruments
- 2.2.6 Thermal instruments
- 2.2.7 Hot wire instruments
- 2.2.8 Thermo – couple instruments
- 2.2.9 Rectifier type instruments
- 2.2.10 Induction type instruments

### **Unit 3: Measurements of Resistance**

**[8hrs]**

- 3.1. Classification
- 3.2. Measurement of low resistance
- 3.3. Measurement of medium resistance
- 3.4. Measurement of high resistance
- 3.5. Ohm Meters
- 3.6. AVO meter
- 3.7. Megger

### **Unit 4: Measurement of Power**

**[10hrs]**

- 4.1. Measurement of power using voltmeter & ammeter
- 4.2. Wattmeter type
  - 4.2.1 Energy meter (Kwh meter), Operation & application
  - 4.2.2 Dynamo type meter, Operation & application
- 4.3. Instrumental Transformer
  - 4.3.1 Introduction to potential transformer, operation and application
  - 4.3.2 Introduction to current transformer, operation and application

### **Unit 5: Application of Instrumentation**

**[20 hrs]**

- 5.1 Fundamental & Importance of Instrumentation, selection of instruments, performance of instruments, error in measurement, calibration & standard, Calibration of Instruments: Methods & analysis, Process Instrumentation, recording instruments, indicating & recording Instruments.
- 5.2 Miscellaneous measurement: force & torque, level, pH, gas analyzer, emissivity, refractive index, viscosity, surface tension, & color. Spectro-photo-metry, chromatography & NIR Introduction to biosensors.
- 5.3 Basic concept of process controls, types of control & their application. Concept of automatic control & its classification, Instrumentation & control of typical food processing units like reactor, evaporator, dryer etc.

### **Practical/Lab**

**[30 hrs]**

1. Measure speed using Tachometer
2. Measure stress/strain using strain gauge
3. Measure flow using rotometer
4. Measure temperature using thermocouple
5. Measure various pressure elements
6. Measure the level of a liquid using a transducer
7. Draw the characteristics of a potentiometer
8. Demonstrate the use of digital temperature controller
9. Test thermistor in ON/OFF Switch

10. Demonstrate of variable capacitive transducer
11. Measure linear displacement using LVDT
12. Demonstrate the use of electrical strain gauge
13. Demonstrate sequence control system in lifting a device for packaging and counting

**References:**

1. J.B. Gupta "A Course in Electronics & Electrical Measurement & Instrument"
2. A.K. Sawhney "A Course in Electrical & Electronics measurement & instrumentation", Dhanpati Rai & Co. (Pvt.) Ltd

# Electrical Workshop

EG 2103 EE

Year: II  
Semester: I

Total: 4 hour /week  
Lecture: hours/week  
Lab: 4 hours/week

## Course Description:

This course deals with the selection, uses of basic tools. Measuring equipment and wiring accessories for incandescent as well as fluorescent lighting using different control method.

## Course Objectives:

On completion of this course the students will be able to:

1. Understand electrical hazards and safety.
2. Identify, use and care of electrical tools required for wiring Installation.
3. Identify different types and size of wires and cable
4. Perform different types of cable joints and termination.
5. Identify various wiring accessories and install them with PVC duct.

## Course contents

- Unit 1:** [2 hrs]  
L: Electrical hazards, safety rules and practice, conditions and cause of electric shocks removal of casualties and artificial respiration.  
P: Type and size of wire, forming stripping and termination of various wires and cable with eyelet, cable shoe, soldering and crimping
- Unit 2:** [2 hrs]  
L: Identify the following tools and measuring instruments  
Types and sizes of screw drivers, line tester, electric pliers, end cutting, diagonal cutting, combination, flat nose and round nose, electrician knife, wire stripper, crimpers.  
P: Practice on various types of cable joints – straight light joint, T joint with solder, mechanical connector, soldering practice
- Unit 3:** [2 hrs]  
L: Use of multimeter, ohmmeter and oscilloscope  
P: Make a 220/6v adaptor with diode in bridge connection and capacitor measure 6V AC and DC by voltmeter as well as oscilloscope.
- Unit 4:** [2 hrs]  
L: Introduction and identification of wiring accessories switches, sockets, plugs, fuse, MCB, RCD and RCCB, MCCB, ELCB holders, ceiling rose, J.B etc.  
P: Installation of 220V bell with push bottom switch. Draw symbol – lay out diagram – connection diagram
- Unit 5:** [4 hrs]  
L: Introduction of mutual, gang call system.  
P: Installation of 6 gang indicator call bell system – understand connection diagram
- Unit 6:** [4 hrs]  
L: Introduction of extension lamp and power cord, current carrying capacity.  
P: a) Make extension lamp set for 100W lamp  
b) Make Iron cord for 750W iron  
c) Make power extension cord 15Amp socket  
d) Use current carrying table to select the size of wire for above work.

- Unit 7:** [4 hrs]  
 L: Introduction of light point (lamps) in a circuit.  
 P: Installation of one lamp controlled by one 6 Amp switch in PVC duct as per given lay out.
- Unit 8:** [4 hrs]  
 L: Methods of addition, renovation of lighting work.  
 P: Additional installation of two number of 5Amp 2 pin socket on above job.
- Unit 9:** [4 hrs]  
 L: Behavior of lamps in series and parallel connection  
 P: Installation of two lamps controlled by one switch.
- Unit 10:** [4 hrs]  
 L: Introduction of Power point wiring (sockets) in a circuit.  
 P: Installation of two number of 15Amp 3 pin switch socket with MCB in PVC duct.
- Unit 11:** [4 hrs]  
 L: Method of lamp controlled from multi places  
 P: Installation of a lamp controlled by two numbers of alternate switches (two way switches) from two separate places.  
 Using live line is one of the common terminals of one switch.
- Unit 12:** [4 hrs]  
 L: Introduction of fluorescent lamp.  
 P: Installation of fluorescent lamp holders, switch, starter holder, ballast and inter connection one of them, fit tube and starter and connect to supply.
- Unit 13:** [4 hrs]  
 L: Introduction of ring circuit.  
 P: Installation of four numbers of 15Amp power switch socket in ring circuit with 16Amp sp MCB
- Unit 14:** [4 hrs]  
 L: Relation and connection of Ballast power and tube wattage.  
 P: Installation of two number of 20Watt tubes with 40Watt ballast in series
- Unit 15:** [4 hrs]  
 L: Introduction of capacitor connection with tube set  
 P: Install, two numbers of 40Watt tube in parallel with separate ballast and power factor connection condenser.
- Unit 16:** [4 hrs]  
 L: Introduction of LED lamp  
 P: Install different types of LED lamp with dimmer switch
- Unit 17:** [4 hrs]  
 L: Introduction of Energy Meter, working principle, application  
 P: Installation of Energy meter along with four numbers of lights and two power socket

### References:

1. Electrical wiring Fundamentals – Folley Electrical installation and workshop practice – F.G. Thompson
2. Conductor Technical manual – Cable manufacturer



## **Fourth Semester**

### **Subjects:**

- |               |                                   |
|---------------|-----------------------------------|
| 1. EG 2208 ME | Strength of Material              |
| 2. EG 2209 ME | Manufacturing Technology          |
| 3. EG 2221 EX | Electronics Devices and Circuit I |
| 4. EG 2201 EE | Instrumentation II                |
| 5. EG 2222 EX | Microprocessor                    |
| 6. EG 2202 EE | Control System                    |
| 7. EG 2201 MX | Circuit Analysis and Prototyping  |

# Strength of Materials

## EG 2208 ME

<b>Year : II</b> <b>Semester : II</b>	<b>Total: 5 hrs./ w</b> <b>Theory: 4 hrs./ w</b> <b>Lab: 1 hrs./ w</b>
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### Course Description:

Designing is inseparable part in engineering. Before going to solve real life structural problem it is recommended to understand the properties of materials (elasticity, ductility, brittleness etc.) at different load condition. It helps to calculate probable failure in different parts of structure and helps to minimize those problems. The duty of diploma holder is to carry out job smoothly under the guidance of an engineer.

### Course Objectives:

After the completion of this course, the student will be able to:

1. Understand different types of force action
2. Understand important mechanical properties of materials.
3. Conduct the laboratory test or determining
4. Interpret test results of different properties of materials

### Course Contents

#### THEORY

**Unit 1: Introduction to strength of materials and its scope** [2 hrs]

**Unit 2: Load** [10 hrs]

- 2.1 Concept of load and reaction
- 2.2 Different forms of loading: concentrated, U.D.L. and varying/ distributed load:
  - 2.2.1 Moment of inertia
  - 2.2.2 Center of gravity
  - 2.2.3 Section modulus
  - 2.2.4 Reaction and its determination
  - 2.2.5 Concept of internal forces
  - 2.2.6 Deformation of a body under the action of external forces

**Unit 3: Stress and strain** [8 hrs]

- 3.1 Elastic limit, Hooke's law, stress strain curve
- 3.2 Related problems

**Unit 4: Tension and compression** [6 hrs]

- 4.1 Tensile strength
- 4.2 Compressive strength
- 4.3 Related problems

**Unit 5: Shear and torsion** [10 hrs]

- 5.1 Shear stress and strain
- 5.2 Shearing strength of materials
- 5.3 Torsional stress and strain
- 5.4 Related problems:
  - 5.4.1 Moment of resistance
  - 5.4.2 Polar modulus

**Unit 6: Bending** [10 hrs]

- 6.1 Shear force and bending with diagrams
- 6.2 Bending stress and strain
- 6.3 Related problems: beam deflection

**Unit 7: Design of axially loaded columns** [6 hrs]

- 7.1 Introduction
- 7.2 Columns with different support conditions
- 7.3 Stresses in compressed columns
- 7.4 Timber columns
- 7.5 Related problems

**Unit 8: Combined loading** [8 hrs]

- 8.1 Unsymmetrical bending
- 8.2 Eccentric tension and compression
- 8.3 Combined bending and torsion
- 8.4 Combined shear and torsion
- 8.5 Related problems

**Practical/Lab** [15 hrs]

- 1. Demonstrate the change in material properties in bending test.
- 2. Perform shear test on two different metal specimens.
- 3. Perform deflection test on a metal bar.
- 4. Perform torsion test to determine angle of twist at different torque.
- 5. Perform experimental determination of support reactions.

**Reference**

- 1. Strength of Materials by R.S. Khurmi
- 2. Strength of Materials by S. Ramamurtham
- 3. Theory and problems of Strength of Materials by William A. Nash
- 4. Strength of Materials by Siger
- 5. Mechanics of Structures by S.B. Junnarkan
- 6. Strength of Materials by A. Kozachenko and others
- 7. Strength of material by RK Bansal

# Manufacturing Technology

EG 2209 ME

<b>Year: II</b> <b>Semester: II</b>	<b>Total: 10 hrs/w</b> <b>Theory: 2 hrs/w</b> <b>Practical: 8 hrs/w</b>
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## Course Description:

The subject aims at imparting knowledge and skill components in the field of basic manufacturing science. The course is offered as an extension of the Workshop Technology. It deals with different machine tools required for manufacturing processes. Also it deals with the different types of welding processes.

## Course Objectives:

After the completion of the course, the student shall be able to

1. Practice workshop safety rules effectively
2. Operate various equipment and machine tools and manipulate them
3. Produce simple metal components and articles using different machine tools and accessories
4. Supervise mechanical works in the subject related field  
Perform maintenance works of the machines and undertakes repair works wherever necessary.
5. Operate arc, oxyacetylene and TIG-MIG welding equipment.

## Course contents (Theory)

**Unit 1: General safety Considerations on machining workshop [1 hrs]**

**Unit 2: Metal Cutting [4 hrs]**

- 1.1. Introduction
- 1.2. Orthogonal and Oblique cutting
- 1.3. Classification of cutting tools
- 1.4. Tool geometry in Co-ordinate System
- 1.5. Types of chips
- 1.6. Sources of heat in metal cutting
- 1.7. Tool failure
- 1.8. Tool life
- 1.9. Tool wear
- 1.10. Cutting Tool Materials
- 1.11. Mach inability

**Unit 3: Machines [12 hrs]**

- 1.1. Lathe Machine
  - 1.1.1 Introduction
  - 1.1.2 Working Principle
  - 1.1.3 Operation
- 1.2. Shaping Machine
  - 1.2.1 Introduction

- 1.2.2 Working Principle
- 1.2.3 Operation
- 1.3. Drilling Machine
  - 1.3.1 Introduction
  - 1.3.2 Working Principle
  - 1.3.3 Operation
- 1.4. Grinding Machine
  - 1.4.1 Introduction
  - 1.4.2 Working Principle
  - 1.4.3 Operation
- 1.5. Milling Machine
  - 1.5.1 Introduction
  - 1.5.2 Working Principle
  - 1.5.3 Operation
- 1.6. Capstan and Turret Lathe
  - 1.6.1 Introduction
  - 1.6.2 Working Principle
  - 1.6.3 Operation

**Unit 4: Maintenance** **[2 hrs]**

- 4.1. Introduction
- 4.2. Types of Maintenance
- 4.3. 10.3 Maintenance Schedule

**Unit 5: Introduction to welding** **[1 hrs]**

- 5.1. Introduction to welding
- 5.2. Classification of welding
- 5.3. Selection of different types of welding processes

**Unit 6: Arc Welding** **[3 hrs]**

- 6.1. Introduction to arc welding
- 6.2. Equipment and accessories for arc welding
- 6.3. Arc welding electrode
- 6.4. Arc welding fundamentals and techniques

**Unit 7: Oxyacetylene (gas) Welding** **[3 hrs]**

- 7.1. Introduction to Oxyacetylene (gas) welding
- 7.2. Equipment and accessories for Oxyacetylene (gas) welding
- 7.3. Oxyacetylene flame
- 7.4. Oxyacetylene (gas) welding fundamentals and techniques

**Unit 8: TIG-MIG Welding** **[4 hrs]**

- 8.1. Introduction to TIG-MIG welding
- 8.2. Equipment and accessories for TIG-MIG welding
- 8.3. TIG-MIG electrode and fillers
- 8.4. TIG-MIG welding fundamentals and techniques

## Practical

[120 hrs]

S.N	Description
1	Demonstration of formation of chips on a lathe, continuous, discontinuous and fractured by changing variables like rake angle, speed feed and depth of cut.
2	Grinding of single point (H.S.S.) tools.
3	Demonstration of preparing soluble oil cutting fluid and its use for improving the surface
4	Practice of various operations on Lathe (Facing, turning, step turning, knurling)
5	Practice of taper turning and screw cutting on a centre lathe
6	Practice of drilling, boring and reaming on a lathe.
7	Practice of mounting cutters on the milling m/c and setting of m/s.
8	Practice of up milling and down milling operation.
9	Practice on shaper machine.
10	Practice on Milling machine.
11	Surface grinding on a flat surface.
12	Practice on drilling machine
13	Practice on Capstan & Turret Lathes
14	Schedule maintenance work required for various machine tools.
5	Practice arc welding
6	Practice on oxyacetylene(gas) welding
7	Practice on TIG welding
8	Practice on MIG welding

## References:

1. Workshop Technology, Part 1, Dr. W. A. J. Chapman, Standard Publishers and Distributors, Delhi, INDIA, First Edition,1998
2. Workshop Technology, Part 2, Dr. W. A. J. Chapman, Standard Publishers and Distributors, Delhi, INDIA, First Edition,1998
3. Elements of Workshop Technology, Vol. I: Manufacturing Processes, S. K. Hajra Choudhury and A. K. Hajra Choudhury, Media Promoters and Publishers Pvt. Ltd., Bombay, INDIA, Tenth Edition,1993
4. Elements of Workshop Technology, Vol. II: Machine Tools, S. K. Hajra Choudhury, S. K. Bose and A. K. Hajra Choudhury, Media Promoters and Publishers Pvt. Ltd. , Bombay, INDIA, Eight Edition,1988
5. A Course in Workshop Technology, Vol. I – Prof. B. S. Raghuwanshi, Dhanpat Rai and Co. (P) Ltd, Delhi, INDIA, Ninth Edition,2002
6. A Course in Workshop Technology, Vol. II – Prof. B. S. Raghuwanshi – Dhanpat Rai and Co. (P) Ltd, Delhi, INDIA, Ninth Edition,2002
7. Workshop Technology, Vol. I – H. S. Bawa – Tata McGrawHill publishing company Limited, New Delhi,INDIA,
8. Workshop Technology, Vol. II – H. S. Bawa – Tata McGrawHill publishing company Limited, New Delhi,INDIA,
9. A text book of Workshop Technology - R. S. Khurmi and J. K. Gupta - S. Chand and Company Ltd, New Delhi.INDIA

# Electronics Devices and Circuit-I

EG 2221 EX

**Year: II**  
**Semester: II**

**Total: 5 hours/week**  
**Lecture: 3 hours/week**  
**Lab: 2 hours/week**

## Course Description:

Every Electronics Engineer should have sound knowledge about the components used in electronics industry. To meet the industry need, diploma holder must know about the most fundamental subjects like electronic devices and circuits. By studying this subject, they will be skilled in handling all types of electronic devices and able to apply the skill in electronics system.

## Course Objectives:

On completion of this course, the student will be able to:

1. Introduce the fundamentals of analysis of electronic circuits
2. Provide the basic understanding of semiconductor devices and analog integrated circuits

## Course contents (Theory)

### Unit 1: Diodes Applications [6 hrs]

- 1.1. Physical operation of diode
- 1.2. Analysis of diode circuits
- 1.3. Small Signal Analysis of Diode
- 1.4. DC power supply, Rectifier and types of rectifier (Half wave, Center tapped and bridge rectifier).
- 1.5. Clippers and Clamper Circuits

### Unit 2: Bipolar Junction Transistor [6 hrs]

- 2.1. Operation of NPN transistor in active mode
- 2.2. Transistor as an amplifier
- 2.3. Transistor load line analysis
- 2.4. Transistors input output characteristics curve of CB and CE configuration

### Unit 3: Transistor Biasing [4 hrs]

- 3.1. Introduction
- 3.2. Fixed Bias Circuit
- 3.3. Emitter Bias
- 3.4. Voltage divider Bias
- 3.5. Collector Bias

### Unit 4: Field Effect Transistor [8 hrs]

- 4.1. Difference between FET and BJT, Classification of FET (JFET and MOSFET)
- 4.2. MOSFET: Types and Characteristics of N-channel and P-channel MOSFET, Characteristics of E-MOSFET and D-MOSFET
- 4.3. Junction field Effect Transistor: Construction and operation of JFET

### Unit 5: Oscillators [4 hrs]

- 5.1. Introduction to Oscillator, Conditions for Oscillation (Barkhausen Criterion)

5.2. Classification of Oscillator: LC Oscillator, Hartley Oscillator, Colpitts Oscillator, RC Oscillator, Crystal Oscillator

**Unit 6: Output Stages and Power Amplifiers** [7 hrs]

- 6.1. Classification of Output Stages
- 6.2. Class A output stages
- 6.3. Class B output stages
- 6.4. Class AB Output Stages
- 6.5. Push Pull Amplifier
- 6.6. Tuned amplifiers

**Unit 7: Power Supplies and Voltage Regulators** [10 hrs]

- 7.1. Power Supplies: Unregulated Power Supply and Regulated Power Supply
- 7.2. Voltage Regulator: Linear Voltage Regulator (series, Shunt), Zener Voltage Regulator
- 7.3. Integrated circuit voltage regulator
- 7.4. Idea of Switching Mode Power Supply

**Practical/Lab** [30 hrs]

1. Operate multimeter, CRO, signal generator, regulated power supply
2. Plot V-I characteristics of Zener diode
3. Plot input and output characteristics of transistor
4. Plot V-I characteristics of FET amplifier
5. Design and test a full wave rectifier
6. Design and test a half wave rectifier

**Reference Text Books**

1. Basic Electronics and Linear Circuit by NN Bhargava and Kul Shreshta, Tata Mcgraw Hill, New Delhi
2. Electronic Fundamental by Flyod, Latest Edition



# Instrumentation II

EG 2201 EE

**Year: II**  
**Semester: II**

**Total: 5 hrs/ w**  
**Lecture: 3 hrs/ w**  
**Tutorials: hrs / w**  
**Practical: 2 hrs/ w**

## Course Description:

The syllabus has been designed to integrate the basic knowledge to make the base of understanding instrument technology. The basic principles involves in instrumentation system, displays etc. are included in the syllabus. This concept will help the students to pick up the higher knowledge which is to be imparted in the following years. The faculty may give some assignments and arrange for industrial trips.

## Course Contents (Theory)

### **Unit 1: Basic building blocks of any instrumentation systems [8 hrs]**

- 1.1. Scope and necessity of instrumentation
- 1.2. Name of important process variables, their units
- 1.3. Building blocks instrumentation systems
- 1.4. Various testing signals

### **Unit 2: Performance characteristics of Oscillator Instruments [10 hrs]**

- 2.1. Static and dynamic characteristics of instruments
- 2.2. Concept of time constant, response time, natural frequency, damping co-efficient - Order or instruments (1st and 2nd order) with industrial applications
- 2.3. Ramp, sinusoidal, step response of different order of instruments systems
- 2.4. Analytical execution

### **Unit 3: Display and recording devices [12 hrs]**

- 3.1. Operating mechanism in indicators and recording devices
- 3.2. Various indicating, integrating and recording methods and their combination
- 3.3. Merits and demerits of circular chart and strip chart recorder
- 3.4. Basic of printing devices
- 3.5. Scanning, data logging and field buses
- 3.6. Bar graph LDC, Seven segment display, X-Y recorder, scanners
- 3.7. Design experiments for display systems

### **Unit 4: Instrument selection [10 hrs]**

- 4.1. Factors effecting instrument selection, accuracy, precision, linearity, resolution, sensitivity, hysteresis, reliability, serviceability, loading effect, range advantage and limitation, cost effectiveness and availability
- 4.2. Static and dynamic response
- 4.3. Environmental effect
- 4.4. Calibration tool

### **Unit 5: Errors [5 hrs]**

- 5.1. Sources and classification of errors, the remedial action

- 5.2. Grounding, earthing, guarding and shielding
- 5.3. Precaution
- 5.4. Analytical execution

**Practical/Lab**

**[30 hrs]**

- 1. Determine the constant of 1st order instrument
- 2. Determine the constant of 2nd order instrument
- 3. Determine the response of 1st order instrument with step, sinusoidal and ramp input
- 4. Determine the response of 2nd order instrument with step, sinusoidal and ramp input
- 5. Assemble seven segment display using LEDs
- 6. Build fourteen segments display using LCD and verify it
- 7. Build the DOT Matrix display and its verification
- 8. Make any word using LCD and LED
- 9. Demonstrate circular and strip chart recorder

**Reference Books:**

- 1. Mechanical and Industrial Measurement of by RK Jain, Khanna publisher publishers, New Delhi
- 2. Industrial Instrumentation by Donald PEickrman
- 3. Electrical and Electronics Measurement of by AK Shawney, Dhanpath Rai and Company, New Delhi
- 4. Advanced Instrumentation and Control by MF Kureshi

# Microprocessors

EG 2222 EX

**Year: II**  
**Semester: II**

**Total: 5 hrs/ w**  
**Lecture: 3 hrs/ w**  
**Lab: 2 hrs/ w**

## Course Description:

This course deals with fundamentals of microprocessor, basic low level microprocessor programming, interfacing and introduction to basic programmable devices.

## Course Objectives:

After completing this course the students will be able to

1. Understand the working principle of microprocessor
2. Understand the process of writing and executing low level language
3. Know how to interface devices with a computer

## Course Contents (Theory)

### **Unit 1: Introduction to Microprocessor** [6 hrs]

- 1.1. Microprocessor, microcomputer, microcontroller
- 1.2. Block diagram of a typical microprocessor and microcontroller
- 1.3. General architecture of a microcomputer system showing control buses

### **Unit 2: Microprocessor architecture and the instruction set** [10 hrs]

- 2.1. Internal architecture of 8085 microprocessor
- 2.2. Instruction and data formats
- 2.3. Instruction classifications
- 2.4. 8085 Instruction set
- 2.5. Addressing modes in 8085

### **Unit 3: Assembly language programming for 8085** [10 hrs]

- 3.1. Introduction to assembly language and assemblers
- 3.2. Assembly language code
- 3.3. Using loops, counters, delays
- 3.4. Table processing
- 3.5. Subroutine and stack
- 3.6. Code conversion ASCII/BCD/Binary

### **Unit 4: Interfacing I/O and memory devices** [8 hrs]

- 4.1. Introduction to Machine cycles
- 4.2. Introduction to Address Decoding
- 4.3. Introduction to Interfacing I/O Devices, Address decoding using block decoders, Interfacing Memory-mapped I/O
- 4.4. Memory Interfacing introduction, Memory structure and its requirement, RAM and ROM chips
- 4.5. Address decoding using NAND and block decoders, Direct memory access

## **Unit 5: 8085 Interrupt processing**

**[7 hrs]**

- 5.1. Programmed I/O
- 5.2. Interrupt Driven I/O
- 5.3. The 8085 Interrupt
- 5.4. 8085 Vectored Interrupts
- 5.5. Restart and software instructions

## **Unit 6: Advanced Microprocessors**

**[4 hrs]**

- 6.1. Architecture of 8086 microprocessors
- 6.2. Addressing modes and programming features
- 6.3. Comparison with 8085 microprocessor
- 6.4. Some programming examples based on 8086 assembly language

## **Practical/Lab**

**[30 hrs]**

1. Demonstrate basics of microcomputer system through the 8085 microprocessor trainer kit
2. Write and test programs that uses data transfer instructions
3. Write and test programs that uses arithmetic instructions
4. Write and test programs that uses logical instructions
5. Write and test programs with conditional and unconditional branching
6. Write and test programs with conditional and unconditional subroutine call and stack
7. Write and test programs involving loops and counters
8. Write and test programs that involves masking and checking numbers
9. Write and test programs to manipulate table of numbers
10. Write and test program for BCD and ASCII manipulation
11. Write and test programs to perform multiplication and division
12. Write and test programs to read and write from the port

## **RECOMMENDED BOOKS**

1. Amesh S. Gaonkar, "8085 Microprocessor programming and interfacing", New Age
2. John Uffenbeck, "The 8080, 8085 & Z-80 Programming, Interfacing and Troubleshooting", PHI
3. Albert Paul Malvino, Jerald A. Brown, "Digital Computer Electronics", McGraw-Hill

# Control System

EG 2202 EE

**Year: II**  
**Semester: II**

**Total: 5 hrs/ w**  
**Lecture: 3 hrs/ w**  
**Tutorials: hrs/w**  
**Lab: 2 hrs/ w**

## Course Description:

The inputs imparted through this subject will enable the students apprehend the various types of control system techniques used in Mechatronics. These courses introduce the fundamentals of system components and operation of an automatic control system.

## Suggestions for Instruction:

1. As far as possible avoid derivation of complex mathematical equations.
2. Elaborate the mathematics as far as possible by using graphical representation
3. Show the sectionalize sketches of physical components using projectors.

## Course Objectives:

After completion of this course, the students will be able to

1. Familiarize various control system working characteristics which can be interpreted
2. Understand the use of feedback loops and their application in real world control system such as Mechatronics, industrial control and robotics.

## Course Contents (Theory)

### Unit 1: Introduction

[8 hrs]

- 1.1. Elements of control systems and basic control system terminology
- 1.2. Functional block diagram of a Basic control system
- 1.3. Open loop and closed loop control systems
- 1.4. Manually controlled closed loop systems and automatic controlled closed loop systems. Examples of automatic control systems
- 1.5. Self regulating and non self-regulating processes

### Unit 2: Basic Control Loops and Characteristics

[7 hrs]

- 2.1. Basics of process control, process variables
- 2.2. Single and multi capacity processes
- 2.3. Single capacity level, pressure, temperature and flow loop systems

### Unit 3: Time Response Analysis

[10 hrs]

- 3.1. Dynamic characteristics of systems
- 3.2. Linear and non-linear systems
- 3.3. Step response of first order and second order systems- overshoot and undershoot, damping ratio
- 3.4. Steady state response and error

**Unit 4: Stability Analysis** [8 hrs]

- 4.1. Concept of stability
- 4.2. Introduction to Characteristic equation
- 4.3. Introduction to Routh's stability criteria
- 4.4. Relative stability indices-phase margin and gain margin

**Unit 5: Controllers** [5 hrs]

- 5.1. Necessity and functionality of a controller in control system
- 5.2. Physical interpretation of lead lag networks
- 5.3. Lead lag networks realization by electrical circuits
- 5.4. Physical components for an industrial PID controller
- 5.5. PID controllers with operational amplifiers
- 5.6. Basic understanding of the working of Pneumatic and hydraulic controllers

**Unit 6: DC and Stepper Motors in Control Systems** [5 hrs]

- 6.1. Review of DC motors operating principle.
- 6.2. Working of a DC motor for control systems.
- 6.3. Armature control and field control DC motors
- 6.4. Permanent magnet excited DC motors
- 6.5. Working of stepper motors and their driver circuits

**Unit 7: AC Motors in Control Systems** [2 hrs]

- 7.1. Review of AC motors operating principle.
- 7.2. Operation and characteristics of two axis AC motors.
- 7.3. Working of an AC motor for control systems.

**Practical/Lab** [30 hrs]

1. Demonstrate the circuit and working of open loop system.
2. Demonstrate the circuit and working of closed loop system.
3. Demonstrate the transfer function of a given system.
4. Determine the time lag, overshoot and other parameters of a system
5. Demonstrate the step response of first order system
6. Demonstrate step response of a second order system.
7. Construct of PID controller circuits using operational amplifiers.
8. Demonstrate for Pneumatic PID controllers.

**References:**

1. G.T. Brayan, "Control system for technicians", Hodder and Stoughton Educational, Great Britain
2. A.K. Mahalanabis, "Introductory System Engineering" Wiley eastern Limited, India
3. L.A Meyer, "Control System Basics for HVAC Technicians" Lama Books, ISBN: 41-0-88069-036-2
4. G.T. Brayan, "Control system for technicians", Hodder and Stoughton Educational, Great Britain
5. A.K. Mahalanabis, "Introductory System Engineering" Wiley eastern Limited, India,
6. L.A Meyer, "Control System Basics for HVAC Technicians" Lama Books, ISBN: 41-0-88069-036-2

# Circuit Analysis and Prototyping

EG 2201 MX

**Year: II**  
**Semester: II**

**Total: 5 hrs/ w**  
**Theory: hrs/ w**  
**Practical: 5 hrs/ w**

## Course Description:

The subject is oriented to a PBL (Project Based Learning) methodology. Subsequently develops the theoretical material necessary for the justification of the electronic designs to be made during the course. It is a methodology of collaboration in small groups with which students implement, supervised by the teacher, the work project (or projects) in progress. After this first phase of work in the laboratory, we proceed to the design work, also with collaborative methodology supervised by the teacher, but in groups larger than 4 or 5 students, with the aim of getting the proper implementation of the final project. The number of working groups and the number of projects developed during the course is a function of the number of students enrolled.

## Course Objectives:

After the completion of this course, students will be able to:

1. Design circuit boards using CAD tools
2. Design proto type enclosures using CAD tools
3. Appreciate the advantages and limitations of additive3Dprinting
4. Understand how signal integrity is affected by circuit board design
5. Develop skills required to successfully implement advanced senior design projects
6. Develop document an engineering project

## Course contents (Practical)

### Unit 1: Design and Construction of Electronic Prototyping. [15 Hrs]

- 1.1. Presentation of the project to be carried by the class.
- 1.2. Introduction to the design of printed circuit boards (PCB) CAD Electrical:  
Introduction to schematic capture, board design and auto router.
- 1.3. Presentation of the web addresses of distributors and manufacturers of electronic components.

### Unit 2: Conception and Design of Electronic Prototyping. [12 Hrs]

- 2.1. Detailed description of the prototype to perform. Assigning tasks based on practical problem.
- 2.2. Selection and design of electronic circuits and components to perform and simulation tools to be used.
- 2.3. Analysis according to manufacturer specifications of the critical components of the prototype.
- 2.4. Use simulation tools to find out the functionality and optimization of the chosen circuit and its component.
- 2.5. Introduction to Programming PICs/AVR.

### Unit 3: Mounting on Proto board and/or perforated plates. [8 Hrs]

- 3.1. Design and optimization of critical system circuits by using proto boards or perforated plates.
- 3.2. Programming PICs/AVR.

3.3. Schematic final proposal to be implemented.

**Unit 4: Design and layout of Photolithographs. [15 Hrs]**

4.1. Design of the printed circuit board. Standards and design limitations.

4.2. Presentation of the schematic and its discussion.

4.3. Presentation of the boards and its discussion.

4.4. Presentation of the PIC programming and its discussion.

**Unit 5: PCBs Construction. [10 Hrs]**

5.1. Performing the different printed circuit boards.

5.2. Starting method of assembly and testing.

**Unit 6: Construction and Verification of Electronic Prototype. [15 Hrs]**

6.1. Guidelines for verification and testing of prototype electronic.

6.2. Final characterization of the electronic prototype. Testing errors.

6.3. Study of the critical points of design and its possible improvement.

**References**

- Simon Monk, “Make Your Own PCBs with EAGLE: From Schematic Designs to Finished Boards”, McGraw Hill, 2014.
- Peter Wilson, “The Circuit Designer’s Companion”, 3rd edition, Newnes, 2012.
- Printed Circuit Boards: Design, Fabrication, Assembly and Testing by R.S. Khandpur, Tata McGrawHill,2005



**Third Year**  
(Fifth and Sixth Semesters)

**Fifth Semester**

**Subjects:**

- |               |                                    |
|---------------|------------------------------------|
| 1. EG 3101 MX | Advance Manufacturing Technology.  |
| 2. EG 3102 MX | Industrial Automation              |
| 3. EG 3111 EX | Electronics devices and circuit II |
| 4. EG 3111 ME | Machine Design                     |
| 5. EG 3103 MX | Plant Maintenance                  |
| 6. EG 3112 ME | Industrial Management              |
| 7. EG 3104 MX | Minor Project I                    |

# **Advanced Manufacturing Technology**

## **EG 3101 MX**

**Year: III**  
**Semester: I**

**Total: 7 hrs/ w**  
**Theory: 3 hrs/ w**  
**Practical: 4 hrs/ w**

### **Course Description:**

The subject aims at imparting knowledge and skill components to the students who have aimed to develop their career as job professionals. The course is offered as an extension of the Manufacturing Technology. The intention of this course is to polish the knowledge and skill of the students by introducing modern trends in manufacturing processes. It deals with modern aspects of manufacturing technology.

### **Course Objectives:**

After the completion of the course, the student shall be able to

1. Demonstrate knowledge and skill on non-conventional machining methods
2. Produce simple metal components and articles using NC and CNC machines
3. Supervise advanced mechanical works in the subject related field
4. Demonstrate knowledge and skill on advanced manufacturing technologies.

### **Course contents (Theory)**

#### **Unit 1: Non-conventional Machining Processes**

**[10 hrs]**

- 1.1. Limitations of conventional Machining
- 1.2. Introduction to non-conventional machining
- 1.3. Non-conventional machining processes: Working principle, operating parameters and application
  - 1.3.1 Electro Chemical Machining
  - 1.3.2 Chemical Machining
  - 1.3.3 Electric Discharge Machining
  - 1.3.4 Abrasive jet Machining
  - 1.3.5 Wire Cutting
  - 1.3.6 Ultrasonic Machining
  - 1.3.7 Electron Beam-machining
  - 1.3.8 LASER Beam-Machining
  - 1.3.9 Plasma Arc-Machining

#### **Unit 2: Introduction to CAD, CAM and CIM**

**[10 hrs]**

- 2.1. Definition of CAD, CAM and CIM
- 2.2. Computers: The Foundation of CAD/CAM
- 2.3. General Design procedure and application of computer in design
- 2.4. Computer integrated manufacturing systems(CIMS)
- 2.5. Basic components of CIMS
- 2.6. Benefits of CAD/CAM and CIMS
- 2.7. Programmable Controllers
- 2.8. Adaptive controller
- 2.9. Automation
  - 2.1.1 Objectives of Automation
  - 2.1.2 Types of Automation
  - 2.1.3 Applications of Automation

**Unit 3: Numerical Control and Computer Numerical Control of Machine tools [8 hrs]**

- 3.1. Introduction, Basic Components of NC systems
- 3.2. Classification of NC systems
- 3.3. Working Principles of NC Machines
- 3.4. Advantages, Disadvantage and Application of NC Machine Tools
- 3.5. Introduction to Computer Numerical Control Machine tools
- 3.6. Brief History of CNC Machine tools
- 3.7. Major Elements and Function of CNC Systems
- 3.8. Comparison of NC systems and CNC systems

**Unit4: Types of CNC systems and their advantages [12 hrs]**

- 4.1 CNC Lathe
- 4.2 Milling
- 4.3 Routers
- 4.4 Laser Cutter
- 4.5 Plasma Cutter
- 4.6 Printers
- 4.7 Machine Center

**Unit 5: CNC programming [5 hrs]**

- 5.1 Fundamentals of CNC programming
- 5.2 G-codes and M-codes
- 5.3 Basic programming using G and M codes

**Practical/Lab [60 hrs]**

1. Get acquainted with construction, principle and operation of NC and CNC machine tools
2. Write program for CNC machines
3. Perform machining operation in NC and CNC machine tool
4. Get acquainted with hardware, software, operating system and command of CAD (Computer Aided Design) and CAM (Computer Aided Manufacturing)
5. Develop basic skills in loading programs, making directories, opening and saving files in CAD
6. Develop basic skills in loading programs, making directories, opening and saving files in CAM
7. Manufacture a part using 3d printer
8. Manufacture a part using CNC Lathe
9. Manufacture a part using CNC Milling

**References:**

1. Fundamentals of Modern Manufacturing, materials, processes and systems, Mikell P. Groover, John Wiley and Sons, Inc , Singapore,2004
2. Manufacturing Engineering and Technology, SeropeKalpakjian and Steven R. Schmid, Addison Wesley Longman (Singapore) Pte. Ltd., Fourth Edition,2000
3. Production Engineering and Science, Dr. P. C. Pandey and Dr. C. K. Singh, Standard Publishers Distributors, Delhi, INDIA, Seventh Edition,2003
4. Manufacturing Processes II – H. S. Bawa, Tata McGraw Hill Publishing Company Limited, New Delhi, INDIA,2004
5. Computer Aided Manufacturing, C. Elanchezhian, T. Sunder Selwyn and G. Shanmuga Sundar, Laxmi Publications (P) Ltd, New Delhi, INDIA, First Edition,2005
6. Manufacturing Technology, M. Adithan and A. B. Gupta, New Age International (P) Limited, Publishers, New Delhi, INDIA,1996
7. Numerical Control by Marthin (E.L.B.S.)
8. Understanding of CAD/CAM- Design with computer by D.J. Bowman, and R.N. MC- Douglas (BPB Publication)

# Industrial Automation

EG 3102 MX

Year: III  
Semester: I

Total: 7 hrs/ w  
Theory: 4 hrs/ w  
Practical: 3 hrs/ w

## Course Description:

This course provides the student with basic knowledge of the industrial automation systems design, installation, modification, maintenance, and repair.

## Course Objectives:

After the completion of this course, the student will be able to:

1. Describe working of various blocks of basic industrial automation system
2. Connect the peripherals with the PLC
3. Use various PLC functions and develop small PLC programs
4. Use various industrial motor drives for the Industrial Automation

## Course Contents

### THEORY

<b>Unit 1 Nature of Industrial Process</b>	<b>[2hrs]</b>
1.1. Continuous & discrete state sequential process	
1.2. Process variables and their classification	
<b>Unit 2 Introduction to Process Control Philosophies</b>	<b>[3hrs]</b>
2.1. Type of relays	
2.2. Ladder logic methodology	
2.3. Ladder symbols	
<b>Unit 3 Introduction to Programmable Logic Controllers</b>	<b>[5hrs]</b>
3.1 Advantages & disadvantages of PLC with respect to relay logic	
3.2. PLC architecture	
3.3. Input Output modules	
3.4. PLC interfacing with plant memory structure of PLC	
<b>Unit 4 PLC programming methodologies</b>	<b>[6 hrs]</b>
4.1. Ladder diagram, STL, functional block diagram	
4.2 Creating ladder diagram from process control descriptions	
4.3 Introduction to IEC61131 international standard for PLC	
<b>Unit 5 PLC functions</b>	<b>[8hrs]</b>
5.4 Bit logic instructions	
5.2 Ladder diagram examples	
5.3 Interlocking, latching, inter dependency and logical functions	
5.4 PLC Timer & Counter functions on-delay timer, off-delay timers	
5.5 Retentive on-delay timers, pulse timers, timer examples	
5.6 Up-counter, down-counter and up-down counter, counter examples	
5.7 Register basics	
<b>Unit 6 PLC Data Handling</b>	<b>[8hrs]</b>
6.1 Data move instructions	
6.2 Table and register moves	
6.3 PLC FIFO & LIFO functions	

<b>Unit 7 PLC arithmetic and logical functions</b>	<b>[8hrs]</b>
7.1 Addition, subtraction, multiplication, division instructions	
7.2 Increment decrement, trigonometric and log functions	
7.3 AND, OR, XOR, NOT functions	
7.4 PLC, compare and convert functions	
<b>Unit 8 PLC program control and interrupts</b>	<b>[4 hrs]</b>
8.1. Jumps, subroutine, sequence control relay, watchdog	
<b>Unit 9 Applications of PLC</b>	<b>[4 hrs]</b>
9.1 Process Controls	
9.2 Washing Machine	
<b>Unit 10 Analog value processing</b>	<b>[6 hrs]</b>
10.1 types of analog modules	
10.2 analog input and output examples	
10.3 PID control of continuous process	
<b>Unit 11 Industrial drives</b>	<b>[6 hrs]</b>
11.1 Induction motor drive: V/F Control, Direct torque control	
11.2 Stepper motor drives	
11.3 AC and DC Servo motor drives	
11.4 DC motor drives	
<b>PRACTICAL</b>	<b>[45 hrs]</b>
1. Demonstrate the working of PLC	
2. Perform basic logic operations, AND, OR, NOT, functions	
3. Develop logic control systems with time response as applied to clamping operation	
4. Develop sequence control system in lifting a device for packaging and counting	
5. Write enter and test programs using a hand-held programmer for the following operations:	
• Ladder Logic	
• Timers	
• Counters	
6. Demonstrate the industrial drives	

**Reference Books:**

- JOHN WEBB: Programmable Logic Controllers Principles & applications, PHI
- T. A. HUGHES: Programmable Controllers
- C. D. JOHNSON: Process Control Instrumentation

# **Electronic Devices and Circuit-II**

## **EG 3111 EX**

**Year: III**  
**Semester: I**

**Total: 6 hrs/ w**  
**Lecture : 4 hrs/w**  
**Theory: hrs/ w**  
**Lab: 2 hrs/ w**

### **Course Description:**

This subject is the continuation of Electronic Devices and Circuit-I that is included in Diploma in Mechatronics II Year II Part with emphasize on data conversion, instrumentation and power circuits. To meet the industry need, diploma holder must know about the most fundamental subjects like electronic devices and circuits. By studying this subject, they will be skilled in handling all types of electronic devices and able to apply the skill in electronics system.

### **Course Objectives:**

On completion of this course, the student will be able to

1. Introduce the fundamentals of analysis of electronic circuits
2. Provide the basic understanding of semiconductor devices and analog integrated circuits

### **Course content (Theory)**

#### **Unit 1: Operational Amplifiers**

**[10 Hrs]**

- 1.1. Characteristics of Ideal Operational amplifier and its Block Diagram
- 1.2. Operational amplifier as Inverter, Adder, Subtractor, Differentiator and Integrator
- 1.3. Definition of Differential voltage gain, Slew rate, Input offset Voltage, Input Bias, Input Offset Current
- 1.4. Concept of Schmitt trigger circuit and Simple/Hold Circuit using Operational Amplifier

#### **Unit 2: Analog to Digital and Digital to Analog Converter**

**[10 Hrs]**

- 2.1. Introduction to A/D Conversion, Types of A/D converter (Dual slope, Flash and Successive Approximation ADC)
- 2.2. Introduction to D/A Conversion, Types of D/A converter (Binary Weighted Resistor, R-2R Ladder Network DAC)
- 2.3. Basic Characteristics of A/D and D/A Convertors

#### **Unit 3: Introduction to Power Electronics**

**[12 Hrs]**

- 3.1. Silicon Controlled Rectifier (SCR) and its applications
- 3.2. Diac and Triac
- 3.3. Thyristors: Operational Principle and Characteristic curve
- 3.4. Photo Diode and Photo Transistor
- 3.5. Opto-Coupler
- 3.6. Inverters

#### **Unit 4: Multistage Amplifier**

**[8 Hrs]**

- 4.1. Need for multistage amplifier
- 4.2. Gain of multistage amplifier

- 4.3. Types of Coupling used in multistage amplifier (RC coupling, Transformer coupling, direct coupling) with their frequency response and bandwidth

**Unit 5: Multi-vibrator and Waveform Shaping Circuits [8 Hrs]**

- 5.1. Introduction of A-stable, Mono-stable and Bi-stable Multi-vibrator  
5.2. Generation of square and triangular waveform using A-stable multi-vibrator  
5.3. IC 555 as mono-stable and A-stable multi-vibrator

**Unit 6: Switched Power Supplies [8 Hrs]**

- 6.1. Voltage Step-down regulator  
6.2. Voltage Step-up regulator  
6.3. Step up/Step down Regulator  
6.4. Control circuit, IC switched

**Unit 7: Instrumental Amplifier [4 Hrs]**

- 7.1. Introduction  
7.2. Requirements of a good instrumentation amplifier  
7.3. Working of instrumentation amplifier, 4 Advantages, disadvantage &  
7.4. Application

**Practical [30 hrs]**

1. Plot Characteristics of Operational Amplifiers
2. Operate / test 4-bit D/A converter
3. Demonstrate the characteristics of Silicon Controlled Rectifier and TRIAC circuit
4. Demonstrate switched voltage regulator
5. Demonstrate square and triangular waveform
6. Demonstrate the output waveform of a bi-stable multi-vibrator
7. Plot Characteristics of Instrumental Amplifier
8. Design switched power supply
9. Test photo diode / Transistor
10. Demonstrate the characteristics of TRIAC circuit

**Reference /Text Books**

1. Basic Electronics and Linear Circuit by NN Bhargava and kulshreshta, Tata Mcgraw Hill, New Delhi
2. Electronic Fundamental (circuit, devices and application) 10th Edition by Flyod
3. Power Electronics: devices, drivers and applications / B.W. Williams
4. Electronics devices and circuit theory by BOYLESTEAD 11<sup>th</sup> edition.
5. Electronics devices and circuits by MILLMAN HALKIAS 1967 edition.

# Machine Design

EG 3111 ME

**Year: III**  
**Semester : I**

**Total: 6 hrs/ w**  
**Theory: 4 hrs/ w**  
**Lab: 2 hrs/ w**

## Course Description:

This course deals with the fundamental law & their application in the field of machines and mechanisms. This deals with position, velocity, acceleration and forces in a mechanism. The main emphasis is given on graphical approach than analytical approaches. It also deals with fundamentals of vibrations in a machine.

## Course Objectives:

After the completion of this course, the student will be able to:

1. Understand design and uses of various machine components.
2. Understand design and uses of various mechanisms.

## Course Contents (Theory)

### Unit 1: Machine elements

[24hrs]

- 1.1. Introduction
- 1.2. Shaft, axles (concept, types and comparison between shaft, axle and selection)
- 1.3. Bearing Belt, pulleys (types, application and selection)
- 1.4. Gear (types, application, dimensioning calculation and selection)
- 1.5. Chains& Ropes (types, application and selection)
- 1.6. Power transmission (belt drive, gear drive, chain drive related problems and selection)
- 1.7. Couplings, clutches (types, function, application and selection)
- 1.8. Springs& Seals (types, application and selection)

### Unit 2: Mechanisms

[6hrs]

- 2.1. Lever and Cam mechanism
- 2.2. Wedge and screw mechanism
- 2.3. Gear and Friction mechanism
- 2.4. Belt mechanism
- 2.5. Hydraulic and pneumatic mechanism
- 2.6. Electro mechanical mechanisms
- 2.7. Graphical presentation of different mechanism

### Unit 3: Introduction to balancing

[3hrs]

- 3.1. Introduction
- 3.2. Static: principle and application
- 3.3. Dynamic: principle and application

### Unit 4: Fundamental principles of Machine Design

[15 hrs]

- 4.1. The difference between mechanism, machine element, and machine.
- 4.2. Design procedure, Gathering information and formulating design problems.
- 4.3. Basic requirements of machine elements, strength, stiffness, rigidity, wear resistance



- 4.4. Magnitude, direction, and type of load – axial, bending, torsion, and combination.
- 4.5. Strain and elasticity, stress, factor of safety.
- 4.6. Elastic and plastic behavior of ductile and brittle materials, modulus of elasticity and modulus of rigidity.
- 4.7. Fatigue, endurance limit, stress concentration, effects on factor of safety.
- 4.8. Materials availability, weight and dimensions, process-ability and standardization.
- 4.9. Manufacturing considerations in design
- 4.10. Related Problems

**Unit 5: Design of following components under axial loading [12 hrs]**

- 5.1. Bolts under tension, both tension and compression, effect of initial tightening
- 5.2. Riveted joints lap and butt for tie bar 131
- 5.3. Welded connections (lap and butt weld)
- 5.4. Turn buckle
- 5.5. Pins
- 5.6. Helical springs.
- 5.7. Related Problems

**Practical / Lab [30 hrs]**

1. Demonstrate the geometry of machine elements and specification
  - 1.1. Machine element (shaft, axle, bearing, belt, pulley, chain, gears, belt drive, gear drive, chain drive, coupling & clutches, spring, seals)
2. Demonstrate the mechanisms and their characteristics
  - 2.1. Lever mechanisms
  - 2.2. Cam mechanisms
  - 2.3. Wedge & screw mechanism
  - 2.4. Gear mechanism
  - 2.5. Friction mechanism
  - 2.6. Belt mechanism
  - 2.7. Hydraulic and pneumatic mechanism
  - 2.8. Electro-mechanical mechanism

**Reference Books:**

1. Rao, J. S. &Dukkipati, R. V. 2002 (or latest edition) Mechanism & Machine Theory, New Age International, India
2. Shigley, J.E. &Uicker, J.J. 1995 (Or latest) Theory of Machines and mechanisms, McGrew Hill, Singapore.

# Design of Mechatronics System

EG 3103 MX

**Year: III**  
**Semester: I**

**Total: 6 hrs/ w**  
**Theory: 4 hrs/ w**  
**Tutorial: hrs/w**  
**Lab : 2 hrs/ w**

## Course Description

Mechatronics System Design is the capstone course for the mechatronics specialization track. Students will integrate and build upon knowledge and skills gained in previous courses to design, assemble, and analyze mechatronics systems using modern methods and tools. Lectures and laboratory experiences will include control theory, dynamic system behavior, communication protocols, pneumatics, embedded programming, and analysis in time- and frequency domains. The course concludes with an open-ended team-based multi-week design project. (3units; lecture/lab)

## Course Objectives:

After the completion of this course, the student will be able to:

1. Provide a comprehensive learning experience that integrates engineering and mechatronics knowledge gained in prior courses.
2. Prepare students for practice of mechatronics in industry or graduate study.

## Course Contents (Theory)

### **Unit 1: Transfer function through analysis of input and output data [6 hrs]**

- 1.1. Given a data set, find and plot the transfer function or state-space representation for the system

### **Unit 2: Characteristics identification by inspection of a data plot [8 hrs]**

- 2.1. Explain system characteristics in the time domain, frequency domain, and using a Nyquist plot
- 2.2. Associate plot features with relevant mathematical expressions

### **Unit 3: Extraction of data from a noisy signal [8 hrs]**

- 3.1 Given a real-world (e.g., noisy, out-of-range, etc.) signal source, acquire and extract useful data using appropriate data acquisition and signal conditioning techniques
- 3.2 Apply appropriate filtering

### **Unit 4: Application of appropriate filters [4 hrs]**

- 4.1. Types of filters and their characteristics for both hardware (passive and active) and software filters

### **Unit 5: Design and implement a hardware controller [12 hrs]**

- 5.1. Design and implement in hardware a controller for an existing system to achieve performance specifications
- 5.2. Interpret and explain circuit schematic diagrams
- 5.3. Explain the disadvantages of over-building or under-building a system

- 5.4. Identify a system that has unnecessary complexity and suggest methods to simplify the system to an 8-bit microcontrollers for controlling mechatronics systems

**Unit 6: Interfacing assorted devices, communication protocols [12 hrs]**

- 6.1 List and describe common data communication protocols used in embedded systems, such as RS-232, SPI, I2C
- 6.2 Learn industry-standard communication protocol, such as I2C, SPI, or CAN to interface a controller with a sensor or other device
- 6.3 Design a simple mechatronics system

**Unit: 7 Design and analyze basic pneumatic systems [10 hrs]**

- 7.1 Select, configure, and implement pneumatic components for a specific task
- 7.2 Size pneumatic components (valves, tubing, regulators, etc.) for a given application
- 7.3 Interface a pneumatic system with a microcontroller or programmable logic device (PLC)

**Practical/Lab [30 hrs]**

The following practical labs are intended to demonstrate different control principals used in process automation:

1. Temperature Control (PID using a relay )
2. Pressure Control (Feedback and control process)
3. Position control with multiple actuators (manipulating of an object)
4. Speed Control and PID (PWM, PPM, Variable voltage)
5. Data acquisition in noisy environment (Shielding, Voltage level, Interference)

**Reference Books:**

1. Åström, K. and Murray, R. (2012). Feedback Systems: An Introduction for Scientists and Engineers. Princeton University Press, Princeton, NJ. The complete text is available for free online at:  
[http://www.cds.caltech.edu/~murray/books/AM08/pdf/am08-complete\\_28Sep12.pdf](http://www.cds.caltech.edu/~murray/books/AM08/pdf/am08-complete_28Sep12.pdf)
2. Scherz, P. (2013). Practical Electronics for Inventors 3rd ed., McGraw-Hill, New York. ISBN: 9780071771337. (The 3rd edition claims to have fixed numerous errors that were in the 1st and 2nd editions, so if you get an earlier edition of this book, also consult the errata at:  
<http://www.eg.bucknell.edu/physics/ph235/errata.pdf>)

# **Industrial Management**

## **EG 3112 ME**

**Year: III**  
**Semester: I**

**Total: 4 hrs/ w**  
**Theory: 4 hrs/ w**  
**Practical: 0 hrs/ w**

### **Course Description:**

This course deals with the fundamental concepts of organization, management, leadership and supervisory, production management, marketing of products or services, materials management and inventory control, engineering economics and capital management required for supervisors and first line managers engaged in industrial activities.

### **Course Objectives:**

After completing the course the student will be able to

1. Describe the concept of organization and management
2. Understand the basic theories of management
3. Explain the various leadership behaviors of a manager
4. Explain the concept of production management and production control
5. Understand the process of marketing
6. Demonstrate the understanding of materials management
7. Apply the principles of engineering economics and capital management

### **Course contents (Theory)**

#### **Unit 1: Introduction**

**[15 hrs]**

- 1.1. Organization
  - 1.1.1 Organization as an open system
  - 1.1.2 Evolution of organizations
  - 1.1.3 Principle of organization
  - 1.1.4 Formal and informal organization
- 1.2. Forms of ownership
  - 1.2.1 Single ownership: introduction, advantages and disadvantages
  - 1.2.2 Partnership organization: introduction, types, advantages, disadvantages
  - 1.2.3 Joint stock company: introduction, types, advantages, disadvantages
  - 1.2.4 Cooperative organizations: basic concept, advantages, disadvantages
  - 1.2.5 Public corporation: introduction, advantages and disadvantages
- 1.3. Organization structure
  - 1.3.1 Line organization
  - 1.3.2 Line and staff organization
  - 1.3.3 Functional organization
  - 1.3.4 Departmentalization
- 1.4. Management
  - 1.4.1 Functions of management
  - 1.4.2 Level of management
  - 1.4.3 Managerial skills
- 1.5. Theory of management
  - 1.5.1 Evolution of management theory
  - 1.5.2 Scientific management theory
  - 1.5.3 Administrative management theory
  - 1.5.4 Behavioral management theory

**Unit 2: Leadership and supervision** [7 hrs]

- 2.1. Definition of leadership
- 2.2. Qualities of leadership
- 2.3. Difference between management and leadership
- 2.4. Theories of leadership
- 2.5. Leadership styles
- 2.6. Definition of supervision
- 2.7. Duties of a foreman
- 2.8. Essential qualities of a foreman

**Unit 3: Production management** [12 hrs]

- 3.1. Introduction
- 3.2. System concept of production
- 3.3. Various techniques used in production system
  - 3.3.1 Forecasting
  - 3.3.2 Plant location and layout
  - 3.3.3 Product design and analysis
  - 3.3.4 Production planning and control
  - 3.3.5 Maintenance management
  - 3.3.6 Inventory control
  - 3.3.7 Quality control
- 3.4. Finance and capital management
  - 3.4.1 Sources of finance for investment
  - 3.4.2 Assets and liabilities
  - 3.4.3 Fixed capital and working capital
  - 3.4.4 Accounting (definition and importance of accounting, concept of debit and credit, journal and ledger, profit and loss account, balance sheet)
- 3.5. Concept of time and motion study

**Unit 4: Marketing** [10 hrs]

- 4.1. Definitions of market and marketing
- 4.2. Modern concepts of marketing: customer orientation and customer satisfaction
- 4.3. Functions of marketing: buying, selling, transport, storage, standardization & grading, financing, risk bearing, market information
- 4.4. Concept of marketing mix: product, price, place, promotion
- 4.5. Understanding consumer behavior
- 4.6. Understanding the concept of distribution channels
- 4.7. Sales promotion
- 4.8. Advertising
- 4.9. Trade exhibitions

**Unit 5: Materials management and inventory control** [8 hrs]

- 5.1. Definition of materials management
- 5.2. Functions of material management: material planning, store/stock control, purchasing, receiving and issue of materials, simplification/standardizing/coding of materials, transportation and handling, value engineering and value analysis, disposal of scrap, surplus and obsolete materials.

5.3. Store management: meaning, objectives, function of store

5.4. Inventory control (inventory level, economic lot size and related numerical)

## **Unit 6: Engineering economics**

**[8 hrs]**

6.1. Introduction

6.2. Importance of manufacturing industry in the economy of the country

6.3. Estimating and costing

6.4. Classification of costs

6.5. Types of project evaluation techniques

### **References:**

1. Ahuja, K.K. (1994). Industrial Management. CBS Publishers and Distributors, India.
2. Agrawal, G.R. (2003). Principles of management in Nepal. M. K. Publishers and distributors, Kathmandu, Nepal.
3. Mahajan, M. (2002). Industrial engineering and production management (2nd ed.). Dhanpat Rai and Co. (P) Ltd., Delhi.
4. Panneerselvam, R. (2005). Production and Operations management (2nd ed.) Prentice Hall of India, Private Limited, Delhi.
5. Sharma, S. K & Sharma, Savita (2002). A course in Industrial engineering and operations management. S. K. Kataria and Sons, Delhi, India.
6. Verma, A.P. (2002). Industrial Engineering. S. K. Kataria & Sons, Delhi.
7. .S.N. Chari, Production and Operations Management, Tata McGraw Hill, 3rd Edition, 2007.
8. B. Mahadevan, Operations Management, Dorling Kindersley, 2006.
9. Joseph G. Monks, Operations Management, Tata McGraw Hill, 2nd Edition, 1996.

# Minor Project

EG 3104 MX

Year: III  
Semester: I

Total: 4 hours /week  
Lecture: hours/week  
Practical: 4 hours/week

## Course Description

This section of the syllabus will be the combination of the knowledge and the skill learnt during the previous courses. The student will be given an outline of device/item/tool/mechanism for the purpose. He/She shall then design and analyze the selected project work. The project report shall be submitted for appraisal. The project report will consists of the following:

- Design considerations ( Static and Dynamic consideration)
- Force-load calculation (if any).
- Considerations on material selection.
- Assembly drawing/working drawing including Bill of Quantity (BOQ).
- Detail analysis of the components or elements.
- Project Cost

The student will be allocated a team of guides comprising of the theory teacher and the practical teacher for his project and design work. The student shall also consult the library and internet for his work. Before submission of the final work, he/she shall have to present his/her work among the evaluation team.

## Overview of Learning Activities

The learning activities included in this course are:

1. Attendance at lectures, and communicate with students regarding projects.
2. Knowledge regarding some of the important topics (555 timer, PLC, logic control, solid works, ADAMS etc.) related to the mechatronics subject will be given to the students for utilizing unproductive time in class room.
3. Students are free (innovation) to chose minor projects whatever they like only if it solves real life problem & cost effective
4. If students are facing problems (project) they are recommended to take advice from expert faculty teachers
5. Students should consult their faculty and choose project wisely before finalizing it. They should inform their project guide as soon as the project is decided.
6. Students must present the research and planning log book. At least diary or copy with all the work and records of individual as well as group activities in order to claim rewarded marks.
7. Project should be selected such that institutional resources are enough to facilitate the fabrication process.

## Evaluation

S.N	Topics	Percentage
1	Attendance (Student participation in project research and planning)	10
2	Action plan	10
3	Documentation	10
4	Project activities and work	50
5	Final presentation	20
Total		100

## Sixth Semester

### Subjects:

1. EG 3201 MX Plant Maintenance
2. EG 3202 MX Estimation and Costing of Mechatronics System
3. EG 3201 MG Entrepreneurship and Development
4. EG 3203 MX Robotics and auto electronics
5. EG 3204 MX Major Project
6. EG 3205 MX Elective (One of the followings)
  - a. Micro Controller and PIC
  - b. Biomedical Instrumentation
  - c. New Product Development
  - d. Maintenance Concepts and Fault Finding



# **Plant Maintenance**

## **EG 3201 MX**

**Year: III**  
**Semester: II**

**Total: 6 hrs/ w**  
**Theory: 3 hrs/ w**  
**Practical: 3 hrs/ w**

### **Course Description:**

This course deals with the necessity of maintenance of equipment and machines in the industries and various types of maintenance works that are performed. It also compares the merits and demerits of different maintenance strategies that need to be adopted in the industry.

### **Course Objectives:**

After completing this course the students will be able to

1. Explain the necessity of maintenance in industry
2. Describe the causes of components failure
3. Select the appropriate maintenance strategies
4. Perform the necessary maintenance as per equipment manual

### **Course Contents (Theory)**

#### **Unit 1: Introduction to maintenance:** **[2 hrs]**

- 1.1. Definition and needs
- 1.2. Maintenance objectives

#### **Unit 2: Wear** **[4 hrs]**

- 2.1. Causes of component failure
- 2.2. Types of failure
- 2.3. Wear reduction methods
- 2.4. Assets care: effective monitoring and maintenance

#### **Unit 3: Types maintenance** **[6 hrs]**

- 3.1. Break down: definition, merit/demerits, and applications
- 3.2. Preventive: definition, merit/demerits, applications
- 3.3. Predictive: definition, merit/demerits, applications
- 3.4. Proactive: definition, merit/demerits, applications

#### **Unit 4: Maintenance activities** **[8 hrs]**

- 4.1. Inspections: methods, inspection schedule, inspection report [parts, working condition, strength]
- 4.2. Adjustments: methods, tools, [gap, clearance, etc.]
- 4.3. Testing: methods, equipment, procedures [pressure, temperature, etc.]
- 4.4. Calibrations: methods, equipment/instruments, procedures [pressure gauge, temperature, etc.]
- 4.5. Rebuilds: methods, equipment, procedures [gears, shaft]
- 4.6. Replacements: as per requirement or on regular replacement cycle, procedures [v-belts, filters, gears, bearings]

## **Unit 5: DC Circuits and DC Machines**

**[7 hrs]**

- 5.1. Definition- Electric current, voltage and resistance -Ohm's law and Kirchhoff's law. Resistance in series and parallel and series, parallel – simple problems electromagnetism(definitions only ) – magnetic flux, flux density magnetic field intensity, MMF, permeability, reluctance, Faraday's law of electromagnetic induction, electrical and mechanical units
- 5.2. DC generators – construction, principle of operation, types and application.
- 5.3. DC motors: - construction, principle of operation, types and application. DC generators – construction, principle of operation, types and application.
- 5.4. Necessity of starters: Three point, four point starters.

## **Unit 6: AC Circuits and AC Machines**

**[10 hrs]**

- 6.1. Fundamentals of AC voltage, and current – peak, average, RMS value of sine wave, frequency, time period, amplitude, power and power factor (definition only)- star and delta connection relationship between phase, line voltage and current in star and delta connections.
- 6.2. Transformer: Principle of operation and construction – EMF equation (no definition)- losses in Transformer – efficiency – application.
- 6.3. Alternator construction – principle of operation – types and applications.
- 6.4. AC machine: AC motors- Principle of operation of single phase capacitor start and universal motor induction motor- applications- Three phase induction motors – Squirrel cage and slip ring Induction motors (construction and working principle only) - application – speed control of 3 $\Phi$  Induction motor -Necessity of starters – DOL and star/delta starter.

## **Unit 7: Stepper and Servo Motors & Drives**

**[8 hrs]**

- 7.1. PMDC, Stepper motor- construction and working principle and applications - Servo motor – types: brushless servo motor, permanent magnet servo motor construction and applications.
- 7.2. Industrial drives- types, group drive, individual drive, multi motor drive, block-diagram of Variable frequency drive, stepper motor drive: single stepping and half stepping. Servo drives.
- 7.3. Electrical safety: - importance of earthing - electric shock: first aid, precautions - causes of accident and their preventive measures. Energy conservation

## **Practical**

**[45 hrs]**

- 1 **Preparatory Activity:**  
Study and demonstrate use of various types of tools. (Fix spanners, box spanners, ring spanners, allen keys, types of pliers, screw drivers, bearing puller, etc.).
- 2 **Measurement of Wear:**  
Measure wears of any one of the following.  
a. Machine guide ways. b. Shaft –sleeve.  
c. Piston –cylinder. d. Bearing.
- 3 **Corrosion:**  
Each student will collect corroded component from field and identify the types of corrosion and possible causes. Student will also suggest prevention methods.

- 4 **Fault Tracing and Decision Tree:**  
Develop decision tree for location of fault for **any two** items from following-  
a. Internal combustion (IC) engine. b. Boiler c. Pump. d. Machine tool.  
e. Air compressor. f. Electric motor. g. Control box
- 5 **Maintenance of Electro-Mechanical Based Equipment/Device/Machine.**  
Maintenance of **any two** from following. Batch may be divided into two groups and each group may be given one case.  
(Dismantle of given case, observe rules, follow sequence of dismantling operations, cleaning, inspection, measuring deviations, recovery methods, testing and assembling).
- 6 **Preventive Maintenance:**  
Prepare a preventive maintenance schedule of any workshop having- air compressors, car washing pumps, tyre changer, lifts, welding machines, and wheel alignment.
- 7 **Safety:**  
Demonstrate use of fire fighting and safety related equipment.
- 8 **Test Chart:**  
Prepare test chart of newly installed or repaired machine tool.
- 9 **Mini Project And Presentation:**
  - a. Identify electro-mechanical based any one equipment / device / machine at institute level which requires maintenance.
  - b. Prepare general sketch.
  - c. Perform fault tracing and prepare the decision tree.
  - d. Dismantle. Write the sequence of dismantling. Also describe the steps. List the tools used for this activity.
  - e. Attend necessary maintenance tasks. Write the tasks performed.
  - f. Assemble, test and if necessary, modify. Write the steps.
  - g. Prepare power point presentation. Present the project. This must include photographs / movies of group working on project.
- 10 **Industrial Visit:**  
Arrange visit to nearby automobile workshop/machine shop.

### References:

1. S.N. Bhattacharya, 1995, Installation Servicing and Maintenance, S. Chand & Company Ltd., New Delhi – 110055, India. ISBN: 81-219-0831-0.
2. Sushil Kumar Srivastava, 1998, Industrial Maintenance Management, S. Chand & Company Ltd., New Delhi – 110055, India. ISBN: 81-219-1663-1.
3. P. Gopalakrishnan & A. K. Banerji, 1991, Maintenance and Spare Parts Maintenance, Prentice-Hall of India Pvt. Limited, New Delhi – 110001. ISBN:0-87692-669-3.
4. [www.wmeng.co.uk/wmeng/wmrem/rem.htm](http://www.wmeng.co.uk/wmeng/wmrem/rem.htm)

# Estimation and Costing of Mechatronic System

## EG 3202 MX

**Year: III**  
**Semester : II**

**Total: 6 hrs/ w**  
**Theory: 4 hrs/ w**  
**Tutorial: 2 hrs/ w**

### Course Description:

This course is designed to enable the student better understand the cost occurred in the different parts of the mechatronics system. Throughout the course the students will be introduced to different mechatronics systems and taught to estimate the cost incurred in each step of mechanical design, Mechanical fabrication, Electrical design, Electrical fabrication and the cost of the programming associated to it as well.

### Course Objectives:

After the completion of this course, the student will be able to:

1. Analyze the factors affecting choice of materials, assuming knowledge of materials as covered in material science and strength of materials
2. Calculate the total cost of manufacturing of simple machine element
3. Calculate the total cost of manufacturing simple control systems
4. Calculate the total cost of the embedded software and the process

### Course Contents (Theory)

#### **Unit 1: Estimating and costing** [12 hrs]

- 1.1. Introduction – Purpose of estimating and costing.
- 1.2. Difference of estimating and costing.
- 1.3. Types of costs.
- 1.4. Ladder of costs.
- 1.5. Allocating of overheads.

#### **Unit 2: Estimation of material cost.** [12 hrs]

- 2.1. Estimation of cost by volume.
- 2.2. Estimation of cost by weight.
- 2.3. Cost estimation of simple machine elements (pulley, spindle, wall bracket, Turn buckle)
- 2.4. Cost estimation of simple electronic components and associated software development cost
- 2.5. Related Problems

#### **Unit 3: Estimation in machine shop** [12 hrs]

- 1.1. Set up time
- 1.2. Estimation of operation time: machine time for various operations – turning, facing, threading, drilling, milling and shaping.
- 1.3. Non machining time.
- 1.4. Down time
- 1.5. Related Problems

**Unit 4: Estimation of electronics control system****[12 hrs]**

- 4.1. Design Time.
- 4.2. Fabrication type and complexity
- 4.3. Components cost and evaluating the value
- 4.4. Scenario of costing considering the time, complexity, availability and components used
- 4.5. Related Problems

**Unit 5: Real Scenario of some Mechatronics system estimation****[12 hrs]**

- 5.1. Estimation of automation of existing mechanical system.
- 5.2. Estimation of automation module of a process plant
- 5.3. Uncertainty and variance in estimation
- 5.4. Estimate process of a Research and Development

**References:**

1. Rajendra Karwa: A textbook of Machine Design, Laxmi Publications, Latest edition
2. Banga and Sharma: Estimation and costing, Khanna Publishers Delhi.
3. TTTI Madras: Mechanical Estimating and Costing

# **Entrepreneurship Development**

## **EG 3201 MG**

**Year: III**  
**Semester: II**

**Total: 5 hours /week**  
**Lecture: 3 hours/week**  
**Tutorial: hour/week**  
**Practical: 2 hours/week**  
**Lab: hours/week**

### **Course description:**

This course is designed to provide the knowledge and skills on formulating business plan and managing small business. The entire course deals with assessing, acquiring, and developing entrepreneurial attitude; skills and tools that are necessary to start and run a small enterprise.

### **Course objectives:**

After completion of this course students will be able to:

1. Understand the concept of business and entrepreneurship;
2. Explore entrepreneurial competencies;
3. Analyze business ideas and viability;
4. Learn to formulate business plan with its integral components and
5. Manage small business.

### **Course Contents (Theory)**

#### **Unit 1: Introduction to Business & Entrepreneurship [9 hrs]**

- 1.1. Overview of entrepreneur and entrepreneurship
- 1.2. Wage employment , self- employment and business
- 1.3. Synopsis of types and forms of enterprises
- 1.4. Attitudes, characteristics & skills required to be an entrepreneur
- 1.5. Myths about entrepreneurs
- 1.6. Overview of MSMEs (Micro, Small and Medium Enterprises) in Nepal

#### **Unit 2: Exploring and Developing Entrepreneurial Competencies [10 hrs]**

- 2.1. Assessing individual entrepreneurial inclination
- 2.2. Assessment of decision making attitudes
- 2.3. Risk taking behavior and risk minimization
- 2.4. Creativity and innovation in business
- 2.5. Enterprise management competencies

#### **Unit 3: Business identification and Selection [4 hrs]**

- 3.1. Sources and method of finding business idea(s)
- 3.2. Selection of viable business ideas
- 3.3. Legal provisions for MSMEs in Nepal

## **Unit 4: Business plan Formulation**

**[17 hrs]**

- 3.1. Needs and importance of business plan
- 3.2. Marketing plan
  - Description of product or service
  - Targeted market and customers
  - Location of business establishment
  - Estimation of market demand
  - Competitors analysis
  - Estimation of market share
  - Measures for business promotion
- 3.3. Business operation plan
  - Process of product or service creation
  - Required fix assets
  - Level of capacity utilization
  - Depreciation & amortization
  - Estimation office overhead and utilities
- 3.4. Organizational and human resource plan
  - Legal status of business
  - Management structure
  - Required human resource and cost
  - Roles and responsibility of staff
- 3.5. Financial plan
  - Working capital estimation
  - Pre-operating expenses
  - Source of investment and financial costs
  - Per unit cost of service or product
  - Unit price and profit/loss estimation of first year
- 3.6. Business plan appraisal
  - Return on investment
  - Breakeven analysis
  - Risk factors

## **Unit 5: Small Business Management**

**[5 hrs]**

- 5.1. Concept of small business management
- 5.2. Market and marketing mix
- 5.3. Basic account keeping

## **Practical**

**[30 hrs]**

### **Unit 1: Overview of Business & Entrepreneurship**

**[2 Hours]**

- 1.1. Collect business information through interaction with successful entrepreneur

### **Unit 2: Exploring and Developing Entrepreneurial Competencies [2 Hours]**

- 2.1. Generate innovative business ideas

### **Unit 3: Product or service Identification and Selection**

**[2 Hours]**

- 3.1. Analyze business ideas using SWOT method

### **Unit 4: Business Plan Formulation**

**[22 Hours]**

- 4.1. Prepare marketing plan

- 4.2. Prepare operation plan
- 4.3. Prepare organizational and human resource plan
- 4.4. Prepare financial plan
- 4.5. Appraise business plan
- 4.6. Prepare action plan for business startup

### **Unit 5: Small Business Management**

**[2 Hours]**

- 5.1. Prepare receipt and payment account
- 5.2. Perform costing and pricing of product and service

### **References:**

1. Entrepreneur's Handbook, Techno net Asia, 1981.



# Robotics & Auto-Electronics

## EG 3203 MX

**Year: III**  
**Semester : II**

**Total: 7 hrs/ w**  
**Theory: 3 hrs/ w**  
**Practical: 4 hrs/ w**

### Course Description:

Today's industrial assembly line is equipped with robots and man vs. machine interface has been replaced by automation. Most of the machines including our automobiles are available with variety of models and controls. We see luxury cars around us and simply dream of having one. These luxury cars offer varied and many features including safety (central lock, parking assistance, air bags etc.), economy (at times) and comfort as per buyer's criteria. It is therefore need of the day for students to learn Robotics and Auto- electronics shortened as autotronics for working in industry. This course therefore attempt to build required skills of this field in students. Further in order to tune up with growth engine of Gujarat i.e. automobile sector this course has become inevitable.

### Course Objectives:

The theory should be taught and practical should be undertaken in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domains to demonstrate the following course outcomes:

1. Identify a Robot for a specific application.
2. Interface various Servo and hardware components with Controller based projects.
3. Identify parameters required to be controlled in a Robot.
4. Develop small automatic/autotronics applications with the help of Robotics.
5. Test the robotics circuit.

### Course contents (Theory)

#### Unit 1: Basic Components of Robotics Systems [10 hrs]

- 1.1. Definition, need, brief history, social justification
- 1.2. Basic Robot terminology configuration and its working
- 1.3. Robot components (Anatomy)– manipulator, end effects, drive system, controller, sensors (Optical, Proximity, LVDT, Thermocouple-RTD-Thermistor, Force sensing – strain gauge- piezoelectric, Acoustic)
- 1.4. Basic structure of a Robot and Classification – Cartesian, cylindrical, spherical, horizontal articulated (SCARA), Mechanical arm, Degree of freedom, Links and joints, Wrist rotation, Mechanical transmission-pulleys, belts, gears, harmonic drive
- 1.5. Linear and rotary motion and its devices
- 1.6. Robot configurations: (1) stand above (2) in line (3) cycle independent,
- 1.7. Selection criteria for robot
- 1.8. Robot machine vision

#### Unit 2: Servo Mechanism and Motion Systems [10 hrs]

- 2.1. Servo and non servo control systems – Types, basic principles and block diagram
- 2.2. Types, working (with diagrams), and applications of various controls- Computed torque technique, New minimum time control , Variable structure control Non linear decoupled feedback control, Resolved motion control , Adaptive control
- 2.3. Types, electrical hardware, programming languages used, advantages, limitations and specific examples of control systems.

- 2.4. Robot as work cell controller-PLC
- 2.5. Work cell control with local area networking, Multiple network level
- 2.6. Level of Robot controller
- 2.7. Robot path control (Point to point, Continuous path, Sensor based path)
- 2.8. Controller programming
- 2.9. Actuators: DC servo motors, Stepper motor, Hydraulic and pneumatic drives
- 2.10. Feedback devices
- 2.11. Microcontroller based control system

**Unit 3: Sensors and Actuators** **[10 hrs]**

- 3.1. Concept of general measurement system and difference between Mechanical and electrical/electronic instruments;
- 3.2. Measurement of Pressure : Working of Thermocouple vacuum gauge And Pirani vacuum gauge;
- 3.3. Measurement of Flow: Hotwire Anemometer, Ultrasonic flow meter;
- 3.4. Measurement of Speed: Contact less electrical tachometer, Inductive, Capacitive type tachometer, Stroboscope;
- 3.5. Electrical method for moisture measurement;
- 3.6. Basic requirement of Sensors, Functions,
- 3.7. Applications and Circuitry arrangement of various Sensors such as Mass Air flow rate sensor, Exhaust gas Oxygen concentration, Throttle plate angular position, Crank shaft angular position, Coolant temperature, Intake air temperature, Manifold absolute pressure (MAP), Vehicle speed Sensor. Transmission gear selector position, Methanol sensor, Rain Sensor; Sensor Calibration
- 3.8. Task oriented controls and sequencing, Robotic conventions

**Unit 4: Programming and Application in Manufacturing** **[10 hrs]**

- 4.1. Methods of robot programming : Manual Teaching, Lead through
- 4.2. Programming languages, Programming with graphics.
- 4.3. Types, features and applications of various programming languages.
- 4.4. Simulation for robot movements
- 4.5. Applications of robots(including special types)
- 4.6. Robot maintenance: Need and types.
- 4.7. Common troubles and remedies in robot operation.
- 4.8. General safety norms, aspects and precautions in robot handling

**Unit 5: Applications in Industrial Automation** **[5 hrs]**

- 5.1. Automobile Battery
- 5.2. Hybrid Synergy Vehicles
- 5.3. Automation in Automobiles: MPFI, ABS, SRS, Stability and Cruise Control, Electronic Power Steering, Parking Assistant System, Central lock system, Immobilizer system

<b>S. N.</b>	<b>Unit No.</b>	<b>Practical Exercises</b>
1	I	Demonstrate and Configure the robots used for practical
2	I	Use the robot end effecters for movement
3	II	Write program to control servo and non-servo system
4	III	Demonstrate the use of different types of sensor in robotics.
5	III	Interface sensors with $\mu\text{P}$ or $\mu\text{C}$ to read temperature and humidity data
6	III	Measure parameters of Electro-Mechanical Instruments: Pressure, Flow, Speed and Moisture
7	III	Interface Actuators using $\mu\text{C}$ / $\mu\text{P}$ and control them.
8	III	Interface Drives using $\mu\text{P}$ or $\mu\text{C}$
9	III	Interface Stepper Motor using $\mu\text{P}$ or $\mu\text{C}$
10	IV	Interface PLC and prepare Ladder Diagram
11	IV	Demonstrate pick and place action using robot trainer kit
12	IV	Write and test a program for Line Follower Configuration.
13	IV	Write and test a program for golfer /thrower configuration
14	IV	Write and test a program for coffee maker configuration
15	IV	Write and test a program for drawing robot configuration
16	IV	Write and test a program for strider configuration
17	IV	Control robot test kit using Robot programming commands

**References:**

6. Koren Yoram, Robotics for Engineers, McGraw - Hill Education, New Delhi, 1st Edition
7. Hedge, G S, Textbook On Industrial Robotics, Laxmi Publications, New Delhi, 1st Edition
8. Groover Mikell P., Industrial Robotics: Technology, Programming and Applications, McGraw - Hill Education, New Delhi 2nd Edition
9. Denton, Tom, Automobile Electrical and Electronic systems, Arnold
10. William Ribbens, Understanding Automotive Electronics, Newnes; 6th Revised edition

# Major Projects

EG 3204 MX

Year: III  
Semester: II

Total: 8 hours /week  
Lecture: hours/week  
Tutorial: hours/week  
Practical: 8 hours/week  
Lab: hours/week

## Course Description:

This section of the syllabus will be the combination of the knowledge and the skill learnt during the whole course. The student will be given an outline of device/item/tool/mechanism in the field of specialization to be fabricated or repaired or maintained as applicable to different specialization. She/he shall then design and produce or undertake it by himself or do the maintenance or repair job. The finished product along with project report shall be submitted for appraisal. The project report will consists of the following:

- Design considerations-use of relevant standards to design computations.
- Force-load calculation and their complete analysis.
- Considerations on material selection/heat treatment/manufacturing options.
- Assembly drawing/working drawing along with limit, fit and tolerance application including
- Flow chart of control system and automation.
- Any circuit design and programs in softcopy.
- Bill of Quantity (BOQ).
- Estimating and costing /manufacturing time estimate/safety considerations.
- Economic analysis of the product.
- Test/check performance of design prototype.

The student will be allocated a team of guides comprising of the theory teacher and the practical teacher for her/his project and design work. The student shall also consult the library and internet for her/his work.

Before submission of the final work, he/she shall have to present his/her work among the evaluation team.

## Overview of Learning Activities

The learning activities included in this course are:

1. Attendance at lectures, and communicate with students regarding projects.
2. Knowledge regarding some of the important topics (555 timer, PLC, logic control, solid works, ADAMS etc.) related to the mechatronics subject will be given to the students for utilizing unproductive time in class room.
3. Students are free(innovation) to chose minor projects whatever they like only if it solves real life problem & cost effective
4. If students are facing problems(project) they are recommended to take advice from expert faculty teachers
5. Students should consult their faculty and choose project wisely before finalizing it. They should inform their project guide as soon as the project is decided.
6. Students must present the research and planning log book. At least diary or copy with all the work and records of individual as well as group activities in order to claim rewarded marks.
7. Project should be selected such that institutional resources are enough to facilitate the fabrication process.

### **Evaluation**

<b>S.N</b>	<b>Topics</b>	<b>Weightage %</b>
1	Attendance (Student participation in project research and planning)	10
2	Action plan	10
3	Documentation	10
4	Project activities and work	50
5	Final presentation	20
<b>Total</b>		<b>100</b>

**Elective**  
(One of the Followings)

**Micro Controller and PIC**  
EG 3205 MX

**Year: III**  
**Semester: II**

**Total: 7 hrs/ w**  
**Theory: 3 hrs/ w**  
**Practical: 4 hrs/ w**

**Course Description:**

Familiarization of Architecture & Functionality of 8051 makes the work as a complete Engineer. Usage of interfacing helps them to do programming & take-up project works.

**Course Objectives:**

After completion of this course students will be able to:

1. Explain Architecture of 8051 Microcontroller.
2. Explain the functions of various registers.
3. Understand interrupt structure of 8051.
4. Understand serial data communication concepts.
5. Understand the programming techniques.
6. Explain various addressing modes.
7. Write simple programs using 8051.
8. Understand the block diagram and control word formats for peripheral devices.
9. Understand how to interface with RS232C.
10. Understand how to interface with 8255.
11. Understand various application of 8051 Microcontroller
12. Understand PIC Microcontroller

**Course Contents (Theory)**

**Unit 1: Architecture of 8051**

**[10 hrs]**

- 1.1. Block diagram of Microcontroller
- 1.2. Comparison of Microprocessor and Microcontroller
- 1.3. Advantage of Microcontroller
- 1.4. Selection of Microcontroller
- 1.5. Pin details of 8051
- 1.6. ALU, Special function registers
- 1.7. ROM–RAM–RAM Memory Map (including registers and register banks)
- 1.8. Program Counter PSW register, Stack, I/O Ports
- 1.9. Timer, Interrupt, Serial Port
- 1.10. External memory, Clock, Reset, Clock Cycle, Machine Cycle, Instruction cycle, Instruction fetching and execution
- 1.11. Overview of 8051 family

**Unit 2: Instruction Set and Programming**

**[10 hrs]**

- 2.1. Assembling and running an 8051 program
- 2.2. Instruction set of 8051, Different addressing modes
- 2.3. Data transfer instructions, Arithmetic Instructions

- 2.4. Logic and Compare instructions, Call instructions
- 2.5. Signed number concepts and arithmetic operations
- 2.6. Rotate instruction and data serialization
- 2.7. BCD, ASCII, Assembler directives–Sample programs.
- 2.8. Loop and jump instructions
- 2.9. Time delay routines, Program control

**Unit 3: I/O, Timer, Interrupt and Serial Programming** **[10 hrs]**

- 2.1. Bit addresses for I/O and RAM
- 2.2. I/O programming , I/O bit manipulation programming
- 2.3. Programming 8051, Timers , Counter programming
- 2.4. Basics of Serial programming
- 2.5. 8051 connection to RS232, 8051Serial Port Programming
- 2.6. 8051interrupt, Programming Timer Interrupt
- 2.7. Programming external hardware interrupts
- 2.8. Programming the serial communication interrupt
- 2.9. Interrupt priority in 8051

**Unit 4: PIC** **[15 hrs]**

- 2.1. Overview of PIC 18 family-PIC 18 Features-PIC Architecture
- 2.2. WREG Register in the PIC-PIC File Register
- 2.3. File register and access bankinPIC18
- 2.4. PIC Status Register
- 2.5. Program counter in the PIC-ROM memory map in the PIC18
- 2.6. Where the PIC wakes up when it is power dup
- 2.7. Placing code in Program ROM-Executing a program byte by byte-ROM Width in the PIC18
- 2.8. Harvard architecture in the PIC-RISC architecture in the PIC-Features of RISC, PIC Instructions
- 2.9. MOVWF instructions
- 2.10. COMF instruction
- 2.11. DECF instruction
- 2.12. MOVF instruction
- 2.13. ADDLW instruction and Status Register

**PRACTICAL** **[60 hrs]**

**Note:**

- All the experiment should be conducted
- Different data are to be given for each

**Part–A**

1. Write an Assembly Language Program for Multi-byte Addition and execute the same in the 8051 Kit.
2. Write an Assembly Language Program for Multiplication and Division of two numbers and execute the same in the 8051 Kit.
3. Write an Assembly Language Program for arranging the given data in

4. Ascending order and execute the same in the 8051 Kit.
5. Write an Assembly Language Program for BCD to Hex conversion and execute the same in the 8051 Kit.
6. Write an Assembly Language Program for Hex to BCD conversion and execute the same in the 8051 Kit.
7. Write an Assembly Language Program for ASCII to Binary and execute the same in the 8051 Kit.
8. Write an Assembly Language Program for Parity bit generation and execute the same in the 8051 Kit.
9. Write an Assembly Language Program for using timer / Counter and execute the same in the 8051 Kit.

## **Part– B**

### **Interfacing with application boards**

1. Write an Assembly Language Program for interfacing Digital I/O board and test it.
2. Write an Assembly Language Program for interfacing Matrix keyboard and test it
3. Write an Assembly Language Program for interfacing seven segments LED displays and test it.
4. Write an Assembly Language Program for interfacing Traffic light control and test it.
5. Write an Assembly Language Program for interfacing 8 bit ADC and test it.
6. Write an Assembly Language Program for interfacing 8 bit DAC and test it.
7. Write an Assembly Language Program for interfacing STEPPER MOTOR and test it.
8. Write an Assembly Language Program for interfacing DC motor and test it.
9. Write an Assembly Language Program for Sending data through serial port between controller kits and test it.

### **Text Books:**

1. Mazidi, Mazidi and D. MacKinlay–“8051 Microcontroller and Embedded Systems using Assembly and C “-2006 Pearson Education Low Price Edition.
2. R.Theagarajan –“Microprocessor and Microcontroller “- Sci Tech Publication, Chennai
3. Kenneth J. Ayala –“8051 Microcontroller”
4. Muhammad Ali Mazidi, Rolind D. Mckinlay, Danny Causey-PIC Microcontroller
5. Embedded systems using Assembly and C for PIC 18.

### **Reference Books:**

1. Myke Predko, -“Programming customizing the 8051 Microcontroller “Tata McGraw Hill”



# Biomedical Instrumentation

## EG 3205 MX

**Year: III**  
**Semester: II**

**Total: 7 hrs/w**  
**Lecture: 3 hrs/w**  
**Tutorial: hrs/w**  
**Practical: 4 hrs/w**

### Course Description:

This course is designed to present the basic concepts of medical instruments, design analysis of various types medical Instruments currently used in medical, clinical and hospital field. This course deals with study, design, uses and applications of advanced biomedical equipment.

### Course Objectives:

After the completion of this course students will be able to:

1. Describe the uses of various kinds of bio-potential electrodes.
2. Explain the uses and applications of different physiological transducers
3. Perform checking, maintenance, diagnosis and testing of various medical instruments

### Course Contents (Theory)

#### Unit 1: Biomedical Engineering

[2 hrs]

- 1.1. Introduction
- 1.2. Biometrics
- 1.3. Man-instrument system
- 1.4. Components of man-instrument system
  - 1.4.1 Subject
  - 1.4.2 Stimulus
  - 1.4.3 Transducers
  - 1.4.4 Signal conditioning equipment
  - 1.4.5 Display
  - 1.4.6 Recording and data transmission
  - 1.4.7 Data storage
- 1.5. Physiological system of the human body

#### Unit 2: Biomedical system

[4 hrs]

- 2.1. Bioelectric potential
- 2.2. Resting potential
- 2.3. Action potential
- 2.4. Propagation of action potential
- 2.5. Biological signals
  - 1.9.1 Electrodes
  - 1.9.2 Bio-potential electrodes
  - 1.9.3 Microelectrodes
  - 1.9.4 Sin surface electrodes

**Unit 3: Physiological Transducers** [4 hrs]

- 3.1. Active transducers
- 3.2. Passive transducers
  - 3.2.1 Passive transducers using resistive elements
  - 3.2.2 Passive transducers using inductive elements
  - 3.2.3 Passive transducers using capacitive elements
- 3.3. Transducers for biomedical applications

**Unit4: Measuring and monitoring system** [8 hrs]

- 4.1 Electrocardiograph (ECG)
  - 4.1.1 The electrocardiogram
  - 4.1.2 The electrocardiographic diagnosis
  - 4.1.3 ECG lead configurations
  - 4.1.4 Computer aided electrocardiograph analysis
- 4.2 Electroencephalograph (EEG)
  - 4.2.1 EEG electrode configurations
  - 4.2.2 EEG recording techniques
- 4.3 Electromyograph (EMG)
  - 4.3.1 Electromyographic recording techniques
  - 4.3.2 Different muscle related diseases

**Unit 5: Diagnostics and Imaging Instruments** [8 hrs]

- 5.1. Principle of ultrasonic measurement
- 5.2. Ultrasonic imaging system
- 5.3. X-Ray and radio instruments
  - 5.3.1 Basic definition of radiology
  - 5.3.2 X-ray tubes
  - 5.3.3 Block diagram of x-ray machine
  - 5.3.4 Biological effects of x-rays
- 5.4. CAT scan machine
- 5.5. Nuclear magnetic resonance imaging system

**Unit 6: Patient monitoring system and biotelemetry** [8 hrs]

- 6.1. ECG Monitoring
- 6.2. BP monitoring
- 6.3. ICU monitoring instruments
- 6.4. Biotelemetry for general use
- 6.5. The components of a biotelemetry system
- 6.6. Design of a system.
- 6.7. Multichannel system
- 6.8. Frequency modulation techniques in telemetry link
- 6.9. Real time processing
- 6.10. Telemetry in operating room
- 6.11. Sports physiology studies through telemetry

**Unit 7: Therapeutic and prosthetic devices****[5 hrs]**

- 7.1. Cardiac pace makers and other electric stimulators
- 7.2. Defibrillators
- 7.3. Hemodialysis
- 7.4. Lithotripsy
- 7.5. Ventilators
- 7.6. Therapeutic applications of the laser

**Unit 8: Blood flow meters and Oximeters****[6 hrs]**

- 8.1. Electromagnetic Blood Flow meter
- 8.2. Types of Electromagnetic Blood Flow meter
- 8.3. Ultrasonic Blood Flow meter
- 8.4. Blood Flow estimation by Radiographic method
- 8.5. Oximeter
- 8.6. Pulse Oximeter
- 8.7. Skin Reflectance Oximeter

**Practical / Lab****[60 hrs]**

1. Study on anatomy and physiology system of the human body
2. Design study of different types of electrodes used in medical electronics
3. Case study of physiological transducers and design
4. Study of intracranial pressure transducer
5. Computer aided ECG analysis and their recording techniques
6. Practical details of EEG machine
7. Practical details of EMG machine
8. Diagnostic X-ray machine and uses
9. Diagnostic ultrasound machine and their applications
10. Study and orientation of CT and MRI machines
11. Design study of telemetry system in ICU department of the hospital
12. Study of different Therapeutic devices

**References:**

1. John G. Webster, Medical Instrumentation, Application and Design: Third edition, John Wiley and sons, New York
2. Leslie Cromwell, Bio medical Instrument and measurements, Prentice Hall, Inc, Englewood cliffs
3. Onkar N. Pandey, Bio medical Electronics and Instrumentation, S.K.Kataria and sons, Publishers of Engineering and Computer books

# New Product Development

## EG 3205 MX

**Year: III**

**Total: 7 hrs/ w**

**Semester: II**

**Theory: 3 hrs/ w**

**Practical: 4 hrs/ w**

### **Course Description:**

After the completion of this course, students will be able to understand the basic principles and concepts of new product development strategies, the product life cycles.

### **Course Objectives:**

After the completion of this course, the student will be able to:

1. Understand the differences between product design and new product development.
2. Understand importance of innovation and new product development in various industries.
3. Understand the overall cycle of new product development.
4. Implement new product development process.

### **Course Contents**

#### **THEORY**

- |  |                |
|--|----------------|
| <b>Unit 1: Concept of New Product, New Product Development and Product Design</b>    | <b>[6hrs]</b>  |
| 1.1 Need for Innovation and design   |                |
| 1.2 User Innovation  |                |
| 1.3 Introduction to product and Product design and new product development           |                |
| 1.4 Difference between Product development and product design                        |                |
| <br>   |                |
| <b>Unit 2: Innovation and Importance of New Product Development</b>                  | <b>[8hrs]</b>  |
| 2.1 Factors driving new product development.   |                |
| 2.2 Types of innovations that lead to new products.                                  |                |
| 2.3 Importance of new product development.   |                |
| <br>   |                |
| <b>Unit 3: New Product Development in Goods and Service Industries.</b>              | <b>[4hrs]</b>  |
| 3.1 New Product development in Goods Industry  |                |
| 3.2 New product development in Service Industry                                      |                |
| <br>   |                |
| <b>Unit 4: New Product Development, Growth Strategies.</b>                           | <b>[7hrs]</b>  |
| 4.1 Growth Strategies  |                |
| 4.2 New product development Strategies   |                |
| 4.3 Product Lifecycle Strategies   |                |
| <br>   |                |
| <b>Unit 5: New Product Development Process: Idea Generation to Commercialization</b> | <b>[20hrs]</b> |
| 5.1 Idea generation.   |                |
| 5.2 Evaluating product ideas.  |                |
| 5.3 Conducting business analysis.  |                |
| 5.4 Product development.   |                |
| 5.5 Market testing.  |                |
| 5.6 Launching new product  |                |

## **Practical**

[60 hrs]

- Case study on new product development of any one product of any organization within Nepal.

### Scope

1. Understand how the idea for the product was generated.
2. Understand the evaluation of product ideas
3. Understand how business analysis is conducted
4. Understand the R&D behind the product
5. Understand the marketing strategies

### Deliverables

- A complete report containing new product development process: Idea generation to commercialization of the chosen product.
- Presentation on the topic

### ***Reference Books:***

- Gilbert A. Churchill, Jr. and J. Paul Peter; “Marketing: Creating Value for Customers” Austin Press, 1995.
- Kenneth Kahn, “The PDMA Handbook of New Product Development”, 2nd Edition, 2004.
- Philip Kotler, “Marketing Management: Analysis, Planning, Implementation and Control”.

# **Maintenance Concepts and Fault Finding**

## **EG 3205 MX**

**Year: III**

**Total: 7 hrs/ w**

**Semester: II**

**Theory: 3 hrs/ w**

**Practical: 4 hrs/ w**

### **Course Description:**

This course deals with the basic fundamentals concepts of fault finding in different mechatronics system and general machineries and gives the working principles of different systems. This course is designed to focus on the procedures followed in different sectors and the sensitivity, similarities and differences of the maintenance process in different cases.

### **Course Objectives:**

After completing this course the student will be able to:

1. Describe the uses of various industrial and automatic machineries.
2. Explain the operation of various kinds of equipment.
3. Demonstrate basic knowledge of service, check, maintenance, diagnosis and testing of equipment.

### **UNIT 1: Basic Procedures/Principles of Maintenance**

**[8Hrs]**

- 1.1. Safety
- 1.2. Standards for maintenance process
- 1.3. Drawings, PNID, schematics, catalogues
- 1.4. Steps of diagnosis
- 1.5. Fault analysis
- 1.6. Fault recording and reporting

### **UNIT 2: Maintenance of Robotics Systems**

**[8Hrs]**

- 2.1 Repair and Maintenance of Robotic System
- 2.2 Mechanical Aspects (Couplings, Joints, Material Joining and Removal of Different Types of Joints, Hydraulic and Pneumatic Actuators,)
- 2.3 Electronic and Electrical Aspects (Circuit Diagnosis, DC/AC/Servo/Stepper motor repair, Solenoids, Sensors)
- 2.4 Programming (Types of Controller, Reprogramming a Controller)
- 2.5 Maintenance Reporting

### **UNIT 3: Maintenance of Robotics System**

**[8Hrs]**

- 3.1. Repair and Maintenance of Automobile Electronics
- 3.2. Automotive sensors; Speedometer, Fuel Gauge, Lubrication, Temperature sensor and others
- 3.3. Modern Fault Diagnosis and Reporting Systems
- 3.4. Automotive wiring maintenance
- 3.5. Maintenance Log and Schedules

**UNIT 4: Maintenance of Biomedical Devices** [8Hrs]

- 4.1. Repair and Maintenance of Biomedical Devices
- 4.2. Introduction of Biomedical Instrumentation
- 4.3. Fundamental Biomedical Devices and their uses
- 4.4. Diagnosis of X-ray Machine, ECG Machine, CT-Scan
- 4.5. Fittings of Biomedical Devices
- 4.6. Biomedical Device standards and sensitivity with biomedical devices
- 4.7. Reporting standards

**UNIT 5: Maintenance of Daily used Devices** [8Hrs]

- 5.1. Traffic Lights, Pedestrian/Zebra crossing lights
- 5.2. Laptops, PCs, Monitors, Mobile, Air- conditions
- 5.3. Building Equipment (Elevator, Escalator, Water level, Automatic gates, home automations systems)
- 5.4. Fittings of Different Sensors (CCTV, Proximity, and other devices) in home and offices
- 5.5. Recording and Marking maintenance preformed

**UNIT 6: Maintenance Management** [5Hrs]

- 6.1. Management of Repair and Maintenance Process, Plant downtime, production time, OFF/ON duty hours.
- 6.2. Handing and management of product in repair shop, Task Schedules, completed task logs.
- 6.3. Planning of Plant Maintenance, Residential device maintenance.
- 6.4. Documentation aspects of repair and feed back to design process.

**Practical** [60 Hrs]

1. Demonstrate maintenance process of Biomedical Devices and reporting.
2. Demonstrate maintenance process of Daily used equipment and prepare maintenance log.
3. Demonstrate typical Robotic System, its parts, possible faults and process of tracking and reporting faults
4. Visit bottling, Packaging Plants, or any production plant to study to the maintenance process and prepare a report of the maintenance done in such plants.

**References**

5. Sushil Kumar Srivastava, 1998, Industrial Maintenance Management, S. Chand & Company Ltd., New Delhi – 110055, India. ISBN: 81-219-1663-1.
6. P. Gopala krishnan& A. K. Banerji, 1991, Maintenance and Spare Parts Maintenance, Prentice-Hall of India Pvt. Limited, New Delhi – 110001. ISBN: 0-87692-669-3.
7. William Ribbens, Understanding Automotive Electronics, Newnes; 6th Revised edition
8. Mahajan, M. (2002). Industrial engineering and production management (2nd ed.). DhanpatRai and Co. (P) Ltd., Delhi.

## Experts Involved in Curriculum Development

S.N.	Name	Designation	Organization Address
1	Prf. Dr. Pramod Bahadur Shrestha	Professor	IOE, Pulchok, Lalitpur
2	Er. Ram Raj Khanal	Engineer (Robotics & Automation)	Calcgen Selection Pvt. Ltd., Lalitpur
3	Er. Rajeeb Aryal	Industrial Automation	PLC, SLADA, Lalitpur
4	Er. Moti Ram Shrestha	Aviation Expert	Civil Aviation Authority, Kathmandu
5	Er. Umesh Aryal	HOD, Electrical	BSET, Electrical Engineering Department
6	Er. Uttam Bdr Mali	Retired Asst. Professor	IOE/KU
7	Er. Shankar Man Shrestha	HOD, Electrical	BSET
8	Er. Aditya Neupane	Machine Design Expert	MANTRA pvt. Ltd.
9	Er. Subash Neupane	Design Engineer	Calcgen Selection Pvt. Ltd.
10	Er. Asheb Balav Timilsina	Mechanical Engineer	NEA, Kathmandu
11	Er. Sushil Khadka	Drone Engineer	National Innovation Center, Kathmandu
12	Er. Suman Adhikari	Product Design Engineer	Prokura Innovation Pvt.Ltd., Kathmandu
13	Er. Sunil Pariyar	Electronics Engineer	Infinity Lab Nepal, Kathmandu
14	Er. Nirmal Pr. Neupane	Principal	CTEVT/BSET
15	Er. Arjun Devkota	Sr. Officer/Engineer	CTEVT
16	Er. Sajan Amatya	Software Engineer	National Innovation Center, Kathmandu
17	Er. Ramesh Chaudhary	Robotic Expert	IOE, Pulchok
18	Er. Sumit Yadav	Industrial Engineer	Sumit All Engineering, Kathmandu
19	Er. Sangam Timilsina	Industrial Engineer	GRIT Plastics, Kathmandu
20	Er. Shanta Maharjan	Mechatronics Engineer	IOE, Thapali Campus