

CURRICULUM DIPLOMA

Automobile Engineering

(Three year program-semester system)



Council for Technical Education and Vocational Training
Curriculum Development Division

Sanothimi, Bhaktapur

First Revision 2013

Second Revision 2019

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Introduction

The automobile Engineering is genuine field in the engineering and technology sector. Many people in the world have been given emphasis for the broader application of automobile. This sector has been helping the world for the overall development and it has been creating wage and self employment opportunities both in public and private sectors.

This curriculum is designed with the purpose of producing middle level technical human resources equipped with knowledge and skills related to automobile engineering so as to meet the demand of such workforce in the country to contribute in the national economic development of Nepal. The knowledge and skills incorporated in this curriculum will be helpful to deliver the individual needs as well national needs in the field of automobile engineering.

This course is based on the job required to perform by an automobile technician at different related industries and organizations in Nepal and abroad. The Diploma in Automobile 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. This curriculum includes the core subjects like physics, chemistry, and mathematics applicable in the field of auto-mechanical engineering. It also includes language subjects like Nepali and English applicable for the communication in the field of automobile. The second year course focuses on the basic disciplinary subjects of Automobile Engineering. Similarly, third year comprises of the disciplinary subjects of Automobile Engineering. It also has provision of elective subjects in the specific areas of automobile engineering. The course structure and the subject wise contents that follow reflect the details of this curriculum. In short, this curriculum guides its implementers to produce competent and highly employable middle level technical workforce in the field of automobile engineering. The contents of individual subjects prescribed in the curriculum are incorporated in the light of "must to know and must to do" principle.

Rational

Diploma in Automobile Engineering curriculum was last revised in 2013. This is the second revision after the implementation of its first revision. The rationales behind its revision are as follows:

- It crossed the 5 years maturity period of its implementation after the 1st revision and similarly the implementing agencies/college have requested to revise this curriculum based on their teaching experiences.
- The year-wise re-adjustments of the existing subjects are felt necessary.
- Some new subjects seems to be introduce as per the advancement in technology.
- It is needed to revisit its weightage in both theory and practical marks and contents to make it more practical oriented.
- The duration of 3rd year Industrial Attachment needs to be increased.
- The technologies invented in the field of automobile are necessary to incorporated.

Furthermore, technology of automobile occupation upgraded rapidly and new technology are introduce in the recent year. With the advent in technology trained technicians are needed throughout the world. To cope with the national and international demand, the knowledge and the skills should be updated to make the skills relevant and pertinent to the industry. Hence this curriculum is revised to equip the students as per the changing technology in changing environmental context.

Curriculum Title:

Diploma in Automobile Engineering (DAE).

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 workforce in the field of automobile engineering.
- Prepare such technicians who are able to work in the automobile sector related local workshop and industrial settings of the country.
- Meet the demand of such technical workforce for the automobile industries of Nepal.
- Reduce the dependence on employing such technicians from foreign countries.
- 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 Automobile 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
- 1:8 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 subjects' related teachers (refer to course codes SH and MG) should be master's 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 an 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:

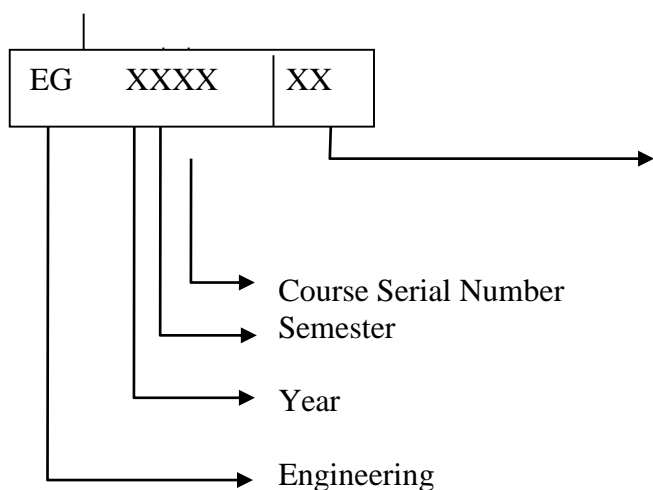
- Distinction: 80% and above
- First division: 65% to below 80%
- Second division: 50 % to below 65%
- Pass division: Pass marks to Below 50%

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 Automobile 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. Body Shop Repair and Maintenance, Motor Cycle Repair and Maintenance, Automobile Air Conditioning and Automobile Service Management.

Career Opportunity

The graduates will be eligible for the position equivalent to Non-gazette 1st 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 question	No of question	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
	Total	23		80	180 minutes	

B. For subject with full marks 60

S. N.	Type of question	No of question	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
	Total	19		60	180 minutes	

C. For subject with full marks 40

	Type of question	No of question	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
	Total	12		40	90 minutes	

Curriculum Structure

DIPLOMA IN AUTOMOBILE ENGINEERING

YEAR: I

SEMESTER I

S.N.	Code No.	Subject	Mode				Total Hours	DISTRIBUTION OF MARKS						Total Marks	Remarks
			Theory			Practical									
			L	T	P	Lab		Assmt. Marks	Final Marks	Time Hours	Assmt. Marks*	Final Marks	Time Hours		
1	EG 1101 SH	Communication Nepali	2				2	10	40	1.5				50	*Continuous assessment
2	EG 1102 SH	Communication English	2				2	10	40	1.5				50	
3	EG 1103 SH	Engineering Mathematics I	4	1			5	20	80	3				100	
4	EG 1104 SH	Engineering Physics I	3	1		2	6	20	60	3	10	10	2	100	
5	EG 1105 SH	Engineering Chemistry I	3	1		2	6	20	60	3	10	10	2	100	
6	EG 1106 ME	Engineering Drawing I			4		4				60	40	4	100	
7	EG 1107 ME	Workshop Technology I (Metal & wood work)	3		9		12	20	80	3	120	80	6	300	
8	EG 1108 EE	Elements of Electrical Engineering	2			1	3	20	60	3	10	10	2	100	
TOTAL			19	3	13	5	40	120	420		210	150		900	

YEAR: I

SEMESTER II

S.N.	Code No.	Subject	Mode				Total Hours	DISTRIBUTION OF MARKS						Total Marks	Remarks
								Theory			Practical				
			L	T	P	Lab		Assmt. Marks	Final Marks	Time Hours	Assmt. Marks*	Final Marks	Time Hours		
1	EG 1201 SH	Engineering Mathematics II	3	1			4	20	80	3				100	*Continuous assessment
2	EG 1202 SH	Engineering Physics II	3	1		2	6	20	60	3	10	10	2	100	
3	EG 1203 SH	Engineering Chemistry II	3	1		2	6	20	60	3	10	10	2	100	
4	EG 1204 ME	Engineering Drawing II			4		4				60	40	4	100	
5	EG 1215 EX	Electronics Engineering	2			1	3	20	60	3	10	10	2	100	
6	EG 1201 ME	Material Science	3			1	4	20	60	3	10	10	2	100	
7	EG 1202 ME	Engineering Mechanics	3			1	4	20	60	3	10	10	2	100	
8	EG 1203 ME	Workshop Technology II (Foundry & Welding)	3		6		9	20	80	3	60	40	4	200	
TOTAL			20	3	10	7	40	140	460		170	130		900	

DIPLOMA IN AUTOMOBILE ENGINEERING

YEAR: II

SEMESTER I

S.N.	Code No.	Subject	Mode				Total Hours	DISTRIBUTION OF MARKS						Total Marks	Remarks
								Theory			Practical				
			L	T	P	Lab		Assmt. Marks	Final Marks	Time Hours	Assmt. Marks*	Final Marks	Time Hours		
1	EG 2101 AE	Machine Elements and Mechanism	3			1	4	20	60	3	10	10	2	100	
2	EG 2110 ME	Thermal Engineering I	3	1		1	5	20	60	3	10	10	2	100	
3	EG 2101 CT	Computer Applications	2		2		4	10	40	1.5	30	20	2	100	
4	EG 2111 ME	Machine Drawing			4		4	-	-		60	40	4	100	
5	EG 2107 ME	Elements of Engineering Economics	2				2	10	40	1.5	-	-		50	
6	EG 2108 ME	Strength of Materials	3			2	5	20	60	3	10	10	2	100	
7	EG 2102 AE	Automotive Technology I	4		9		13	20	80	3	120	80	6	300	
8	EG 2103 AE	Metrology and Measurement	2			1	3	20	60	3	10	10	2	100	
TOTAL			19	1	15	5	40	120	400		250	180		950	

SEMESTER II

YEAR: II

S.N.	Code No.	Subject	Mode				Total Hours	DISTRIBUTION OF MARKS						Total Marks	Remarks
						Theory			Practical						
			L	T	P	Lab		Assmt. Marks	Final Marks	Time Hours	Assmt. Marks*	Final Marks	Time Hours		
1	EG 2211 EX	Mechatronics	3		2		5	20	60	3	10	10	2	100	*Continuous assessment
2	EG 2208 ME	Thermal Engineering II	3	1		1	5	20	60	3	10	10	2	100	
3	EG 2209 ME	Industrial Management	3				3	20	80	3	-	-		100	
4	EG 2201 AE	Automotive Technology II	4		11		15	20	80	3	120	80	6	300	
5	EG 2210 ME	Fluid Mechanics and Fluid Machines	3	1		1	5	20	60	3	10	10	2	100	
6	EG 2202 AE	Elective (One of the following)	2		5		7	10	40	1.5	60	40	4	150	
	EG 2202 AE	a. Body Shop Repair and Maintenance													
	EG 2202 AE	b. Motor Cycle Repair & Maintenance													
	EG 2202 AE	c. Automobile Air Conditioning													
	EG 2202 AE	d. Automobile Service Management													
		TOTAL	18	2	18	2	40	110	380		210	150		850	

DIPLOMA IN AUTOMOBILE ENGINEERING

YEAR: III

SEMESTER I

S.N.	Code No.	Subject	Mode				Total Hours	DISTRIBUTION OF MARKS						Total Marks	Remarks
								Theory			Practical				
			L	T	P	Lab		Assmt. Marks	Final Marks	Exam Hour	Assmt. Marks	Final Marks	Exam Hour		
1	EG 3111 EE	Control Systems	3			1	4	20	60	3	10	10	2	100	*Continuous assessment
2	EG 3105 ME	Computer Graphics (AutoCAD)			3		3	-	-		30	20	2	50	
3	EG 3109 ME	Fundamentals of Hydraulics and Pneumatics	3			1	4	20	60	3	10	10	2	100	
4	EG 3110 ME	Machine Design, Estimating and Costing	3		1		4	20	60	3	10	10	2	100	
5	EG 3101 AE	Automotive Technology III	4		9		13	20	80	3	60	40	4	200	
6	EG 3102 AE	Industrial Orientation			3		3				50			50	
7	EG 3103 AE	Automotive Electronics I	3		3		6	20	80	3	30	20	2	150	
8	EG 3104 AE	Occupational Health and Safety	3				3	20	80	3				100	
TOTAL			19		19	2	40	120	420		200	110		850	

YEAR: III

SEMESTER II

S.N.	Code No.	Subject	Mode				Total Hours	DISTRIBUTION OF MARKS						Total Marks	Remarks
			L	T	P	Lab		Theory			Practical				
								Assmt. Marks	Final Marks	Exam Hour	Assmt. Marks	Final Marks	Exam Hour		
1	EG 3201 AE	Automotive Electronics II	3		2		5	20	60	3	10	10	2	100	
2	EG 3202 MG	Personnel Management	2				2	10	40	1.5	-	-		50	
3	EG 3201 MG	Entrepreneurship Development	3		2		5	20	60	3	10	10	2	100	
4	EG 3202 AE	Automotive Technology IV	3		8		11	20	80	3	60	40	4	200	
5	EG 3203 AE	Vehicle Driving Practice			3		3				30	20	2	50	
6	EG 3204 AE	Industrial Attachment			14		14				200	100	6	300	
		TOTAL	11		29		40	70	240		310	180		800	

First Semester Subjects:

1. EG 1101SH 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 1106 ME Engineering Drawing I
7. EG 1107 ME Workshop Technology I (Metal & Woodwork)
8. EG 1108 EE Elements of Electrical Engineering

कम्युनिकेसन नेपाली

ई.जी. १९०९ एस.एच.

वर्ष: प्रथम
सेमेष्टर: प्रथम

जम्मा: २ घण्टा/ हप्ता
प्रवचन: २ घण्टा/ हप्ता
पूर्णांक : ५०

कोर्सको 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 ।

कोर्सको 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 विषय वस्तु

एकाइ १: संचारात्मक 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, काठमाण्डौ
- लालानाथ सुवेदी, इन्जिनियरिङ नेपाली विद्यार्थी पुस्तक भण्डार, भोटाहिटी, काठमाण्डौ ।
- लालानाथ सुवेदी, नेपाली व्याकरण, बोध/रचना (सम्बन्धित अंश मात्र) विद्यार्थी पुस्तक भण्डार, भोटाहिटी, काठमाण्डौ ।
- 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
Tutorial: hours/week
Practical: hours/week
Lab: 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:

Unit 1. English sound and basic structures:	[2]
1.1. Define with examples: <ul style="list-style-type: none">▪ Phonemes▪ Morphemes	
1.2. Introduction to English sounds with examples: <ul style="list-style-type: none">▪ The Vowels▪ The Consonants	[2]
1.3. Dictionary skills <ul style="list-style-type: none">▪ Alphabetical order▪ Dictionary entry▪ Guide words, head words	[3]
1.4. Spellings <ul style="list-style-type: none">▪ British and American English spelling	[1]
Unit 2. Introduction to grammatical units with examples:	
2.1 Grammatical units <ul style="list-style-type: none">▪ The word▪ The phrase▪ The clause	[2]

2.1	<ul style="list-style-type: none"> ▪ The sentence 	[2]
2.2	Types of sentence <ul style="list-style-type: none"> ▪ Forms ▪ Function 	
2.3	Communicative functions <ul style="list-style-type: none"> ▪ Introducing ▪ Requests and offers ▪ Expressing gratuities ▪ Expressing likes/dislikes ▪ Asking for permission ▪ Agreeing/disagreeing ▪ Encouraging/discouraging ▪ Inviting/making invites ▪ Accepting/decling ▪ Suggesting/advising ▪ Making and receiving telephone calls ▪ Group discussing and presentation 	[4]
Unit 3.	Reading: <ul style="list-style-type: none"> ▪ Reading comprehension ▪ Defining trade related terminologies 	[2]
Unit 4.	Writing skills in English: <ul style="list-style-type: none"> 4.1. Writing paragraphs 4.2. Writing dialogues 4.3. Writing precies/summaries 4.4. Writing letters <ul style="list-style-type: none"> ▪ 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 Memo 4.10. Writing instructions 4.11. Writing technical proposal 	[12]

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, L.A. introduction to Linguistics, Longman York press, 1991.
7. Blundell, Jon, Higgins, 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

- Trigonometric ratios and equations, inverse circular functions and properties of triangles
- Straight lines, angle between lines, circle and parabola
- The progressions, permutations and combinations, binomial theorem, exponential and logarithmic series as well as the quadratic and polygonal equations
- 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
 - General form
 - Tangents and normal
- 2.4. Parabola:
 - Standard equation
 - Tangents and normal

Unit 2. Algebra:

[12]

- 3.1. Progressions:
 - A.P., G.P. and H.P.
- 3.2. Permutations and combinations
- 3.3. The binomial theorem for any index
- 3.4. Series:
 - Exponential & logarithmic
- 3.4. Equations:
 - Quadratic & polynomial

Unit 3. Set relation and function:

[8]

- 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. Calculus:

[16]

- 5.1. Limit of community.

- 5.2. Derivatives from definition of simple functions like:
 - x^n , $(ax+b)^n$, $\sin(ax+b)$, e^{ax} , a^x , and $\log x$.
- 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 Publication 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:

- a. 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.

b. 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

c. 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.

d. **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 H₂, O₂, and Cl₂
- 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= $2 \times V.D.$, in the deduction of atomicity of elementary gases H_2 , Cl_2 , O_2 , and N_2)
 - 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, gramper 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. H₂, O₂, N₂, CH₄, H₂O, NH₃, C₂H₂
 - Coordinate co-valency eg. H₂O₂, SO₂, O₃, SO₃
 - Electronic dot structure of some compounds eg. H₂SO₄, CaCO₃, K₂SO₃
- 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 O₂, O₃, oxyacids, halogens, K₂Cr₂O₇, KMnO₄
 - Reducing agent: Definition and eg. H₂, H₂S with some examples,
 - auto-oxidation eg. H₂O₂, HNO₂, SO₂
 - Idea of oxidation number
 - Balancing chemical equation by oxidation number method
- 3.7 Atomic structure:
- Subatomic particles (electron, proton and neutron)
 - Classical α - 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 (CuSO₄, Zn, Mg, Al, Fe, CCl₄, C₆H₆, C₂H₅OH) [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 1106 ME

Year: I
Semester: I

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

Course description:

This course deals with geometrical construction, orthographic projections and basic techniques of freehand sketch.

Course objectives:

After completing this course the students will be able to:

- Represent different shapes accurately by applying geometrical constructions,
- Project point, line, plane and geometrical solids,
- Represent three dimensional objects in orthographic from and dimension them,
- Use freehand techniques to sketch different shapes.

Course content:

Unit 1: Introduction

[4]

- 1.1 Engineering drawing as graphic language
- 1.2 Drawing instruments
- 1.3 Scale: Reduced scale, enlarged scale, full size scale
- 1.4 Conventional line types
- 1.5 Sheet size and sheet layout
- 1.6 Exercise on drawing horizontal, vertical and inclined lines and conventional line types [*Sheet 1*]

Unit 2: Technical Lettering

[4]

- 2.1 General procedure for freehand technical lettering: letter stroke, letter proportion, use of pencil and pens, uniformity of letters
- 2.2 Single stroke vertical capital letters, Single stroke inclined capital letters, Single stroke vertical lowercase letters, Single stroke inclined lowercase letters, vertical and inclined numerals, vertical and inclined fractions
- 2.3 Lettering using templates
- 2.4 Exercise on freehand technical lettering and lettering using templates [*Sheet 2*]

Unit 3: Geometrical Construction

[12]

- 3.1 Construction on straight lines and angles
Bisection and trisection of a straight line, Bisection and trisection of an angle, To draw perpendicular lines, To draw parallel lines, To divide a straight line into any

number of equal parts, To divide a straight line proportionately, To draw an angle equal to given angle

3.2 Construction of polygons

To draw triangles, To inscribe a circle of a triangle and circumscribe a circle about a given circle, To draw squares, To draw a regular polygon, To draw a regular hexagon, To draw a regular octagon, To draw a regular polygon (general method)

3.3 Exercise on construction on straight lines and angles and construction of polygons [Sheet 3]

3.4 Construction on circular arcs and circles

To determine center of a given arc, To draw a circle passing through three given points, To draw an arc tangent to given two straight lines, To draw an arc tangent to given straight line and a given circle or circular arc, To draw an arc tangent to given two circles or circular arcs, To draw open belt and cross belt tangents, To draw an ogee curve between two parallel lines

3.5 Exercise on construction on circular arcs and circles [Sheet 4]

3.6 Construction of standard curves

Construction of parabola, ellipse, hyperbola, cycloid, helix, spiral, involute

3.7 Exercise on construction of standard curves [Sheet 5]

Unit 4: Dimensioning

[4]

4.1 Dimensioning terms and notations

4.2 Techniques of dimensioning: Size and location dimensioning

4.3 Placement of dimensions: Aligned and Unidirectional system

4.4 Rules for dimensioning and conventions

4.5 Exercise on dimensioning of two dimensional figures including straight line, angles, circles, circular arcs [Sheet 6]

Unit 5: Projection of Points, Lines and Planes

[8]

5.1 Principle of projection

5.2 Principle planes of projections, four quadrants

5.3 Projection of point

Projection of point on two planes of projection, Projection of point on three planes of projection

5.4 Projection of line

Projection of line perpendicular to VP, Projection of line perpendicular to HP, Projection of line parallel to both VP and HP, Projection of line parallel to VP and inclined to HP, Projection of line parallel to HP and inclined to VP, Projection of line inclined to both VP and HP

5.5 Exercise on projection of point and line [Sheet 7]

5.6 Projection of plane

Projection of plane parallel to VP, Projection of plane parallel to HP, Projection of plane perpendicular to both VP and HP, Projection of plane perpendicular to VP and inclined to HP, Projection of plane perpendicular to HP and inclined to VP

5.7 True Length of an Oblique Line

5.8 True shape of an Oblique Plane

- 5.9 Exercise on projection of plane; true length of an oblique line; true shape of an oblique plane [Sheet 8]

Unit 6: Projection of Geometrical Solids [4]

- 6.1 Types of Solids: Polyhedra and Solids of revolution
6.2 Projection of geometrical solids: Prism, Cylinder, Pyramid and Cone
6.3 Projection of points on the surfaces solids
6.4 Exercise on projection of cylinder, prism, cone and pyramid; Projection of points on the surfaces of these solids [Sheet 9]

Unit 7: Orthographic Projection [20]

- 7.1 Principle of Orthographic Projection
7.2 Systems of Orthographic Projection: First Angle and Third Angle
7.3 Making an Orthographic Drawing
7.4 Analysis in Three Views
7.5 Exercise on orthographic projection of rectangular objects with horizontal and vertical plane surfaces [Sheet 10]
Exercise on orthographic projection of rectangular objects with inclined plane surfaces [Sheet 11]
Exercise on orthographic projection of objects with cylindrical surfaces [Sheet 12 & 13]
Exercise on orthographic projection and dimensioning [Sheet 14]

Unit 8 Freehand Sketching [4]

- 8.1 Techniques of Sketching: Pencil hardness, paper with grid or lines
8.2 Techniques for horizontal and vertical lines; arcs and circles
8.3 Exercise on freehand sketches of different shapes with lines, arcs, and circles [Sheet 15]

Reference:

1. Luzadder, W.J., Fundamental of Engineering Drawing, Prentice-Hall of India Pvt-Ltd., New Delhi, Latest edition.
2. Bhatt N. D. and Panchal V.M. Engineering Drawing, Charotar Publishing House, 2001.
3. Gill P.S, Engineering Drawing, S. K. Kataria & Sons, New Delhi, 2004/2005

Workshop Technology I

(Metal & Wood Work)

EG 1107 ME

Year: I
Semester: I

Total: 12 hours/week
Lecture: 3 hours/week
Tutorial: hours/week
Practical: 9 hours/week
Lab: hours/week

Course description:

This subject deals with the identify basic hand tool, measuring instrument, power tools, uses, care and safety in the mechanical, wood work engineering area.

Course objectives:

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

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

Course contents:

Unit 1: Safety in the workshop [1]

- 1.1 Workshop rules.
 - Cause of accident and prevention.
 - Safety environment.
 - Used the protective cloths, and equipment.
 - Arrange the workshop, hand tools.

Unit 2: Laying Tools [1]

- 2.1 Layout tools
 - Identify the scribe, punch, divider, surface plate, v-block and vernier height gauge.
 - Select the tools for the line and point on the surface.
 - Handle the layout tools, care and maintenance.
- 2.2 Hammer \hammering
 - Identify the ball, cross, straight, claws and soft hammers.
 - Select the hammers for the driving, chipping, punching, pulling nails, riveting and fitting.
 - Holding handles and replace handle. Be care when the stroking by hammer.
- 2.3 Wrenches
 - Identify the single, double, pipe and the adjustable wrenches.
 - Wrench holding and processes of tightening and opening the elements and parts.
- 2.4 Work holding device

- Identify the bench, machine, pipe and chain vices.
- Select the device and uses.
- After uses clean and maintenance the vices, protect vice jaws and work pieces.

Unit 3: Cutting tools

[14]

3.1 Chisels

- Identify the cross, diamond and round chisels.
- Select the angle of the chisels and removing metal from the surface.
- Holding the hammer and chisel and chipping processes.
- Uses the chipping guard, care and maintenance the work place and tools.

3.2 Handsaw and sawing

- Select the hand saw, blade, cutting metal.
- Method of the holding the work piece and rules of sawing.

3.3 Files and filing

- Identify the parts, shapes, sizes, cuts of the files.
- Select the file for the shaping different types of the metal and surface finish accuracy $\pm 0.2\text{mm}$.
- Method of the holding, balancing and the direction of the filing.
- Clean and store the files.

3.4 Reamer and reaming

- Types of the reamers, hand, taper and adjustable reamers.
- Select the holding device, reamer, drill speed.
- The method of the reaming on the metal.
- Clean and store the reamers.

3.5 Thread and threading

- Name of the taps, dies, handle, kinds of the thread, size, angle, main part of the thread and uses.
- The method of the producing the thread by the taps and dies, lathe machine, rolling, pressing.
- Clean and store the tools.

3.6 Scraper and scraping

- Identify the flat, three side and curve scraper.
- The method of the scraping and the qualities of the surface.

Unit 4: Measuring instrument

[2]

- 4.1 Identify the vernier caliper, micrometer, try square, bevel protractor, wire, and filler radius and thread gauge.
- 4.2 The main parts of the measuring instrument, accurately reading the scale of the measuring instrument.
- 4.3 The rules of the measuring and using the measuring instrument.
- 4.4 Care and store the measuring instrument.

Unit 5: Rivet and riveting

[1]

- 5.1 Identify the rivets, size, head, metal, riveting sets punches.
 - Calculate the length, diameter of rivet and head.
 - The procedure of the riveting and the joints mistakes.

- Unit 6: Solder and soldering** [1]
- 6.1 Name of the soldering iron, types of solder, cleaning tools and the fluxes.
- Select the source of heat and temperature.
 - The process of cleaning and the joining work metal.
 - Care and the prevent accidents. Safely uses of the equipments.
- Unit 7: Shear and shearing** [2]
- 7.1 Identify the hands, press, torch, snip, shear tools.
- Select the method of the shearing sheet, rod, and square, flat angle metal.
 - Observe the safety rules and care of the tools.
- Unit 8: Bend and bending** [1]
- 8.1 Name of the bending devices, vice pliers, range, hand bar and fork.
- Select the folding, radius bending and rolling.
 - The method of bending the metal bar, flat and the plate.
 - Bending the metal into many shapes and the maintenance of the tolls and equipments.
- Unit 9: Power tools** [2]
- 9.1 Drill machines
- Identify the hand drill machine, bench, gang, colon and radial drill machine.
 - Select the correct types of the machine.
 - The correct method of using the drilling machine.
 - Select the correct speed and the fit for different size of the drill and the metal.
- 9.2 Drill and drilling
- Identify the different kinds of drill size, purpose and angle.
 - Select the work and the drill, holding tools, equipments.
 - Operates all the types of drill machine of the drill holes of acceptable standards.
 - Name the operation of the drill machines and the function by coolant.
 - Operate the machine safely and use safety equipments.
- Unit 10: The sheet metal work** [10]
- 10.1 Hand tool metal
- Identify the types of the sheet metal, mild steel, galvanized steel. Copper, brass, aluminum familiar with sizes and thickness of the sheet metals.
 - Measure the sheet with the gauge and instruments.
- 10.2 Marking tools
- Identify and uses of sheet metal, marking tools, scribe, rules, try square, punch, divider, trammel and depth gauge.
 - Select the marking and sheet metal tools and uses such as the hand snipes, stacks, punch plat, hatchet, blow horn, hand punch, pop riveters fork devices, hammers, fly cutter, groove, seaming tools.
- 10.3 Power tools
- Identify the bending, rollers, folders, and edge forming, sawing, crimping, spot welding and polishing parts.

- Understand, select, adjust, controls and to operate the power tools. Cut the sheet for final shape or the forming.

10.4 Development sheet

- Select the lines and develop for apply in the workshop.
- Mark cut and the produce patterns, templates for sheet boxes, book stand, scoop, tool box, funnel pipe and machine guards.

10.5 Sheet metal joining

- Familiar with the proportions of the sheet metal joints, relative the tools.
- Uses the hand tools for the single and double edge lap joints.

10.6 Safety

- Know and to take precaution against from the unsafe condition in the sheet metal workshop.
- Wear the safety dresses and equipments in the workshop.
- Safely maintenance the workshop floor, hand tools, hand power tools.

Unit 11: Wood work and working

[10]

11.1 Hand tools

- Identify the marking, divider, saw, wood chisel, hammer, wild stone, planner, boring, drilling, driving, cramping and the holding tools.

11.2 Power tools

- Name the drill place, sander, jig saw, planner, circular saw, surface facer, thickness, hand saw and routers.
- Select and uses, operate controls; adjust all hand tools and the machine.

11.3 Measuring tools

- Identify the measuring tools and is familiar with the range of rules, tabs and non precision measuring tools.
- Reads the graduation of metric scale, transfers directly by the caliber scale to the work pieces, use the caliber to measure inside and outside dimension of the work pieces.
- Clean, clear and stores after uses.

11.4 Timber

- Setting, marking and cutting of timbers. Using saw and cutting tools.
- Wood work joints, halving, notching, cogging, bridle, mortice, tenon and dove tails.
- Types of the joint, lengthening, bearing, widening and angle.
- Select the timber, plywood and fitting accessories and fastening materials.
- Construction carpentry: Assemble the door frames, leveling, and bracing for fixing to the brick work. Correct sizes for hanging, closing and securing to produce bracket, shelve, table and tool box.
- Handle the tools safely and efficiently. The replace guards rules of the general safety in the wood workshop.

Reference books:

1. Workshop Technology(Vol. 1)By S. K. Hajra Chaudhary
2. Shop Theory (Vol. 1)By Henp Fort Trade School

Practical

S.N.	Task practical	Time: 145 hrs	Remark key point
1	Marking : straight, curve,dot	5 hrs	
2	Measuring: rules, vernier caliper, gauge	10 hrs	
3	Hammering by ball, cross, soft straight pin	5 hrs	
4	Sawing by hand saw power	3 hrs	
5	Filling with single , double and rasp cut	15 hrs	
6	Chiseling by the flat, cross, concave, power chisel	2 hrs	
7	Reamering: Hand and adjustable	3 hrs	
8	Threading: Tap and dies	3 hrs	
9	Scrapping: Flat and curve on the metal surface	3 hrs	
10	Rivetting: Rivetted sets pup riveter	3 hrs	
11	Soft soldering: Solder, heat joint metal	5 hrs	
12	Shearing: Snip, press folds	5 hrs	
13	Bending by plier, range, hand, bar, fork and power tools	5 hrs	
14	Holding: Bend, machine pipe and the devices	5 hrs	
15	Power tools operating: Drill, folding, rolling, radius bending, spot welding, grinding, beading, crimping, edge forming, hacksaw machines	10 hrs	
16	Drilling: Counter sink, counter boring, reaming, thread cutting	5 hrs	
17	Sheet metal working: Hands pipe bend plot, blow horn, groove and seaming	5 hrs	
18	Developing: Patterns, templates, for the sheet boxes, book stand, scoop funnel, pipe and the machine guards	5 hrs	
19	Wood working: Marking, measuring, sawing, chiseling, boring, planning, drilling, cramping, holding, size facing	10 hrs	
20	Joining: Halving, notching, cogging, bridle, tenon dovetails joints, wide and angle joining Constructing: Door frame, bracing, fixing, hanger, closing, securing, fitting, fastening	10 hrs	
21	Maintenance: Cleaning and storing, working place Test	2 hrs 6 hrs	

S. N.	Project	Skill	Metal	Mm size/	Time hrs	Free hand sketch
1	Hammer	Measuring, marking, sawing, filing, drilling, thread cut	Tool steel 1 pc	25x25x155	6	
2	Papper height	Measuring, marking, sawing, filing	M. S. rod 1 pc	Ø 30x30	12	
3	G. Clamp	Measuring, marking, dot, punching, drilling, chiseling, sawing, filing		10x100x70	12	
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	6	
6	Hammer handle	Measuring, marking, filing, thread cutting	M.S. rod	Ø 2x210	3	
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	6	
9	Hanger	Measuring, marking, bending, joining	G. I. wire	Ø 3x800 or 1000	3	
10	Candle light	Measuring, marking, cutting, filing, bending, drilling, thread cutting	M.S. flat	10x100x150 3x25x300	15	
11	Try square	Measuring, marking, cutting, filing, riveting, drilling	M.S. flat M.S. sheet	10x20x80 2x15x120	6	
12	Hand vice	Measuring, marking, cutting, filing, drilling, counter sink, reaming, thread cutting	M.S., M.S. rod	16x16x200 Ø 12x70 Ø 8x80	12	
13	G.I. box	Measuring, marking, cutting, hem, seaming, folding, riveting, soldering	G.I. sheet 22 gauge	200x200	3	
14	Funnel	Measuring, marking, rolling, seaming, soldering	G.I. sheet 22 gauge	100x300	3	
15	Store box	Measuring, marking, heming, seaming, cutting, folding, rivetting	G.I. sheet 22 gauge	400x500	6	
16	Hand tool box	Measuring, marking, heming, seaming, cutting, folding, riveting	Block sheet	1.5 600x1000	15	
17	Practical test	Enval the all the bench work Sharping the hand tool and power tool	As per need	As per need	6	

Elements of Electrical Engineering

EG 1108 EE

Year: I
Semester: I

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

Course description:

This course deals with the fundamental of electrical quantities, electro-magnetic field and d.c. & a.c. circuit analysis. It also describe the about electrical machines, supply & installation, measurement, maintenance and safety.

Course objectives:

After completing this course the students will be able to:

- identify the fundamental principles of electrical engineering
- apply the basic electro-technology in the mechanical engineering
- identify & verify the role of electrical energy on production process

Course contents:

Unit 1.	Introduction	[1]
	1.1 Brief history of the generation of electricity in Nepal	
	1.2 Energy sources and production	
	1.3 Application of electrical energy in the field of mechanical engineering.	
Unit 2.	Fundamentals of electricity	[2]
	2.1 Concept of atomic structure and electric charge	
	2.2 Concept of electric voltage and current	
	2.3 Concept of resistor, inductor and capacitor	
Unit 3.	Electric Laws and d.c. circuit	[6]
	3.1 Electric circuit.	
	3.2 Ohm's law	
	3.3 Kerchiefs laws.	
	3.4 Network analysis	
	3.5 Electrical work, energy and power	
Unit 4.	Electric and magnetic field	[6]
	4.1 Fundamental concept of electric field	
	4.2 Laws of electric field and electrostatic induction	
	4.3 Fundamental concept of magnetic field	
	4.4 Electro-magnetism and electro-magnetic induction.	

	4.5 Magnetic material, magnetic circuit and application	
Unit 5.	Chemical effect of electricity	[2]
	5.1 Basic concept	
	5.2 Faradays laws of electrolysis	
	5.3 Electro chemical voltage generation	
Unit 6.	Single & three phase a.c. circuit analysis	[8]
	6.1 Generation of an alternating voltage	
	6.2 A.C. quantities	
	6.3 Loads in a.c. circuit	
	6.4 Power in a.c. circuit	
	6.5 Three phase a.c. circuit	
Unit 7.	Electrical Machine	[8]
	7.1 Transformer: types, construction, working principle, loaded and no-load operation of transformer	
	7.2 D.C. machine: types, construction, working principle of motor and generator, methods of excitation, armature reaction, back emf in dc motor	
	7.3 A.C. machine: types, construction, working principle of motor and generator.	
	7.4 Selection of electric motor.	
Unit 8.	Electrical measurement, supply and installation	[6]
	8.1 General concept of supply and distribution of electric system.	
	8.2 Basic concept of electrical installation, control and protection	
	8.3 Electrical measuring units, instruments and measurement method.	
Unit 9.	Electrical maintenance and safety	[4]
	9.1 Concept of preventive maintenance and routine check	
	9.2 Basic maintenance of electric system	
	9.3 Concept of safety rules and regulation	
	9.4 First aid steps to be taken in electrical accident	
Unit 10.	Basic industrial electronics	[5]
	10.1 Introduction to semiconductor material, diodes, transistors, thyristors, electronic valves and IC chips and their simple working principle, construction and application.	
	10.2 Simple electronics circuits of transistor, rectifying, amplifying, control etc.	

Practical

1. Determine the characteristics of voltage vs resistance on a) Tungsten Filament b) Carbon resistor
2. Verify Kirchhoff's Laws in series and parallel circuits.
3. Measure power, power factor, vars and phaser diagram in RL and RC circuit.
4. Study RLC resonance circuit
5. Measure of power and power factor in balanced three-phase circuit using two single-phase watt meters.
6. Determine the following parameters for single phase transformer:
 - a) Polarity of primary and secondary windings
 - b) Voltage ratio transformer
7. Perform open circuit and short circuit test on a single-phase transformer and calculate its equivalent circuit parameters, efficiency and voltage regulation.
8. Determine magnetizing characteristics of a separately excited d.c. generator for different speed and plot the complete hysteresis loops for one speed.
9. Perform speed control of a d.c. motor using:
 - a) field current control
 - b) armature voltage control
10. Perform No-load and blocked-rotor tests on a 3-phase induction motor.
11. Familiarize diodes, rectifiers, bipolar transistor and operational amplifiers.

Textbooks/Reference books

1. Vincent Del Toro, "Principles of Electrical Engineering", Prentice Hall of India.
2. Leonard S. Bobrow, "Fundamentals of Electrical Engineering", published in India by Oxford University Press.
3. B. L. Theraja, A. K. Theraja, "A textbook of Electrical Technology", S.Chand & Company Ltd., India
4. Jain & Jain, "ABC of Electrical Engineering", Dhanpat Rai Publishing Company, India.
5. S N Tiwari, A S Bin Saroor, "A first course in Electrical Engineering", A. H. Wheeler Co. Ltd., India.

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 1204 ME Engineering Drawing II
5. EG 1215 EX Electronic Engineering
6. EG 1201 ME Material Science
7. EG 1202 ME Engineering Mechanics
8. EG 1203 ME Workshop Technology II (Foundry & Welding)

Engineering Mathematics II

EG 1201 SH

Year: I
Semester: II

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

- Explain the concepts of vectors in plain and vectors in space and apply them in the field of the related engineering area
- Explain the concepts of the complex numbers, linear inequalities and programming apply them in the field of the related engineering area.
- Explain the concepts of determinants and matrices and apply them in the field of the related engineering area
- Explain the concepts of determinants and matrices and apply them in the field of the related engineering area
- Explain the concepts of applications of derivatives and areas of curves and apply them in the field of the related engineering:
- Explain the concepts of coordinates in space and planes and apply them in the field of the related engineering area
- 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 $A + ib$. <ul style="list-style-type: none"> 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. <ul style="list-style-type: none"> 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, <ul style="list-style-type: none"> Algebra of matrices, Properties of determinants, Ad joint and inverse of matrices. Solution of linear equations using Cramer's rule Row equivalent matrices Idea of polynomial equations 	
Unit 3.	Calculus:	[9]
3.1.	Applications of derivatives- <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> Use of definite integral as limit of a sum to find areas under curves Areas of closed curves and Areas between curves. 	
3.3.	Antiderivatives: <ul style="list-style-type: none"> Curve tracing, maxima and minima Riemann 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: <ul style="list-style-type: none"> Introduction to statistics Measures of Central Tendency Measures of Dispersion Moments, Skewness and Kurtosis Correlation and Regression 	
5.2.	Probability: <ul style="list-style-type: none"> 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 Publication 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 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:

- Explain the basic concepts related to the electricity and apply it in the field of the related engineering area
- Explain the basic concepts related to the waves and apply it in the field of the related engineering area
- Explain the basic concepts related to the properties of matter and apply it in the field of the related engineering area
- 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:
- Seebeck 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 modules, 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 hours/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:

- Nonmetals and their compounds
- Metals and their compounds
- 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 "Sulpherdioxide")
- 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, H₂SO₄(dil.)& HNO₃ (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 Woulff bottle but in Kipp's apparatus commonly) [2]
8. To detect the acid radicals (Cl⁻, NO₃⁻, SO₄²⁻, CO₃²⁻) by dry and wet ways (4)
9. To detect the basic radicals (Cu⁺⁺, Al⁺⁺⁺, Fe⁺⁺⁺, Zn⁺⁺, CO⁺⁺, Ni⁺⁺, Ca⁺⁺, Ba⁺⁺, Mg⁺⁺) 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

EG1204 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 deals with sectional view, pictorial projections, development of surfaces and intersection of solids.

Course objectives:

After completing this course the students will be able to:

- Draw sectional view of the given three dimensional solid,
- Draw pictorial projections from the given orthographic views,
- Develop the surfaces of the geometrical solids, and,
- Draw interpenetration line/curve for the given intersecting solids.

Course content:

Unit 1: Sectional Views

[8]

- 1.1 Use of sectional views
- 1.2 Cutting plane line and hatching lines
- 1.3 Types of Section: Full section and Half Section
- 1.4 Exercises on Full Section [Sheet 1]
Exercise on Half Section [Sheet 2]

Unit 2: Pictorial Projection: Isometric Drawing

[12]

- 2.1 Introduction to Axonometric projection
- 2.2 Isometric projection and isometric drawing
- 2.3 Procedure of Making an Isometric Drawing
- 2.4 Non isometric Lines and Non isometric surfaces
- 2.5 Box and coordinate construction method
- 2.6 Angles in isometric
- 2.7 Circles and circular arcs in isometric
- 2.8 Orientation of object in isometric drawing
- 2.9 Exercise on isometric drawing of rectangular objects with horizontal and vertical planes [Sheet 3]
Exercise on isometric drawing of rectangular objects with inclined planes [Sheet 4]
Exercise on isometric drawing of objects with cylindrical surfaces and cylindrical holes [Sheet 5]

- Unit 3: Oblique Drawing** [4]
- 3.1 Oblique projection and Oblique drawing
 - 3.2 Procedure of Making an Oblique Drawing
 - 3.3 Rules for Placing Object in Oblique
 - 3.4 Angles, Circles and Circular Arcs in Oblique
 - 3.5 Cavalier and Cabinet Projection
 - 3.6 Exercise on oblique drawing of objects with plane and curved surfaces [Sheet 6]
- Unit 4: Surface Development** [16]
- 4.1 General concepts and practical considerations
 - 4.2 Development of Right solids: Cylinder, Prism, Cone and Pyramid
 - 4.3 Development of Oblique solids: Cylinder, Prism, Cone and Pyramid
 - 4.4 Development of Truncated solids
 - 4.5 Exercise on development of truncated right prism and cylinder [Sheet 7]
Exercise on development of truncated right pyramid [Sheet 8]
Exercise on development of truncated right cone [Sheet 9]
Exercise on development of oblique solids [Sheet 10]
- Unit 5: Intersection of solids** [12]
- 5.1 Lines of intersection of geometric surfaces
 - 5.2 Intersection of two cylinders
 - 5.3 Intersection of two prisms
 - 5.4 Intersection of a prism and a cylinder
 - 5.5 Intersection of a prism and a pyramid
 - 5.6 Intersection of a prism and a cone
 - 5.7 Intersection of a cylinder and a cone
 - 5.8 Intersection of a cylinder and a pyramid
 - 5.9 Exercise on intersection of two cylinders, intersection of two prisms, intersection of a prism and a cylinder [Sheet 11]
Exercise on intersection of a prism and a pyramid, intersection of a prism and a cone [Sheet 12]
Exercise on intersection of a cylinder and a cone, intersection of a cylinder and a pyramid [Sheet 13]
- Unit 6: Pattern Making** [8]
- 6.1 Pattern of three dimensional solids
 - 6.2 Pattern of geometrical solids
 - 6.3 Pattern of intersecting solids
 - 6.4 Exercise on patterns of any two solid objects from Sheet 1 and 2 [Sheet 14]
Exercise on patterns of any two solid objects from Sheet 7, 8, 9 and 10 [Sheet 15]

Reference:

1. Luzadder, W.J., Fundamental of Engineering Drawing, Prentice-Hall of India Pvt. Ltd., New Delhi, Latest edition.
2. Bhatt N. D. and Panchal V.M., Engineering Drawing, Charotar Publishing House
3. Gill P.S, Engineering Drawing, S. K. Kataria & Sons, New Delhi, latest edition

Electronics Engineering

EG 1215 EX

Year: I
Semester: II

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

Course description:

This course deals with Electronic engineering related with mechanical engineering. It also describes various applications of theories including digital electronics and logic devices.

Course objectives:

After completing this course the student will be able to:

- Explain Importance of electronics in modern society.
- Identify integrated circuit
- Identify digital electronics
- Identify combinational logic devices
- Identify sequential logic devices
- Identify analog and digital conversion
- Identify memory

Course contents:

- Unit 1. Introduction:** [2]
- 1.1. Importance of electronics in modern society.
 - 1.2. Use of electronics in Mechanical Control system and automation.
- Unit 2. Introduction to Electronic Passive Components** [3]
- Resistive components**
- 2.1. Introduction to Resistor.
 - 2.2. Classification of resistors. Fixed Resistors, Variable Resistors, Adjustable Resistors and Special Resistors.
 - 2.3. Resistor Color Codes
 - 2.4. Resistor Circuits. Series Circuit, Parallel Circuit and Series - Parallel Combined Circuits.
 - 2.5. Characteristics, application and demonstration of Thermistors (PTC, NTC), LDR (Light Dependant Resistor).
 - 2.6. Characteristics, application and demonstration of Thermistors (PTC, NTC), LDR (Light Dependent Resistor).

Unit 3. Inductive Components

[2]

- 3.1 Introduction to Inductive Components and basic construction.
- 3.2 Types of Inductors used in electronic equipment.
- 3.3 Classification of Inductors in terms of operation frequency.
- 3.4 Inductance Circuits. Series Circuit, Parallel Circuit and Series - Parallel Combined Circuits.
- 3.5 Demonstration of various types of inductive components indicating briefly their application.

Unit 4. Capacitive components

[2]

- 4.1 Introduction of Capacitance, basic construction of capacitor and units.
- 4.4 Range of Capacitances and operating voltages of each type of Capacitor.
- 4.5 Capacitor Circuits. Series Circuit, Parallel Circuit and Series - Parallel Combined Circuits.
- 4.6 Variable capacitors
- 4.11 Basic construction and classification of Variable Capacitors based on applications.

Unit 5. Principles of semiconductors

[2]

- 5.1 Introduction to Semiconductor. Atomic structure, Semi-conductor Crystals and their characteristics
- 5.2 Adding impurities to semiconductors, Donor and Acceptor impurity in intrinsic Germanium.
- 5.3 N Type and P Type Semiconductor.

Unit 6. Semiconductor diode

[5]

- 6.1 PN Junction Diode
- 6.2 Basic construction, Junction barrier & barrier potential.
- 6.3 Forward and Reverse Bias Characteristics of Junction Diode.
- 6.4 Point contact diode (Signal Diode).
- 6.5 Application of Diode. Half Wave Rectifier, Full Wave Center Tapped and Bridge Rectifier circuit.
- 6.6 Rectifier Filter Circuits. Principles of operation of Capacitor filter, RC and LC Filter Circuit
- 6.7 Checking of Diode using Ohm Meter.
- 6.8 Zener Diode
 - 6.8.1 Basic construction and operation of a Zener diode.
 - 6.8.2 Forward and reverse bias Characteristics of a Zener diode.
 - 6.8.3 Application of Zener Diode as a Voltage Regulator.

Unit 7 introduction to bi-polar junction transistor (bjt).

[2]

- 7.1 Basic structure of BJT, PNP and NPN type.
- 7.2 Biasing of PNP and NPN Transistor principles of operation.
- 7.3 Voltage and Current Characteristics. Input and Output Characteristics, Collector current as a function of base current (Family of Collector characteristics curve), Cutoff, Saturation and DC Load line.
- 7.4 Basic Configuration of Transistor Circuits. Common Emitter (CE), Common Base (CB) and Common Collector (CC)

Unit 8. Special semiconductor devices

[5]

8.1 Silicon Controlled Rectifier (SCR)

8.1.1 Basic construction & physical features of SCR

8.1.2 Voltage - current characteristics.

8.1.3 Application of SCRs

8.2 Unijunction Transistor (UJT)

8.2.1 Basic construction & physical features of UJT

8.2.2 Voltage - current characteristics.

8.2.3 Application of UJT. (Relaxation Oscillator and Relay control circuit)

8.3 Junction Field Effect Transistor (JFET)

8.3.1 Basic construction & physical features of JFET

8.3.2 Voltage - current characteristics of JFET.

8.3.3 Application of JFET.

8.4 Metal Oxide Semiconductor (MOSFET)

8.4.1 Basic construction & physical features of MOSFET

8.4.2 Voltage - current characteristics.

8.4.3 Application of MOSFET.

8.5 Photo Diode and Opto Coupler

8.5.1 Basic construction & physical features and operation of Photo diode.

8.5.2 Application of Photo Diode and Opto Coupler.

Unit 9 Introduction to integrated circuit

[2]

9.1 Introduction to IC, basic construction of IC chip

9.2 Monolithic Integrated circuit.

9.4 Large scale Integrated circuit (LSI).

9.4 General classification of Integrated Circuits based on application. (Linear and Digital ICs).

9.5 Illustration of some Linear ICs. Voltage regulator IC, Timer IC, OP Amplifier etc

Unit 10 Digital electronics

[4]

10.1 Introduction to Number System.

10.1.1 Decimal Number System

10.1.2 Binary Number System

10.1.3 Octal Number System

10.1.4 Hexa -Decimal Number System

10.1.5 Conversion of Number system

10.2 Introduction to Binary Arithmetic Addition, Subtraction, Multiplication, Division.

10.2.1 Signed and Unsigned Binary Numbers.

10.2.2 Binary Coded Decimal Numbers and ASCII Codes.

Unit 11 Fundamentals of digital electronics

[8]

11.1 Principles of operations of two state operation and its advantages.

11.2 Operation of Transistor as a Switch and Relay Control.

11.3 Introduction to Logic Gates (NOT, AND, OR, NAND, NOR XOR). Symbols, Truth Tables, Boolean algebra and Associate Rules.

- 11.4 De-Morgan's Theorem.
- 11.5 Universal Gates
- 11.6 Minimization of Logical Expressions using Boolean algebra.
- 11.7 Application of Karnuf's Map (K-Map) for minimization of Logical expressions.

Unit 12 Combinational logic devices

[4]

- 12.1 Encoder / Decoder – Decimal to Binary, Binary to Gray Code, Priority Encoder.
- 12.2 Multiplexer and De-Multiplexer.
- 12.3 Parity Generator and Checker.
- 12.4 Half Adder, Full Adder and Subtractor.

Unit 13 Analog and digital conversion

[2]

- 13.1 Introduction
 - Analogue to Digital Conversion.
 - Digital to Analogue Conversion.

Unit 14. Memory

[2]

- 14.1 Functions of Flip-flop as Memory.
- 14.2 Types of Memory: ROM, RAM, PROM, EPROM, EEROM, UVPRM.
- 14.3 Static and dynamic Memory.

Material Science

EG 1201 ME

Year: I
Semester: II

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

- Explain the properties of materials and their dependence on.
- Describe the principle of iron and steel production.
- Explain the principle of heat treatment.
- Develop knowledge for material selection.

Course contents:

Unit 1: Introduction to Material Science: [2]

- 1.1 Importance and Scope
- 1.2 Material structure: Atoms, molecules and sub particles as the building block of all materials
- 1.3 Classification of materials based on:
 - 1.3.1 State
 - 1.3.2 Natural, artificial
 - 1.3.3 Metals, non-metals

Unit 2: General Properties of Materials [6]

- 2.1 Physical Properties:
 - 2.1.1 Luster
 - 2.1.2 Color
 - 2.1.3 Density
- 2.2 Mechanical Properties
 - 2.2.1 Plasticity, elasticity
 - 2.2.2 Behavior of materials under tensile stress
 - 2.2.3 Ductility, malleability
 - 2.2.4 Brittleness, hardness and toughness
 - 2.2.5 Behavior under impact and repeated stress
 - 2.2.6 Creep and Fatigue
- 2.3 Electrical Properties
 - 2.3.1 Conductor, semi-conductor, insulator, super-conductor

- 2.3.2 Electrical conductivity, receptivity, specific conductivity
- 2.3.3 Effect of temperature in conductivity.
- 2.4 Magnetic Properties
 - 2.4.1 Ferro-magnet, Para-magnet, Dia-magnet
 - 2.4.2 Magnetically soft and hard material
- 2.5 Thermal Properties:
 - 2.5.1 Specific heat, latent heat
 - 2.5.2 Thermal conductivity
 - 2.5.3 Thermal expansion and coefficient of thermal expansion
 - 2.5.4 Consideration of thermal properties in material selection.
- 2.6 Difference between metals and non metals on the basis of different properties

Unit 3: Iron and Steel Production [6]

- 3.1 Introduction
- 3.2 Classification of iron and steel
- 3.3 Blast furnace, iron ore, processes in pig iron production
- 3.4 Production of steel
- 3.5 Various Steel making processes
 - 3.5.1 Bessemer Process
 - 3.5.2 Open hearth Process
 - 3.5.3 Electric Process
 - 3.5.4 Duplex Process

Unit 4: Iron Carbon System [6]

- 4.1 Micro constituents in iron
- 4.2 Effect of carbon in iron
- 4.3 Iron Carbon equilibrium diagram
- 4.4 Temperature transformation diagram (cooling, heating)

Unit5: Metals [10]

- 5.1 Carbon Steel
- 5.2 Classification of carbon steel
- 5.3 Composition and metallurgy of carbon steel
- 5.4 Properties and uses of various carbon steel
- 5.5 Alloy Steel
 - 5.5.1 Classification of alloy steel
 - 5.5.2 Effect of alloying elements in steel
 - 5.5.3 Properties and uses of various alloy steel
- 5.6 Cast iron
 - 5.6.1 Introduction
 - 5.6.2 Types, Properties and Uses
- 5.7 Non-Ferrous Metals
 - 5.7.1 Introduction
 - 5.7.2 Aluminum and its alloys: composition, properties and uses
 - 5.7.3 Copper and its alloys: Composition, properties and uses
 - 5.7.4 Bronze and brass: properties and uses.

Unit 6: Heat treatment process [6]

- 6.1 Introduction and purposes
- 6.2 Classification: working principle and application
 - 6.2.1 Annealing Process
 - 6.2.2 Hardening Process: Case, Surface, Nitriding, Carburizing, Quenching
 - 6.2.3 Tempering Process
 - 6.2.4 Normalizing Process

Units 7: Non-Metals [4]

- 7.1 Introduction to non-metals
- 7.2 Lubricants: properties, classification and uses
- 7.3 Fuels: Properties, classification and uses
- 7.4 Polymers: Properties, classification and uses
- 7.5 Rubber: Properties and uses
- 7.6 Ceramics: Properties, classification and uses
- 7.7 Composite materials: properties, classification and uses
- 7.8 Glass: properties, classification and uses

Unit 8: Testing of Metals [5]

- 8.1 Types: working principle
 - 8.1.1 Destructive test
 - 8.1.2 Non-destructive test
- 8.2 Tensile test: Stress-Strain diagram of mild steel and glass
- 8.3 Fatigue test
- 8.4 Hardness test: Brinell and Rockwell
- 8.5 Impact test: Izod and Charpy

Lab/Practical [15]

- 1. Identification of metals and non-metals
- 2. Identification of different metals using grinding process
- 3. Performing Tensile test on standard specimen
- 4. Performing Hardness test on standard specimen
- 5. Performing Impact test on standard specimen
- 6. Demonstration of microstructure of iron
- 7. Performing Heattreatment process of metal

Reference/Text Books:

- 1. H.S. Bawa, Material and Metallurgy, TMG edition, New Delhi
- 2. A.K Gupta, R.C Gupta, Material Science, S.Chand and Co. Ltd, New Delhi
- 3. Donall R. Askelad, "The Science and Engineering of Materials", Chapman and Hall, Madras.

Engineering Mechanics

EG 1202 ME

Year: I
Semester: II

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

Course description:

This course provides the students with a fundamental knowledge of the principles, concepts and application of engineering mechanics for solving engineering problems. The students will become familiar with the common types of problems of Statics and Dynamics and learn the methods to solve them.

Course objectives:

General

After completion of this course the students will be able to apply knowledge of mechanics insolving practical engineering problems.

Specific

After completion of this course the students will be able to

- Describe fundamental principles and concepts of mechanics.
- Explain the principles of forces and their effects on particle and rigid body
- Describe the concept of equilibrium in two dimensions and three dimensions
- Analyze concentrated and distributed forces
- Solve different types of numerical problems of statics
- Describe kinematics and kinetics of particles and rigid bodies
- Explain Newton's laws of motions
- Describe principles of work and energy
- Solve different types of numerical problems of dynamics

Course contents:

Unit 1. Introduction

[3]

- 1.1 Definition, classification and scope of engineering mechanics
- 1.2 Basic concepts
- 1.3 Physical quantities
- 1.4 Reference frame of axes
- 1.5 System of units

Unit 2. Static of particles and rigid bodies

[6]

- 2.1 Introduction to static
- 2.2 Concepts of force and force system
- 2.3 Resultant of a force system

2.4 Determination of resultant of different force systems	
2.5 Resolution and composition of forces	
2.6 Rectangular components of force	
2.7 Moment of a force about a point	
2.8 Moment of a force about an axis	
2.9 Principle of Moments	
2.10 Torque and couple	
2.11 Related problems	
Unit 3. Equilibrium	[2]
3.1 Introduction to the concept of equilibrium	
3.2 Conciliations of equilibrium in two- and three dimensions	
3.3 Body constraints and free body diagrams	
Unit 4. Distributed forces	[8]
4.1 Concept of concentrated and distributed forces	
4.2 Centre of gravity and centroids	
4.3 Location of centroids and center of gravity of lines, areas and solid bodies with regular and composite shapes and forms	
4.4 Second moment of area and moment of inertia	
4.5 Related problems	
Unit 5. Dynamics	[8]
5.1 Introduction to dynamics	
5.2 Kinematics of particles	
5.3 Motion and its types	
5.4 Rectilinear motion of particles: displacement, velocity, speed, acceleration and distance traveled by particles	
5.5 Curvilinear motion of particles: radius vector, displacement, velocity, and acceleration	
5.6 Motion under gravity	
5.7 Relative motion and dependent motion	
5.8 Kinematics of rigid bodies	
5.9 Introduction to kinetics	
5.10 Newton's laws of motion	
5.11 Equations of motion and related problems	
5.12 Linear momentum of particles	
5.13 Principle of impulse and momentum	
Unit 6. Work, power and energy	[10]
6.1 Relation between rpm, torque and power	
6.2 Application of work and energy principles to rigid bodies	
6.3 Potential and kinetic energy	
6.4 Law of conservation of mechanical energy	
6.5 Related problems	

Unit 7. Tutorials

[8]

6 assignments

2 assessment tests

Practical

List of laboratory experiments

[15]

1. Verification of parallelogram law and triangle law of forces
2. Verification of polygon law of forces
3. Verification of principle of moments
4. Determination of moment of inertia by flywheel
5. Determination of the support reaction of simply supported beams with concentrated loads at one or more points
6. Identification of composition and resolution of forces by vector method

References

1. Beer, F.P and Johnston Jr. E.R., “Vector Mechanics for Engineers (In SI Units): Statics and Dynamics”, 11th Edition, Tata McGraw-Hill Publishing company, New Delhi (2016)
2. Hibbeler, R.C and Ashok Gupta, “Engineering Mechanics: Statics and Dynamics”, 11th Edition, Pearson Education 2010.
3. Malhotra, M.M, Subramanian, R., GahlotRathor, P.S, B.S: Text book in applied mechanics, Wiley Eastern Limited.
4. Kumar, D.S: Engineering Mechanics, 4th Edition, Kataria S.K & Sons.

Workshop Technology II

(Foundry & Welding)

EG 1203 ME

Year: I
Semester: II

Total: 9 hours/week
Lecture: 3 hours/week
Tutorial: hours/week
Practical: 6 hours/week
Lab: hours/week

Course description:

This course is the extension one for the students who have undergone manufacturing process. The course deals with further new and advanced methods such as foundry and machining processes. Technicians need to acquire advanced techniques and performance standard so as to be competent in the mechanical engineering field.

Course objectives:

After completing this course the students will be able to:

- Follow the safety rules in foundry and machining operations.
- Make simple patterns from wood and metal as per drawing.
- Produce casting parts as per supplied drawing using casting tools and equipment's.
- Produce parts as per specification using forging hand tools in forging Shop.
- Be familiar with the machines used in mechanical machining operations such as lathe, milling, shaper and drilling.
- Able to perform lathe, milling, grinding and shaper operations for different applications.

Unit 1: Metal Forming Process

[8]

- 1.1 Introduction to metal forming processes
- 1.2 Hot working: introduction, principle, advantage and disadvantage
- 1.3 Cold working: introduction, principle, advantage and disadvantage
- 1.4 Rolling: principle, typical rolling shapes, rolling stand arrangement, roll passes
- 1.5 Forging
 - 1.5.1 Forging Operations
 - 1.5.2 Forging Methods
 - 1.5.3 Types of Forging
 - 1.5.4 Forging Defects
- 1.6 Extrusion: Introduction, Principle, Type and Application
- 1.7 Drawing: Introduction, Principle, Type and Application

Unit 2: Metal Casting Process

[11]

- 2.1 Introduction and History of Casting Process
- 2.2 Casting Terminology
- 2.3 Types of Casting and their Principles, Applications, Advantage & Disadvantage
 - 2.3.1 Precision Investment Casting
 - 2.3.2 Permanent Mould Casting
 - 2.3.3 Die-casting

- 2.3.4 Vacuum Casting
- 2.3.5 Low Pressure Die Casting
- 2.3.6 Centrifugal Casting
- 2.3.7 Continuous Casting
- 2.3 Sand Casting
 - 2.3.1 Introduction to Sand Casting
 - 2.3.2 Patterns and Patterns Making
 - 1. Pattern Material
 - 2. Types of Pattern
 - 3. Pattern Making Process
 - 3. Pattern Allowances
 - 2.3.3 Sand Mold & Mold Making
 - 1. Sand Molding Hand Tools
 - 2. Sand Molding Process
 - 2.3.4 Core Making
 - 2.3.5 Sand Casting Process
 - 2.4 Applications of Casting
 - 2.5 Advantage and Disadvantage of Casting
 - 2.6 Safety Precaution in Casting Process
 - 2.7 Casting defects and its preventions

Unit 3: Gating System for Casting

[6]

- 3.1 Introduction to Gating System
- 3.2 Elements of Gating System
 - 3.2.1 Poring Basin
 - 3.2.2 Sprue
 - 3.2.3 Sprue Base Well
 - 3.2.4 Runner
 - 3.2.5 Runner Extension
- 3.3 Gates or In-Gates
 - 3.3.1 Top Gate
 - 3.3.2 Bottom Gate
 - 3.3.3 Parting Gate
 - 3.3.4 Step Gate
 - 3.3.5 Riser
 - 3.3.6 Chill
- 3.4 Casting Yields

Unit 6: Lathe Machine & Lathe Operations

[7]

- 6.1 Introduction to lathe machine
- 6.2 Components of lathe machine: Bed, Head stock, Tailstock, Carriage, Feed mechanism and thread cutting mechanism
- 6.3 Working Principle of lathe machine
- 6.4 Types of Lathe machine
- 6.5 Specification of Lathe

6.5 Lathe Operations: Principle, Procedure and Applications

- 6.5.1 Turning
- 6.5.2 Facing
- 6.5.3 Grooving
- 6.5.4 Chamfering
- 6.5.5 Knurling
- 6.5.6 Forming
- 6.5.7 Thread Cutting
- 6.5.8 Drilling
- 6.5.9 Boring
- 6.5.10 Reaming
- 6.5.11 Tapping
- 6.5.12 Parting Off

6.6 Machining parameters in Lathe operations: Speed, Feed and Depth of Cut

6.7 Selection of machining parameters in lathe operations

6.8 Accessories and attachments of lathe

Unit 7: Milling Machine & Milling Operations

[6]

7.1 Introduction to milling

7.2 Principle of milling

7.3 Milling Methods

7.3.1 Up Milling or Conventional Milling: principle and Application

7.3.2 Down milling or climb milling: Principle and application

7.4 Component of milling machine

7.5 Types of milling machine

7.6 Milling Operations: Principle, Procedure and Applications

7.6.1 Face milling

7.6.2 Side milling

7.6.3 Plain or Slab Milling

7.6.4 Angular Milling

7.6.5 Form milling

7.6.6 End milling

7.6.7 Profile milling

7.6.8 Straddle milling

Unit 8: Grinding and Grinding Operations

[4]

8.1 Introduction to Grinding

8.2 Principle and Purpose

8.3 Grinding machine and its component

8.4 Grinding wheel and its specifications

8.5 Grinding operations: Principle, Procedure and Applications

8.5.1 Cylindrical grinding

8.5.2 Surface grinding

8.5.3 Internal grinding

8.5.4 Form grinding

Unit 9: Shaper and Shaper Operations

[3]

- 9.1 Introduction
- 9.2 Working principle
- 9.3 Components of shaper machine
- 9.4 Specification of shaper
- 9.5 Types of shaper machine
- 9.6 Crank slider and quick return mechanism
- 9.7 Common surface generated from shaper

Practical I: Foundry

[30]

Molding exercise (practical)

1. Making a Single Wood pattern of a given size
2. Making Split wood pattern of a given size
3. Making a Core box of a given size
4. Preparations of Sand molding for split pattern with core
5. Making wax suitable pattern such as anyone of flying bird, twisted spiral coiled or any simple irregular article.
6. Making moulds with plaster of Paris of a given specification
7. Casting on sand moulds
8. Casting on permanent moulds
9. Casting on investment mould

Practical II: Forging:

[10]

Forging exercise (practical)

1. Safety and familiarization with equipment and tools
2. Forging Square piece
3. Forging Rectangular Small Flat Chisel
4. Performing Heat treatment of Chisel

Practical III: Lathe Operations

[30]

1. Perform the following turning operations
 - a. Plain turning (One exercise)
 - b. Step turning (One exercise)
 - c. Taper turning (One exercise)
 - d. Eccentric turning (One exercise)
2. Perform facing operation of a given work piece
3. Perform Knurling operation of a given work piece
4. Perform Drilling operation on a given work piece
5. Perform thread cutting operation (each one exercise)
 - a. Left hand thread
 - b. Right hand thread
6. Perform chamfering operation
7. Perform Reaming Operation

8. Perform Boring Operation
9. Perform parting-off operation
10. Perform tapping operations on Lathe

Practical IV: Milling Operations

[8]

1. Perform the end milling operations
2. Perform the side milling operations
3. Perform the plain milling operations
4. Cut a key slot on a shaft using appropriate milling cutter

Practical V: Grinding Operations

[8]

1. Generate a tool geometry of single point cutting tool
2. Perform the surface grinding using surface grinder
3. Perform cylindrical grinding tasks

Practical VI: Shaper Operations

[4]

1. Generate a horizontal plane surface using shaper machine
2. Perform the task of cutting a groove using shaper machine

Suggestion for instructions:

1. Note: every practical exercise [assignment] must be accompanied with performance report in A4 size paper. Assignments, Drawing, and Performance Report must be submitted for the work evaluation.

Reference Book:

1. Workshop Technology (Vol. 1) By S. K. Hajra Chaudhary
2. Manufacturing Process for Engineering Materials (1st Edition) By Serope Kalpakjian & Steven R. Schmid
3. Manufacturing Technology (Vol.1), (3rd Edition) By P.N. Rao
4. Shop Theory (Vol. 1) By Henp Fort Trade School
5. Introduction to Basic Manufacturing Processes and Workshop Technology(1st Edition) by Rajender Singh, New Age International Publisher

Third Semester Subjects:

1. EG 2101 AE Machine Elements and Mechanism
2. EG 2110 ME Thermal Engineering I
3. EG 2101 CT Computer Application
4. EG 2111 ME Machine Drawing
5. EG 2107 ME Elements of Engineering Economics
6. EG 2108 ME Strength of Materials
7. EG 2102 AE Automotive Technology I
8. EG 2103 AE Metrology and Measurement

Machine Elements and Mechanism

EG 2101 AE

Year: II
Semester: II

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

Course description:

This course deals with the machine elements and mechanisms which are very essential for machine design.

Course objectives:

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

- Understand different machine elements, power drives and mechanisms used in machines
- classify and describe machine elements
- Explain the applications and limitations of various machine elements and mechanisms
- Select material and manufacturing process

Course contents:

Unit 1: Introduction

4

- 1.1. Machine and machine elements
- 1.2. Classification of machines
- 1.3. Classification of machine elements
- 1.4. Basic requirements for machine elements and machines
- 1.5. Design consideration of machine elements
- 1.6. Selection of materials and manufacturing Process

Unit 2: Joints

3

- 2.1. Types of joints
- 2.2. Undetachable Joints: Rivet Joints, Welded Joints, Brazed joints
- 2.3. Detachable Joints: Thread Joints, Key Joints
- 2.4. Classification of power screws and fastening screws
- 2.5. Forms of threads
- 2.6. Basic Terminology for a Screw Thread

Unit 3: Shafts and Axles

3

- 3.1. Purposes of shaft and axles
- 3.2. Types of Shafts and Axles
- 3.3. Materials and Manufacturing method for shafts and axles

Unit 4: Bearings	3
4.1. Purpose of bearings	
4.2. Plain Bearings: Types, Applications and Limitations	
4.3. Antifriction Bearings: Types, Applications and Limitations	
4.4. Bearing life	
4.5. Selection of bearings	
Unit 5: Mechanical Power drives	12
5.1. Introduction	
5.2. Classification of drives	
5.3. Belt Drives	
• Belt	
• Pulley	
• Types of belt drives	
• Kinematics of belt drive	
• Related numerical problems on geometry and kinematics of belt drive	
5.4. Chain Drives	
• Chain	
• Sprocket	
• Types of chain drives	
5.5. Rope Drives	
• Rope	
• Classification of ropes	
5.6. Friction Drives	
• Introduction	
• Applications and limitations	
5.7. Gear Drives	
• Types of Gears	
• Basic Terminology for Spur Gear	
• Gear Material and Manufacturing Method	
• Related Problems on geometrical and kinematic parameters of spur gear	
Unit 6: Couplings	3
6.1. Introduction	
6.2. Purposes of Couplings	
6.3. Classification of couplings	
6.4. Applications and limitations	
Unit 7: Clutches	3
7.1. Introduction	
7.2. Purposes of Clutches	
7.3. Classification of clutches	
7.4. Applications and limitations	

Unit 8: Spring **3**

- 8.1. Introduction
- 8.2. Purpose of springs
- 8.3. Types of springs
- 8.4. Material for springs
- 8.5. Applications and limitations

Unit 9: Seals **3**

- 9.1. Introduction
- 9.2. Types of seals
- 9.3. Applications and limitations

Unit 10: Mechanism **8**

- 10.1. Introduction
- 10.2. Classification of mechanisms
- 10.3. Introduction and applications and limitations of:
 - Ratchet mechanism
 - Bell crank mechanism
 - Rack and pinion mechanism
 - Slider crank mechanism
 - Cam mechanism
 - Four bar linkage mechanism
 - Reciprocator mechanism

References:

1. Machine design by Dr. P. C. Sharma and Dr. D. K. Agrawal, S. K. Kataria & Sons
2. Elements of Machine by Luza Shrestha, Pulchowk campus
3. A Text Book of Machine Design by R. S. Khurmi and J. K. Gupta
4. Mechanical Engineering Design by J. E. Shigley
5. V. B. Bhandari, Design of Machine Elements, Tata McGraw-Hill Publishing Company Ltd., New Delhi
6. Thomas G. Beckwith, N. Lewis Buck, Roy D. Marangoni, Mechanical Measurements, Narosa Publishing House, New Delhi
7. P.J. Shah, Engineering Mechanics, S. Chand group, New Delhi, S. Chand group, New Delhi
8. J. S. Rao & RV Duggipati, Mechanism and machine Theory, Latest edition
9. Theory of Machines and Mechanism, Tata McGraw Hill Publishing Company Limited, New Delhi

Thermal Engineering-I

EG 2110 ME

Year: II
Semester: I

Total: 5 hours /week
Lecture: 3 hours/week
Tutorial: 1 hours/week
Practical: hours/week
Lab: 1 hours/week

Course description:

This course deals with the fundamental laws of thermodynamics and modes of heat transfer. It also deals with the characteristics of fuel & its calorific values.

Course objectives:

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

- laws of thermodynamics
- properties of ideal gas
- different characteristics of fuel

Course contents:

Unit 1: Introduction to thermodynamics	[4]
1.1 Thermodynamic system and surroundings	
1.2 Thermodynamic properties	
1.3 Temperature, heat and thermal equilibrium	
1.4 Sensible heat and latent heat	
1.5 Units in thermodynamics	
1.6 Related problems	
Unit 2: Introduction to Heat	[6]
2.1 Expansion of solid, liquid and gases	
2.2 Modes of heat transfer: conduction, convection and radiation	
2.3 Related problems to heat transfer	
Unit 3: Ideal gas processes	[6]
3.1 Effect of heat on volume	
3.2 Pressure-temperature-volume relationships of gases	
▪ Volume-temperature relationship at a constant pressure	
▪ Pressure-volume relationship at a constant temperature	
▪ Pressure-temperature relationship at constant volume	
▪ General gas law	

- Related problems on gas laws

Unit 4: Zeroth law of thermodynamics [2]

- 4.1 Definition and applications
- 4.2 Different types of thermometer and their applications

Unit 5: First law of thermodynamics [6]

- 5.1 Definition
- 5.2 Specific heat of gases
- 5.3 Internal energy
- 5.4 Enthalpy
- 5.5 Steady state energy equation
- 5.6 Limitations
- 5.7 Related problems

Unit 6: Basic thermodynamic processes [6]

- 6.1 Constant volume process
- 6.2 Constant pressure process
- 6.3 Constant temperature process
- 6.4 Adiabatic process
- 6.5 Polytropic process
- 6.6 Related problems

Unit 7: Second law of thermodynamics [7]

- 7.1 Classical Definition of second law
- 7.2 Uses of 2nd law: Heat engine, Heat pump, Refrigeration
- 7.3 Reversible and irreversible processes
- 7.4 Entropy
- 7.5 The T-s diagram
- 7.6 Related problems

Unit 8: Combustion [8]

- 8.1 Basic chemistry
- 8.2 Fuel: types, properties and uses
- 8.3 Heating value of fuels
- 8.4 Combustion equations
- 8.5 Air-fuel mixture ratio: lean, stoichiometric and rich mixtures
- 8.6 Combustion stages

Lab

[15]

1. Determine thermal conductivity of a specimen.
2. Compare different types of thermometers
3. Verify ideal gas laws
4. Determine specific heat of an ideal gas
5. Determine density of fuel (Petrol, Diesel)
6. Determine flash point of fuel (Petrol, Diesel)

Suggestion for instruction:

1. Use illustrative teaching materials like model, charts, and overhead transparencies or multimedia projector to visualize the complex parts.

Reference:

1. M. C. Luintel, "Fundamentals of Thermodynamics and Heat Transfer", AthraiPublication (P) Limited.
2. Kulshrestha, S. K. Thermal Engineering, Vikash Publishing House Pvt. Ltd. New Delhi – 110014, India
3. RathaKrishanan E, 2002 Fundamental of Engineering Thermodynamics, Prentice Hall India Pvt. Ltd, New Delhi – 110001, India
4. J. R. Howell & R. O. Buckius, "Fundamentals of EngineeringThermodynamics", McGraw Hill Publishers

Computer Applications

EG 2101 CT

Year: II
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. It also imparts knowledge and skills on 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:

- Understand basic architecture of Computer.
- Identify major components of computer and their role.
- Understand different Operating Systems like MS-DOS, Windows etc.
- Use different Software applications.
- Understand basic networking and Internet concept.

Course contents:

Unit 1	Introduction to Computers	[2]
	1.1 History of computers	
	1.2 Generation and type of computers	
	1.3 Computer hardware and software	
Unit 2	Hardware Components	[6]
	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:	
	• Magnetic storage like floppy disk, hard disk, magnetic tape etc.	
	• Optical storage like CD-ROM, DVD	
	• Pen drive, flash memory card etc.	

Unit 3	Introduction to Operating System Software	[6]
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]
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	
	<ul style="list-style-type: none"> • 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]
5.1	Computer virus and its removal (antivirus programs)	
5.2	Multimedia: Audio, Video and Graphics	
Unit 6	Networks and Internet	[7]
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	
	<ul style="list-style-type: none"> • 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 Exercise

1. Identification of major components of computer and familiarization with keyboard and mouse. (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.

Text books:

1. Rajaraman, “*Fundamentals of Computers*”, Prentice-Hall of India

Reference books:

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

Machine Drawing

EG 2111 ME

Year: II
Semester: I

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

Course description:

This course deals with drawings about machines, elements of machine, standard graphical signs, symbols and notations, different type of fits with limits and tolerances, layout- installation, assembled and detail drawings of a plant or machine.

Course objectives:

After completing this course the students will be able to:

- Read and sketch different universally accepted graphical signs, symbols and notations.
- Understand the importance of limits, fits and tolerances in machines.
- Draw few common machine elements with prevailing common practices.
- Prepare working (detail & assembled) drawings.
- Understand layout and installation drawings.

Course contents:

- Unit: 1 Machining symbols, surface roughness [4]**
- 1.1 Introduction to machining symbols.
 - 1.2 Introduction to surface roughness symbols and their meaning.
 - 1.3 Drawing exercises:
 - Exercise in machining symbols:
 - (Not less than five exercises)
 - Exercise in surface roughness symbols:
 - (Not less than five exercises)
- Unit: 2 Limits, tolerances and fits [8]**
- 2.1 Introduction to Nominal and basic size, limits of size.
 - 2.2 Introduction to fundamental deviations, tolerances, upper & lower deviation.
 - 2.3 Introduction to clearance fit, interference fit & transition fit.
 - 2.4 Introduction to basic hole & basic shaft system.
 - 2.5 Introduction to go, no-go gauge, interchangeability & selective assembly.
 - 2.6 Drawing exercises:
(Not less than five exercises)

- Unit: 3. Gear, Pulley and Belt:** [8]
- 3.1 Introduction to spur gearing, definitions of spur gear terminology & their definitions
- Construction of base circle.
 - Construction of spur gear teeth (involute) profile.
 - Drawing exercises:
(Not less than three exercises)
- 3.2 Introduction to Pulleys & Belts
- Fast and loose pulleys
 - V-belt pulleys
 - Rope pulleys
 - Drawing exercises: Not less than three exercises)
- Unit: 4 Working Drawing (Detail or production drawing):** [16]
- 4.1 Introduction – drawing layout, title box, bill of materials (part list)
- 4.2 Sketch of details of different components of a machine with free hand dimensioning.
- 4.3 Review of different type of sectioning- full, half, partial (or broken), revolved, removed and offset.
- 4.4 Review of common dimensioning types.
- 4.5 Drawing exercises: (Not less than four exercises)
- Unit: 5 Working drawing (Assembly drawing):** [16]
- 5.1 Introduction to drawing layout, detail item list (bill of materials), drawing numbers (sheet numbers), sheet folding and filing styles.
- 5.2 Accepted norm and common practices for assembly drawing.
- 5.3 Introduction to sectioning & dimensioning concept for assembly drawing.
- 5.4 Introduction to sequences of preparing the assembly drawing.
- 5.5 Drawing exercises: (Not less than five exercises)
- Unit: 6 Installation and layout drawing):** [8]
- 6.1 Introduction to plant or machine layout and installation drawing.
- 6.2 Drawing exercises:
(Observation and group discussion of minimum two sets of installation and layout drawings)

Reference:

1. N.D Bhatt and V.M. Panchal, Machine Drawing, Charotar Publishing House, 2001).
2. Luzadder, W.J., Fundamental of Engineering Drawing, Prentice-Hall of India Pvt-Ltd., New Delhi, Latest edition.

Elements of Engineering Economics

EG 2107 ME

Year: II

Semester: I

Total: 2 hours/week

Lecture: 2 hours/week

Tutorial: hours/week

Practical: hours/week

Lab: hours/week

Course description:

This course deals with basic concepts and methodologies to conduct financial evaluations and economic analysis related to engineering projects and/or reviewing and evaluating such work done by others.

Course objectives:

After completing this course the students will be able to:

- Explain and use the terminology that are used in Engineering Economics
- Use interest factor table and conduct the cash flow analysis of engineering projects.
- Carry out the economical evaluation of the projects.
- Understand the project risk and their mitigation procedures.

Course content:

Unit 1: Introduction to Engineering Economics [2]

- 1.1 Role of engineering/technical manpower in organization
- 1.2 Types of engineering economic decision

Unit 2: Brief Understanding of Financial Statements [3]

- 2.1 Familiarization with balance sheets, income statement and cash-flow statement components
- 2.2 Calculation of financial ratios and their familiarization
- 2.3 Related numerical problems on 2.1 and 2.2

Unit 3: Cost and Revenue [2]

- 3.1 The elements of cost
- 3.2 Direct cost, Indirect cost and Overhead cost allocation
- 3.3 Job and Process costing
- 3.4 Revenue and its types
- 3.5 Related numerical problems on 3.2 and 3.3

Unit 4:	Time value of Money, Interest Rate and Depreciation concept	[3]
	4.1 Time value of Money	
	4.2 Simple and compound interest rates, effective interest, and continuous compound interest	
	4.3 Depreciation methods, straight line, declining balance method	
	4.4 Related numerical problems on 4.2 and 4.3	
Unit 5:	Types of cash Flows and their Formulas	[4]
	5.1 Types of cash flows and its significance	
	5.2 Single cash flow formulas	
	5.3 Uneven cash flow series	
	5.4 Equal cash flow series	
	5.5 Linear gradient series	
	5.6 Geometric gradient series	
	5.7 Related numerical problems on 5.2, 5.3, 5.4, 5.5 and 5.6	
Unit 6:	Economic Equivalence of projects	[2]
	6.1 Definition and simple calculations	
	6.2 General observation about equivalence calculations	
	6.3 Related numerical problems on 6.1	
Unit 7:	Project Evaluation Techniques	[8]
	7.1 Initial Project screening methods	
	▪ Payback period	
	▪ Benefits and flaws of payback period method	
	7.2 Net Present Value (NPV) analysis	
	▪ Net Present Value criterion	
	▪ The meaning of Net Present Value	
	7.3 Future Value and Annual Equivalent analysis	
	7.4 Internal Rate of Return (IRR) analysis	
	7.5 Comparing revenue and service projects, projects with different analysis period and project live	
	7.6 Related numerical problems on 7.1, 7.2, 7.3, 7.4 and 7.5	
Unit 8:	Benefit and Cost Analysis	[3]
	8.1 Calculation of Benefits and Costs	
	8.2 Definition on Benefit-Cost (B/V) ratio	
	8.3 Relation between B/C ratio and NPV	
	8.4 Related numerical problems on 8.1	
Unit 9:	Project Risk	[3]
	9.1 Definition of project risk	
	9.2 Sensitivity analysis	
	9.3 Breakeven analysis	
	9.4 Scenario analysis	

9.5 Related numerical problems on 9.2, 9.3 and 9.4

Suggestions for instructions:

1. The method of teaching is lecture on theory augmented by relevant examples.
2. Use relevant diagrams and charts as much as possible.
3. Use calculator or/and interest factor table during calculation demonstration.
4. Give examples of locally operating engineering activities and projects as much as possible.
5. Demonstrate the basic computer applications using MS Excel program if the computer facility is available.

Reference:

1. Chan S. Park, 2002, “Contemporary Engineering Economics”, Third Edition, Prentice-Hall India Pvt. Ltd., New Delhi, India, ISBN-81-203-2143-X.
2. William G. Sullivan, James A. Bontadelli and Elin M. Wicks, 2002, “Engineering Economy”, Eleventh Edition, Addison Wesley Longman Pte. Ltd., Indian Branch, Delhi, India, ISBN 81-7808-349-3.
3. R Panneerselvam, 2001, “Engineering Economics”, First Edition, Prentice-Hall of India Pvt. Ltd., New Delhi, India, ISBN-81-203-1743-2.

Strength of Materials

EG 2108 ME

Year: II
Semester: I

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

Course description:

In Engineering every structure is designed and its drawing is prepared, then the work is executed. After design the structural members are checked for various stresses whether the member is safe or not for the given load conditions. Then the size and the position of the member are fixed. The responsibility of Diploma holder is to carry out the job successfully under the guidance of an engineer and by the support of tradesmen.

Course objectives:

General

After completing this course the students will be able to:

- Classify the materials according to engineering properties
- Calculate the forces coming in the member for given loading conditions.
- Know the allowable stresses in various conditions of loading.
- Fix the size and position of various members which are safe as well as economical

These objectives are fully accomplished and strengthened through laboratory and practical exercises. Conceptualization of theory explanation is achieved better by many relevant examples/problems.

Course contents:

Unit 1. Introduction

[10]

1.1 Concept and stress and strain.

[6]

- Direct stress and direct strain – compressive and tensile.
- Determination of direct stresses and strains for uniform sections
- Determination of direct stresses and strains for stepped sections.
- Statement of Hooke's law and definition of Young's Modulus of Elasticity.
- Stress-strain diagram for tensile test on mild steel, explanation of elastic limit.
- Limit of proportionality, yield point, ultimate stress, and breaking stress – actual and nominal.
- Factor of safety.
- Applications of Hooke's law to homogeneous and composite section.
- Temperature stresses and strains for homogenous and composite section
- Definition of shear stress, shear strain and modulus of rigidity.
- Concept of single shear and double shear.

- Determination of shear stress and shear strain for homogeneous sections.
- Definition of linear strain, lateral strain and poisson's ratio, volumetric strain, bulk modulus.
- Relationship between elastic constants

Unit 1.2. Compound Stress [2]

- Definitions of principal plane, principal stress and complementary shear stress.
- Effect of pure shear on diagonal planes.
- Solution of problems on compound stress by analytical method.
- Solution of problems on compound stress with the help of Mohr's circle.

Unit 1.3. Strain Energy [2]

- Concept of strain energy
- Resilience
- Proof resilience and modulus of resilience
- Strain energy for uniform homogeneous sections subjected to gradual loads.
- Strain en

Unit 2: Bending Moments and Shear Forces [13]

- 2.1 Beams and their types according to support conditions.
- 2.2 Sign convention
- 2.3 Relationship between load intensity, shear force and bending moment, explanation with SF and BM Diagrams.
- 2.4 Determination of bending moment and shear force in beams of different support and load systems :- (a) Simply supported beams (b) Cantilever beams (c) Overhanging beams and (a) Concentrated loads (b) Uniformly distributed loads (c) Combination of concentrated and uniformly distributed loads – By analytical method.
- 2.5 Drawing bending moment and shear force diagrams.
- 2.6 Determination of maximum bending moment, maximum shears force, point of contra flexure.

Unit 3. Moment of Inertia [6]

- 3.1 Definition and importance about Moment of Inertia.
- 3.2 Moment of inertia of a rectangle and a circle about its center of gravity
- 3.3 Parallel axes theorem.
- 3.4 Determining the moment of inertia of (a) Common standard sections (b) Built upsections - by using the parallel axes theorem.

Unit 4. Stresses in Beams [16]

4.1 Bending Stresses in beams [10]

- Theory of simple bending
- Definition of moment of resistance, neutral axis, modulus of sections.
- Assumptions in simple theory of bending
- Relationship between Bending Stresses and Radius of Curvature

- Relationship between Moment and Radius of Curvature. Derivation and use of Engineer's Theory of Bending Equation: $-\sigma/y = M/I = E/R$.
- Application of bending equation of homogeneous, built up and composite section

4.2 Shearing Stresses in Beams

[6]

- 4.2.1 Shear stress formula and its application
- 4.2.2 Calculation and distribution of shear stress in (a) Rectangular (b) I – section (c) T – section (d) Channel section (e) L – section and (f) H – section.

Text and References books

1. Hibbeler, R.C., "Mechanics of Materials", 10th Edition, Pearson Education, Low Price Edition, 2016
2. SS Bhavikatti: Strength of Materials; Vikas Publishing House, New Delhi.
3. RS Khurmi : Applied Mechanics and Strength of Materials ; S. Chand & Co, Delhi
4. GH Ryder: Strength of Materials; ELBS with Macmillan.

Lab Exercises / Practical

1. Study of extensometer.
2. Study and operation of UTM.
3. Tensile test on mild steel specimen and plotting stress-strain curve.
4. Compression test on timber, cast iron and cement concrete, comparison
5. Charpy and Izod test to determine the toughness of cast iron and mild steel
6. Bending test on timber beams
7. Deflection test on beams
8. Hardness test by Brinell and Rockwell tests

Automotive Technology I

EG 2102 AE

Year: II
Semester: I

Total: 13 hours/week
Lecture: 4 hours/week
Tutorial: hours/week
Practical: 9 hours/week
Lab: hours/week

Course description:

This subject deals with history of automobile including system of transmission, clutch, gearbox, propeller shaft, final drive, axle, brake, suspension, chassis and frame of automobile vehicles.

Course objectives:

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

- Understand the fundamentals of automobile transmission and mechanism, axle and steering, brakes, suspension system, wheels and tires, chassis and frames.
- Understand the working principle and application of transmission and mechanism, steering, brakes, suspension system.
- Maintain, repair and care the various systems of automobile transmission and mechanism, axle and steering, brakes, suspension system, wheels and tires, chassis and frames.

Course contents:

UNIT 1: Short History of Automobile

3 hrs.

- 1.1 Development of Automobile
- 1.2 List the nomenclature of different automobile
- 1.3 automobile aggregates and their processes
- 1.4 Classification of vehicles

UNIT 2: Transmission and Mechanism

2.1 Clutch

3 hrs.

- 2.1.1 Introduction
- 2.1.2 Types of clutch
- 2.1.3 Working principle of clutch
- 2.1.4 Construction of clutch actuating mechanism
- 2.1.5 Uses of fluid or hydraulic coupling
- 2.1.6 Working principle of fluid clutch
- 2.1.7 Working principle of Air assisted hydraulic clutch.
- 2.1.8 Faults and remedies of clutch.

2.2. Gear box	5 hrs.
2.2.1. Introduction	
2.2.2. Types of gearbox	
2.2.3. Working principle of gearbox	
2.2.4. Use and importance of gear shifting mechanism	
2.2.5. Components of gear shifting mechanism	
2.2.6. Operation of epicycle gear train in forward and reverse motion	
2.2.7. Operation of torque converter	
2.2.8. Operation of overdrive	
2.2.9. Operation of Automatic Manual Transmission(AMT)	
2.2.10. Fault and remedies of gear box	
2.3. Propeller shaft and Universal joint	4 hrs.
2.3.1. Introduction to Propeller shaft and Universal joint	
2.3.2. Purposes of Propeller shaft and Universal joint	
2.3.3. Types of Propeller shaft and Universal joint	
2.3.4. Drive mechanism from clutch to wheel in conventional cars and trucks	
2.3.5. Construction of propeller shaft	
• Torque tube drive arrangement	
• Hutch kiss drives arrangement	
2.3.6. Fault and remedies	
2.4. Differential and Rear axle	4 hrs.
2.4.1. Introduction	
2.4.2. Types of axle	
2.4.3. Use and importance of differential and final drive	
2.4.4. Working principle of differential	
2.4.5. Types of differential and axle housing	
• Banjo type	
• Spilt types	
2.4.6. Limited slip type differential	
2.4.7. All wheels drive system	
2.4.8. Function of axle and housing in different types of mounting axle	
2.4.9. Fault and remedies	
2.5. Front axle and steering	6 hrs.
2.5.1. Front axle with different types of steering head	
2.5.2. Different types steering linkages	
2.5.3. Wheel alignment and its importance	
2.5.4. Introduction to steering system	
2.5.5. Working principle of steering system	
2.5.6. Types of steering system	
• Hydraulic Assisted Power Steering	
• Electronic Power Assisted Steering (EPAS)	

- 2.5.7. Working principle of different types of steering gear box
- 2.5.8. Use of different types of steering gear box
- 2.5.9. Operation of power steering
- 2.5.10. Fault and remedies
- 2.6. Brake System 6 hrs.
 - 2.6.1. Purpose of brakes in a motor vehicle
 - 2.6.2. Function of braked mechanisms in a motor vehicle
 - 2.6.3. Components and function of brake system
 - 2.6.4. Classification of brakes and their functions
 - 2.6.5. Working principle of disc and drum brakes
 - 2.6.6. Working principle of hydraulic brake system with Anti lock braking system
 - 2.6.7. Working principle of pneumatic brake system with Anti-Lock Braking System
 - 2.6.8. Fault and remedies of brake system
- 2.7. Suspension system 6 hrs.
 - 2.7.1. Introduction and use of suspension system
 - 2.7.2. Classification of suspension system
 - 2.7.3. Working principle and types of shock absorber
 - 2.7.4. Fault and remedies of suspension system
 - 2.7.5. Air Suspension system
- 2.8. Wheels and tyres 6 hrs.
 - 2.8.1. Introduction and features of wheel and tyres
 - 2.8.2. Types of wheel and tyres
 - 2.8.3. Advantages and disadvantages of radial ply and cross ply tyres
 - 2.8.4. Rating of tyres
 - 2.8.5. Importance of rotation of tyres
 - 2.8.6. Fault and remedies of wheel and tyres
- 2.9. Chassis and frames 2 hrs.
 - 2.9.1. Introduction of chassis and frame
 - 2.9.2. Different types of chassis and frames
 - 2.9.3. Defects on chassis and frame

Reference books:

1. William H. Crouse and Anglin, Automotive Mechanics, Tata McGraw Hill Company, New Delhi
2. T.R. Banga, Nathu Singh, A text book of Automobile Engineering,
3. Frederick C. Nash, Kalman Banitz, Automotive Technology
4. K. M. Moeed, Automobile Engineering, S. K. Kataria and sons, Ansari Road, Daryaganj, New Delhi, 110002
5. R.K. Mohanty, Automobile Engineering Volume I, Standard Book House, 1705A Naisarak, Delhi, 110006
6. P. S. Gill, A Text book of Automobile Engineering Volume I, S. K. Kataria and sons, Ansari Road, Daryaganj, New Delhi, 110002
7. Dr. Kripal Singh, Automobile Engineering Volume I, Standard Publishers Distributors, Naisarak, Post box 1066, Delhi, 110006
8. A. S. Rangwala, Trends in Automobile Engineering, New Age International Publishers
9. R.K. Singal, Automobile Engineering, S. K. Kataria and sons, New Delhi, 110002
10. G.B. S. Narang, Automobile Engineering, Khanna Publishers
11. Harbans Singh Reyat, The Automobile, S. Chand and Company Ltd., New Delhi
12. H. Gerscher, Technology for Automotive Trade Volume 1 & 2, GTZ
13. H.M. Sethi, Automotive Technology, Tata McGraw-Hill Publishing Company Ltd., New Delhi
14. Bosch, Automotive Brake Systems, Society of Automotive Engineers (SAE), USA

Practical

1 Transmission System

1.1 Clutch

- Identification and function of clutch system components.
- Demonstration of operation of different types of clutch.
- Remove different types of clutch system components from vehicle.
- Inspection of different types of clutch components
- Replace different types of clutch system components
- Repair and maintenance of different types of clutch.
- Trouble shooting in clutch system.
- Safety precaution.

1.2 Gearbox and transfer case

- Safety precaution
- Dismantling of gear boxes.
- Identification and function of gear box components.
- Demonstration of the operation of gear box
- Inspection of gear box components.
- Selection of shims for counter shaft, drive shaft and main shaft.
- Assembly of gear box
- Dismantling of transfer cases.
- Identification and function of transfer case components.
- Inspection of transfer case components.
- Repair and maintenance of different types of transfer case.
- Assembly of Transfer case
- Trouble shooting in different types of gear box and transfer case.

1.3 Propeller shaft

- Safety precaution
- Identification and function of propeller shaft components,
- Demonstration of operation of propeller shaft.
- Remove replace propeller shaft components.
- Inspection of propeller shaft components.
- Repair and maintenance of propeller shaft.
- Safety and precaution.

2. Differential and Rear Axle

- Safety precaution
- Removal of rear axle and differential from the vehicle.
- Dismantling of differential.
- Identification and function of differential components.

- Demonstration of operation of differential.
- Inspection of differential components
- Adjustment of tail pinion bearing preload ,tail pinion depth, back lash between axle shaft side gears and differential pinions ,backlash between tail pinion and ring gear and clearance between thrust pad and ring gear.
- Assembly of differential.
- Removal of wheel hub from the vehicle.
- Grease wheel hub bearings
- Adjust wheel hub bearing play.
- Refit axles.
- Trouble shooting of differential and rear axle.

3. Front Axle and Steering

- Safety precaution
- Dismantling of steering system components.
- Identification and function of steering system components,
- Inspection of steering system components.
- Demonstration of operation of steering system
- Assembling of steering system components.
- Repair and maintenance of steering system.
- Trouble shooting of steering system.

4. Suspension System

- Safety precaution
- Identification and function of suspension system.
- Demonstration of operation of suspension system.
- Dismantling of suspension system components.
- Inspection of suspension system components.
- Assembling of suspension system components.
- Trouble shooting of suspension system.

5. Brake System

- Safety precaution.
- Identification and function of conventional hydraulic brake system components.
- Dismantling of brake system components.
- Inspection of brake system components.
- Demonstration of operation of hydraulic brake system.
- Assembling of hydraulic brake system components.
- Repair and maintenance of hydraulic brake system.
- Trouble shooting of hydraulic brake system.

- Identification and function of Anti-lock brake system components.
- Operation antilock brake system.
- Fault finding in antilock brake system by using multimeter and diagnostic tool.
- Identification and function of pneumatic brake system components.
- Dismantling of pneumatic brake system components.
- Inspection of pneumatic brake system components.
- Operation of pneumatic brake system.
- Assembling of pneumatic brake system components.
- Repair and maintenance of pneumatic brake system.
- Trouble shooting of pneumatic brake system.

6. Wheels and Tyres

- Safety precaution.
- Function of wheel and tyres.
- Checking defective tyre repair and replacement.
- Fitting of tyre to the vehicle.
- Checking tyre pressure.
- Rotation of wheel in vehicle.
- Wheel balancing.
- Trouble shooting.
- Safety precaution.

Metrology and Measurement

EG 2103 AE

Year: II
Semester: I

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

Course description:

This course provides knowledge and skills on machine design and manufacturing process. It deals mainly with measurement and inspection of quantities which are expressed in linear and angular terms. This course also deals with some mechanical measurements of parameters like temperature and pressure.

Course objectives:

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

- Explain the scope and fields of Metrology
- Familiar with concept on Standards, Standardization and Standardizing Organizations.
- Describe basic concept , principles and applications of different types of linear, angular, taper measurements
- Acquire basic knowledge on importance of standards
- Explain the principles of limits, fits and tolerances
- Familiarize with the surface finish.
- Explain basics of Screw Thread and Gear Measurement
- Acquire basic knowledge on temperature and pressure measurement

Course contents:

Unit 1: Introduction to Metrology (2 hrs)

- 1.1. Concept of metrology and its scope
- 1.2. General Metrological terms: Accuracy, Precision, Error, Uncertainty, Repeatability, Reproducibility, Sensitivity, Resolution, Calibration, Magnification, Backlash, Range, Span, Traceability, Drift, Response, Stability
- 1.3. Methods of Measurement
- 1.4. Types of error in measurement

Unit 2: Standards, Standardization and Standardizing organizations (2 hrs)

- 2.1. Definition of Standards

- 2.2. Classification of Standards
- 2.3. Line Standards and End Standards
- 2.4. Introduction to National and International Organizations for Standardization

Unit 3: Measuring Instruments (8hrs)

- 3.1. Classification of Measuring Instruments
- 3.2. Linear measurement instruments
 - 3.2.1. Working principle, components and measuring process: Vernier caliper, Micrometer, Slip gauge, dial indicator
- 3.3. Angular measurement instruments
 - 3.3.1. Working principle, components and measuring process: Combination set, Bevel protector, Sine bar, Auto-collimator
- 3.4. Surface measurement instruments
 - 3.4.1. Working principle, components and measuring process: Try square, Surface plate, Surface gauge

Unit 5: Screw Thread Measurement (3 hrs)

- 5.1. Introduction
- 5.2. Classification of threads
- 5.3. Elements of screw thread
- 5.4. Thread measuring Instruments

Unit 6: Gear Measurements (4 hrs)

- 6.1. Introduction
- 6.2. Types of Gear
- 6.3. Spur Gear Terminology
- 6.4. Gear Measuring Instruments

Unit 7: Limits, Fits and Tolerances (7 hrs)

- 7.1. Introduction
- 7.2. Terms : Tolerance, Allowance, Fit, Basic Size, Actual size, nominal size
- 7.3. Classification of fits
- 7.4. Hole basis and Shaft Basis System
- 7.5. Interchangeability
- 7.6. Gauges
- 7.7. ISO system of Limits, Fits and Tolerances
- 7.8. Geometrical tolerances (Form, Profile, Orientation, Location, Run out)

Unit 8: Surface Finish (2 hrs)

- 8.1. Introduction
- 8.2. Concept of surface finish
- 8.3. Roughness, waviness, Form error, sampling length, Lay Direction
- 8.4. Effect of surface finish on machine performance
- 8.5. Surface finish evaluating parameters

- Root mean square value, R_{rms}
- Average Roughness, R_a
- Ten point height of irregularities, R_z
- Bearing area ratio t_p ,

Unit 9: Mechanical Measurements

(2 hours)

- 9.1. Introduction
- 9.2. Units of temperature and Pressure
- 9.3. Temperature measuring instruments
- 9.4. Pressure measuring instruments

References:

1. R. K. Jain, Engineering Metrology, Khanna Publishers, 1999.
2. Manohar Mahajan, A Text book of Metrology, Dhanapat Rai & Co. , (P) Ltd., Delhi,
3. R. K. Rajput, Engineering Metrology and Instrumentation, S. K. Kataria and Sons, Delhi, 3rd edition, 2001.
4. I. C. Gupta, A Text Book of Engineering Metrology, Dhanapat Rai Publications (P) Ltd., Delhi, 1998.

Laboratory works

(15 hours)

1. Familiarization with linear measuring instruments: Vernier caliper, Micrometer, Feller gauge
2. Familiarization with angular measuring instruments: Bevel Protector, Comparator, sine bar.
3. Familiarization with gauges: Go and No-go gauge
4. Familiarization with Thread and Gear Measuring Instruments
5. Familiarization with temperature and pressure measuring instruments

Fourth Semester Subjects:

1. EG 2211 EX Mechatronics
2. EG 2208 ME Thermal Engineering II
3. EG 2209 ME Industrial Management
4. EG 2201 AE Automotive Technology II
6. EG 2210 ME Fluid Mechanics and Fluid Machines
7. Elective (one of the following)
 - a. EG 2202 AE Body Shop Repair and Maintenance
 - b. EG 2202 AE Motor Cycle Repair & Maintenance
 - c. EG 2202 AE Automobile Air Conditioning
 - d. EG 2202 AE Automobile Service Management

Mechatronics

EG 2211 EX

Year: II
Semester: II

Total: 5 hours/week
Lecture: 3 hours/week
Tutorial: hours/week
Practical: 2 hours/week

Course description:

This course includes the fundamental principle and application of mechatronics in general automobile system. Students will be able to understand working principle and necessary components of mechatronics embedded in automobile system along with its system designing.

Course objectives:

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

- Understand essential components and principle of mechatronics.
- Understand modeling and simulation of physical systems
- Understand principle of sensors and transducers
- Understand principle of actuators and actuating devices.
- Understand basics of signal, systems and controls
- Understand basics of ADC/DAC and data logging system
- Understand basic system of Data logging- OBD, EOBD, Scanner Devices.
- Conduct different case studies of automobile mechatronics components.

Course contents:

Unit 1: Introduction to mechatronics	5 hrs.
1.1 Introduction to Mechatronics	
1.1.1 Basic Definition	
1.1.2 Key Elements of Mechatronics	
1.1.3 The Development of the Automobile as a Mechatronics system	
1.1.4 System Interfacing, Instrumentation, and Control Systems used in Mechatronics System	
Unit 2: Physical System and Modeling of Mechatronic System	5 hrs
2.1 Functions of Mechatronic System	
2.1.1 Division of Functions between Mechanics and Electronics	
2.1.2 Improvement of Operating Properties	
2.2 Ways of Integration	
2.2.1 Integrations of components (Hardware)	
2.2.2 Integration of Information Processing (Software)	
2.3 Information Processing Systems	
2.3.1 Basic Architecture and Hardware/Software (HW/SW) Trade-offs	
2.3.1 Introduction to basic architecture	
2.3.1.1 Multilevel Control Architecture	
2.3.1.2 Special Signal Processing	
2.3.1.3 Model-based and Adaptive Control Systems	
2.3.1.4 Supervision and Fault Detection	

2.3.1.5 Intelligent Systems (Basic Tasks)

- 2.4 Concurrent Design Procedure for Mechatronic System
 - 2.4.1 Design Steps
 - 2.4.2 Required Computer Aided Design/Computer Aided Engineering (CAD/CAE) Tools
 - 2.4.3 Modeling procedure
 - 2.4.4 Real time stimulation
 - 2.4.5 Hardware-in-the loop Simulation
 - 2.4.6 Control Prototyping
- Unit 3: Sensors and Actuators 10 hrs
 - 3.1 Introduction to Sensors and actuators
 - 3.1.1 Classification of different types of Sensors
 - 3.1.1.1 Fundamental concept of Contact type Linear and Rotational Sensors
 - a). Infrared
 - b). Resistive
 - c). Tilt (Gravity)
 - d). Capacitive
 - e). AC Inductive
 - f). DC Magnetic
 - g). Ultrasonic
 - h). Magnetostrictive Time-of-Flight
 - i). Laser Interferometry
 - 3.1.1.2 Fundamental concept of different types of Acceleration Sensors
 - a). Inertial Accelerometers
 - b). Electromechanical Accelerometers
 - c). Piezoelectric Accelerometers
 - d). Piezoresistive Accelerometers
 - e). Strain-Gauge Accelerometers
 - f). Electrostatic Accelerometers
 - 3.1.1.3 Working principle of Force Measurement Sensors
 - a). Force Sensors
 - 3.1.1.4 Fundamental concept of Torque and Power Measurement Sensors
 - a). Torque Transducer Construction, Operation, and Application
 - b). Apparatus for Power Measurement
 - 3.1.1.5 Fundamental concept of Flow Measurement
 - a). Differential Pressure Flowmeter
 - b). Variable Area Flowmeter
 - c). Positive Displacement Flowmeter
 - d). Turbine Flowmeter
 - e). Vortex Shedding Flowmeter
 - f). Electromagnetic Flowmeter
 - g). Ultrasonic Flowmeter
 - 3.1.1.6 Fundamental concept of Temperature Measurements
 - a). Electrical Temperature Sensors and Transducers
 - b). Noncontact Thermometers

c).	Microscale Temperature Measurements	
3.1.1.7	Fundamental concept of Distance Measuring and Proximity Sensors	
a).	Distance Measuring Sensors	
b).	Proximity Sensors	
3.1.1.8	Fundamental concept of Light Detection, Image, and Vision Systems	
a).	Light Detectors	
b).	Image Sensors	
3.1.1.9	Integrated Microsensors	
	Examples of Micro- and Nanosensors	
3.1.2	Classification of different types of Actuators	
3.1.2.1	Electrical Actuators	
3.1.2.2	Electromechanical Actuators	
3.1.2.3	Electromagnetic Actuators	
3.1.2.4	Hydraulic and Pneumatic Actuators	
3.1.2.5	Smart Material Actuators	
3.1.2.6	Micro- and Nano Actuators	
3.1.3	Fundamental concept of Electromechanical Actuators	
3.1.3.1	Different types of Electromechanical Actuators	
3.1.3.2	Power Amplification and Modulation - Switching Power Electronics	
3.1.4	Fundamental concept of Piezoelectric Actuators	
3.1.4.1	Piezomaterials	
3.1.4.2	Piezoactuating Elements	
3.1.4.3	Piezomotors (Ultrasonic Motors)	
3.1.4.4	Piezoactuators with Several Degrees of Freedom	
3.1.5	Introduction to Hydraulic and Pneumatic Actuation Systems	
3.1.5.1	Fluid Actuation Systems	
3.1.5.2	Hydraulic Actuation Systems	
3.1.5.3	Block diagram of a Hydraulic Servosystem for Position Control	
3.1.5.4	Pneumatic Actuation Systems	
Unit 4:	Microprocessor-Based Controllers and Microelectronics	5 hrs
4.1	General overview of Microelectronics	
4.2	General overview of Digital Logic	
4.3	General Overview of Control Computers	
4.4	General concept of Microprocessors and Microcontrollers	
4.5	General concept of Programmable Logic Controllers	
Unit 5:	Relay Logic and PLCs	10 Hrs
5.1	Basics of Tuning a process control system	
5.2	Tuning PID loops for level control	
5.3	Modified Ziegler-Nichols tuning method	
5.4	General concept of Relay logic	
5.4.1	Internal Relay	
5.4.2	Ladder Programs	
5.4.3	Battery Backed Relay	
5.5	General concept of Counters	
5.5.1	Forms of Counter	

5.5.2 Programming	
5.5.3 Up and Down Counting	
5.5.4 Timers with counters	
5.6 General concept of Relay Sequencers	
5.7 General concept of Programmable Logic Control (PLC)	
5.7.1 Controllers	
5.7.2 Hardware	
5.7.3 Internal Architecture	
5.7.4 Ladder Diagram	
Unit 6: Data Acquisition System	7 hrs
6.1 General overview of Analog to digital (ADC) and digital to analog conversion (DAC) system	
6.1.3 Types of ADCs and its basic operation process.	
6.1.3.1 Flash type ADC	
6.1.3.2 Successive-Approximation Register	
6.1.3.3 Multistage type ADC	
6.1.3.4 Integrating type ADC	
6.1.3.5 Sigma-Delta type ADC	
6.1.4 Digital to Analog Conversion (DAC) and its basic operation process	
6.1.4.1 Architecture of DACs	
6.1.4.2 Switching Network	
6.1.4.3 Resistive Networks	
6.1.4.4 Summing Amplifier	
6.2 General introduction to Data Recording and Logging system	
6.2.1 Data acquisition method	
6.2.1.1 Sensors Input	
6.2.1.2 Signal Connectivity	
6.2.1.3 Signal Conditioning	
6.2.1.4 Conversion	
6.2.1.5 Online Analysis of data	
6.2.1.6 Logging and Storage	
6.2.1.7 Offline Analysis of data	
6.2.1.8 Display of data	
6.2.1.9 Report Generation	
6.2.1.10 Data Sharing and Publishing	
Unit 7. Basics of Automation,	3 Hrs
7.1 Introduction to Automation	
7.2 Components of Automation	
7.3 Types of Automation	
7.3.1 Fixed Automation	
7.3.2 Flexible Automation	
7.3.3 Programmable Automation	
7.4 Scope of Automation	

Reference Books:

1. Alciatore, David G. and Hstand Michael B., (2012), Introduction to mechatronics and measurement systems, Fourth edition, McGraw-Hill. ISBN 978-0-07-338023-0.
2. Bishop, Robert H., (2006), Mechatronics: an Introduction, Taylor & Francis Group, LLC. ISBN 0-8493-6358-6 (alk. paper)
3. Onwubolu, Godfrey C., (2005), Mechatronics, Principles and Applications, Elsevier Butterworth-Heinemann. ISBN 0 7506 6379 0
4. Shetty, D. and Kolk, Richard A., (2011), Mechatronics System Design, Second Edition, Cengage Learning, ISBN-13: 978-1-4390-6199-2, ISBN-10: 1-4390-6199-8.
5. Bishop, Robert H., (2002), The Mechatronics Handbook, CRC Press, ISBN 0-8493-0066-5
6. Billingsley, J. (John) (2006)., Essentials of Mechatronics, John Wiley & Sons, Inc., Hoboken, New Jersey. ISBN-13 978-0-471-72341-7 (cloth), ISBN-10 0-471-72341-X (cloth)
7. Naik, Ganesh R., ed.(2011)., Intelligent Mechatronics, Intech Open Access Publisher, India, ISBN 978-953-307-300-2.
8. Clarence W. de Silva, ed. (2008)., Mechatronic systems : devices, design, control, operation and monitoring. CRC Press, Taylor & Francis Group, ISBN 978-0-8493-0775-1 (alk. paper).
9. Davim, Paulo J., ed. (2012)., Mechatronics and manufacturing engineering, Research and development. Woodhead Publishing India Private Limited, G-2, Vardaan House, 7/28 Ansari Road, Daryaganj, New Delhi – 110002, India, ISBN 978-0-85709-150-5 (print), ISBN 978-0-85709-589-3 (online).
10. Clarence W. de Silva, Khoshnoud F., Li M., and Halgamuge, Saman K., ed. (2016)., Mechatronics Fundamentals and Applications, CRC Press, Taylor & Francis Group, LLC, ISBN-13: 978-1-4822-3932-4

Practical	30 hrs
1. Demonstration of different type of sensors <ul style="list-style-type: none"> • Demonstration of Linear and Rotational sensors • Acceleration Sensors • Flow measurement sensors • Temperature sensors • Proximity sensors • Image sensors • Microsensors 	7 hrs
2. Demonstration of different type of actuators <ul style="list-style-type: none"> • Piezo actuators • Hydraulic actuators • Pneumatic actuators • Microcontrollers • Microprocessors • Programmable Logic Controls 	7 hrs
3. Demonstration of operation of different ADC <ul style="list-style-type: none"> • Flash type ADC • Successive approximation type register • Multistage ADC • Integrating ADC • Sigma Delta ADC 	3 hrs
4. Demonstration of operation of different DAC <ul style="list-style-type: none"> • Switching Network • Resistive Network • Summing Amplifier 	3 hrs
5. Demonstration of Data logging system using X431 Scanner in cars <ul style="list-style-type: none"> • Vehicle data logging • Reading of current data • Analysis of current data • Erasing of errors 	7 hrs
6. Demonstration of Automation <ul style="list-style-type: none"> • Fixed Automation • Flexible Automation 	3 hrs

Thermal Engineering II

EG 2208 ME

Year: II
Semester: II

Total: 5 hours/week
Lecture: 3 hours/week
Tutorial: 1 hours/week
Practical: hours/week
Lab: 1 hours/week

Course description:

This course deals with the application of laws of thermodynamic cycles, types and functions of boilers, air compressors and refrigeration and air conditioning system.

Course objectives:

After completing this course the students will be able to:

- Describe the uses of boilers, air compressors and RAC system
- Explain the operation of various aggregates, components of heat engines, air compressors and RAC system
- Check the condition and carry out servicing of boiler, air compressors and RAC system and their components.

Course contents:

Unit 1: Boilers

[12]

- 1.1 Introduction and applications
- 1.2 Classifications and comparison among various types of boilers
- 1.3 Requirements of an ideal boiler
- 1.4 Boiler mountings and accessories: water level indicator, feed check valve, Blow off cock, steam separator, safety valves, Feed pump, air preheater, superheater and economizer
- 1.5 Water conditioning
 - 1.5.1 Water problems and Benefits of water conditioning
 - 1.5.2 Constituents and Characteristics of water
 - 1.5.3 Types and causes of scale and deposits
 - 1.5.4 Scale deposit prevention methods

Unit 2: Air compressors

[4]

- 2.1 Classification of air compressors
- 2.2 Reciprocating compressors: construction, operation, and care
- 2.3 Centrifugal compressors: construction, operation, and care

Unit 3: Steam engine/turbine cycles

[8]

- 3.1 Carnot cycle: assumptions, operation and performance

- 3.2 The Rankine cycles: operation, application and performance
- 3.3 Rankine cycle with superheat
- 3.4 The enthalpy-entropy chart
- 3.5 Application of steam tables and chart

Unit 4: Heat engine cycles

[9]

- 4.1 Constant volume cycle: application and performance
- 4.2 Constant pressure cycle: application and performance
- 4.3 Dual cycle: application and performance
- 4.4 Related problem on cycles

Unit 5: Refrigeration and air conditioning cycle

[12]

- 5.1 Refrigerant: types and properties
- 5.2 Introduction to evaporative refrigeration and ice refrigeration
- 5.3 Vapour compression cycles: application and performance
- 5.4 Vapour-absorption cycles: application and performance
- 5.5 The pressure-enthalpy diagram
- 5.6 Domestic refrigerator: components, construction, operation and care
- 5.7 Cold storage: components, operation and installation
- 5.8 Psychrometric chart: Dry and wet bulb temperature, Humidity
- 5.9 Air conditioning system
 - 5.9.1 Working of air conditioning system
 - 5.9.2 Function of different Components: Humidifier, dehumidifier, diffusers, air handling unit, duct, fan
 - 5.9.3 Comfort zone

Suggestion for instruction:

1. Use illustrative teaching materials like model, charts, and overhead transparencies or multimedia projector to visualize the complex parts.
2. Show videos in the class in related topics.
3. Students are asked to assemble, dismantle and test the parts in the practical classes.
4. Use of appropriate tools is emphasized to test the condition of parts.

Reference:

1. R.K. Rajput, "Thermal engineering" Laxmi Publications, New Delhi.
2. Pulkrabek, W. W. 2002 Engg. Fundamentals of Internal Combustion Engines, Prentice Hall of India Pvt. Ltd. New Delhi – 110001, India
3. Kulshrestha, S. K. Thermal Engineering, Vikash Publishing House Pvt. Ltd. New Delhi – 110014, India
4. Domkundwar & Arora, A course in Refrigeration and air conditioning, Dhanpat Rai and sons, 1682, NaiSarak, Delhi – 110006, India
5. Ratha Krishnan E, Fundamental of Engineering Thermodynamics, Prentice Hall India Pvt. Ltd, New Delhi – 110001, India

6. Bernard D. Wood, “Applications of Thermodynamics”, Waveland Press Inc., Illinois.

Lab/Practical:

[15]

1. Performance Study of IC engine
2. Performance Study of air compressor
3. Performance Study of vapor compression refrigeration system
4. Performance Study of vapor absorption refrigeration system
5. Conduct a visit to local cold storage, ice factory and large air conditioning system.
6. Conduct a visit to local food processing industry having boiler.

Industrial Management

EG 2209 ME

Year: II
Semester: II

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

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:

- Describe the concept of organization and management
- Understand the basic theories of management
- Explain the various leadership behaviors of a manager
- Explain the concept of production management and production control
- Understand the process of marketing
- Demonstrate the understanding of materials management
- Apply the principles of engineering economics and capital management

Course contents:

Unit1 Introduction to Organization and Management [16]

- 1.1 Definition of an Organization
- 1.2 Organization as an open system
- 1.3 Evolution of organizations
- 1.4 Formal and informal organization
- 1.5 Industrial organization
 - Types of ownership (forms of business organization): private sector, cooperative sector, public sector
 - Individual ownership: introduction, advantages and disadvantages
 - Partnership organization: introduction, types, advantages, disadvantages
 - Joint stock company: introduction, types, advantages, disadvantages
 - Cooperative organizations: basic concept, advantages, disadvantages
 - State enterprises and undertakings: departmental undertakings, public corporation, government company
 - Difference between private sector and public sectors enterprises

- 1.6 Organization structure and its types
 - Introduction of organization structure
 - Line organization
 - Line and staff organization
 - Functional organization
- 1.7 Departmentation: basic concept, basis of departmentation
- 1.8 Management
 - Introduction and definitions of management
 - Characteristics of management
 - Basic levels of management in industry: top level, middle level and lowest or supervisory level of management
 - Basic responsibilities at different level of management
 - Managerial skills for different level of management: technical skills, human relation skills/interpersonal skills (includes communication skills, motivating skills and leadership skills), conceptual skills (includes decision making and organizational skills)
- 1.9 Processes and functions of management: planning, organizing, staffing, directing, motivating, controlling, leading, decision making and communication
- 1.10 Evolution of management theory
 - Handicraft system
 - Factory system
 - Stages of evolution of management: classical theory, neo-classical theory and modern management theories
 - Scientific management theory and its principles
 - Administrative management theory (Henri Fayol and others) and its 14 principles
 - Bureaucracy theory
 - Human relations and behavior science theories
 - The decision theory of management
 - Management science theory
 - Systems theory of management
 - Contingency theory of management

Unit 2 Leadership and Supervisory

[4]

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

Unit 3 Production Management

[10]

- 3.1 Introduction to production management
- 3.2 Functional subsystems of organization: Marketing, Production, Finance, Personnel
- 3.3 Production: system concept of production of an organization (inputs, transformation processes, outputs)
- 3.4 Introduction to various techniques used in production system
 - Forecasting
 - Plant location and layout
 - Product design and analysis
 - Production planning and control
 - Maintenance management
 - Feedback and control techniques (inventory control and quality control)
- 3.5 Finance and capital management
 - Sources of finance for investment
 - Concept of assets and liabilities
 - Concept of fixed capital and selection of machine tools
 - Concept of working capital and calculation
 - Accounting (definition, objectives, and importance of accounting, concept of debit and credit, concept of journal and ledger, profit and loss account, balance sheet)
- 3.6 Personnel function
 - Introduction and its importance in industrial organization as a support function
 - Activities of personnel function in brief (next to this semester, a course on personnel management is proposed for detail study).
- 3.7 Productivity improvement techniques: definition, a brief discussion on human resource based productivity improvement and machines/technology based productivity improvement techniques
- 3.8 Concept of time and motion study
- 3.9 Role of bottom/lowest level management in production management

Unit 4 Marketing of Product or Services

[5]

- 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
- 4.10 Pricing of goods or services

4.11 Role of bottom level management in marketing process

Unit 5 Materials Management and Inventory Control [5]

- 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 Definition of inventory control
- 5.5 Inventory level
- 5.6 Economic lot size
- 5.7 Duties and responsibilities of store keeper

Unit 6 Engineering Economics and Capital Management [5]

- 6.1 Engineering economics: 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 Capital Management
- 6.6 Basic concept of assets and liability
- 6.7 fixed capital and selection of machine and tools
- 6.8 working capital and calculation
- 6.9 Accounting: objectives and importance of accounting, debit and credit, journal and ledger, profit and loss account, balance sheet

Suggestions for Instructions:

1. Lectures by teacher
2. Presentations by students
3. Guest speakers on any relevant industrial management topics.
4. Industrial visits on existing management practices
5. Relevant case studies on industrial management successes
6. Assignments to broaden the horizon of management skills of students

Note: the above given topics and sub topics are basic guidelines to drive the course for initial stage. The course improvement is a continuous process based on the feedback of the industries. Therefore related authorities are recommended to review the course continuously to address the future needs more effectively.

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 (2nded.). 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. I.K. Chopde, A. M. Sheikh, Industrial Management, S. Chand group, New Delhi

Automotive Technology II

EG 2201 AE

Year: II
Semester: II

Total: 15 hours/week
Lecture: 4 hours/week
Tutorial: hours/week
Practical: 11 hours/week
Lab: hours/week

Course description:

This course includes automobile engine, cooling and lubrication system, fuels, electricity, magnetism, battery, ignition system, starter, alternator and automobile accessories.

Course objectives:

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

- Understand engine and their types
- Explain working principle of engine
- Understand fuel, lubrication, cooling and their properties
- Describe construction and application of alternator and Starter motor, battery and ignition system
- Dismantle and Assemble of petrol engine and measure of engine component.

Course contents:

Unit 1: Engine Fundamentals

14 hrs

1.1 Engine

- 1.1.1. Introduction to engine
- 1.1.2. Classification of engine
- 1.1.3. Spark ignition (SI) and Compression Ignition (CI) engine
- 1.1.4. Working principle of two stroke cycle and four stroke cycle engine
- 1.1.5. Use and importance of Diesel engine and petrol engine components
- 1.1.6. Valve and valve mechanism and valve timing diagram
- 1.1.7. Fault and remedies

1.2 Engine Terminology

4 hrs

- 1.2.1. Bore
- 1.2.2. Stroke
- 1.2.3. TDC/BDC
- 1.2.4. Engine Capacity
- 1.2.5. Mean effective pressure

- 1.2.6. Indicated power
- 1.2.7. Brake power
- 1.2.8. Friction power
- 1.2.9. Indicated thermal efficiency
- 1.2.10. Brake Thermal Efficiency
- 1.2.11. Mechanical Efficiency
- 1.2.12. Indicated Mean Effective pressure
- 1.2.13. Brake Mean Effective Pressure
- 1.2.14. Friction Mean Effective Pressure
- 1.2.15. Specific fuel consumption

Unit 2: Fuel

2 hrs

- 2.1. Introduction and types of fuel
- 2.2. Fuel structure
- 2.3. Properties of liquid fuel
 - Volatility of fuel
 - Flash point
 - Fire Point
 - Ignition temperature
 - Calorific value
 - Octane number
 - Cetane number
 - Antiknock value and ignitability of fuel

Unit 3: Petrol Fuel system

5 hrs

- 3.1. Introduction and types of petrol fuel system
- 3.2. Purpose, importance and uses of petrol fuel system
- 3.3. Working principle and function of fuel system
- 3.4. Components of fuel system: tank, pump, filter, air cleaner
- 3.5. Components of Gasoline Engine Management System (EMS)
- 3.6. Working Principles of Gasoline Engine Management System (EMS)
- 3.7. Fault and remedies

Unit 4: Lubrication System

4 hrs

- 4.1. Lubricants, its types functions and properties
- 4.2. Introduction to lubrication system
- 4.3. Importance, purpose and uses of lubrication system
- 4.4. Working principle and function of lubrication system
- 4.5. Types of lubrication system
- 4.6. Types of Lubricants and grading
- 4.7. Parts and components of lubrication system
- 4.8. Fault and remedies

Unit 5: Cooling system**3 hrs**

- 5.1. Introduction to cooling system
- 5.2. Importance, purpose and uses of cooling system
- 5.3. Working principle of cooling system
- 5.4. Types of Cooling System
- 5.5. Components of cooling system
- 5.6. Types and grading of coolant
- 5.7. Fault and remedies

Unit 8: Automobile Battery**3 hrs**

- 8.1. Introduction
- 8.2. Construction of battery
- 8.3. Function of lead acid battery
- 8.4. Battery capacity
- 8.5. Charging and discharging process of battery
- 8.6. Battery Charging methods
- 8.7. Faults and remedies

Unit 9: Ignition system**5 hrs**

- 9.1. Introduction, purpose and uses of ignition system,
- 9.2. Types of ignition system, conventional and electronic ignition system
- 9.3. Working principle of ignition system
- 9.4. Components of ignition system
- 9.5. Working principle and function of battery coil ignition system
- 9.6. Ignition timing and firing order
- 9.7. Introduction and types of advance mechanism
- 9.8. Introduction to magneto ignition system
- 9.9. Working principle of magneto ignition system
- 9.10. Merits and demerits of coil ignition and magneto ignition system
- 9.11. Transistorized ignition system
- 9.12. Distributor less ignition system.
- 9.13. Faults and remedies

Unit 10: Automobile starting system**5 hrs**

- 10.1. Introduction and function of starting system
- 10.2. Working principle of starter motor
- 10.3. Function of main components of starting system
- 10.4. Types of starter motors
- 10.5. Faults and remedies

Unit 11: Automobile Charging System**5 hrs**

- 11.1. Introduction to charging system
- 11.2. Working principle of alternator
- 11.3. Function of different parts of alternator
- 11.4. Importance and function of regulator

11.5. Faults and remedies

Unit 13: Auto electrical wiring

10 hrs

- 12.1. Symbols used in car wiring
- 12.2. Lighting systems
- 12.3. Harness and color coding in automobile wiring
- 12.4. Electric circuit of an automobile
- 12.5. Accessory circuit
- 12.6. Types of bulbs of an automobile
- 12.7. Headlights and parking light
- 12.8. Side lights, reverse light, brake light, fog light, horn
- 12.9. Interior lights
- 12.10. Fault findings
- 12.11. Wiper System
- 12.12. Power Window

Reference books:

1. William H. Crouse, Automotive Engines, Tata McGraw Hill Company, New Delhi
2. Crouse, Anglin, Automotive Mechanics, Tata McGraw Hill Company, New Delhi
3. T.R. Banga, Nathu Singh, A text book of Automobile Engineering,
4. Frederick C. Nash, Kalman Banitz, Automotive Technology
5. K. M. Moeed, Automobile Engineering, S. K. Kataria and sons, Ansari Road, Daryagunj, New Delhi, 110002
6. R.K. Mohanty, Automobile Engineering Volume I & II, Standard Book House, 1705A Naisarak, Delhi, 110006
7. P. S. Gill, A Text book of Automobile Engineering Volume I & II, S. K. Kataria and sons, Ansari Road, Daryagunj, New Delhi, 110002
8. Dr. Kripal Singh, Automobile Engineering Volume I & II, Standard Publishers Distributors, Naisarak, Post box 1066, Delhi, 110006
9. A. S. Rangwala, Trends in Automobile Engineering, New Age International Publishers
10. R.K. Singal, Automobile Engineering, S. K. Kataria and sons, Ansari Road, Daryagunj, New Delhi, 110002
11. G.B. S. Narang, Automobile Engineering, Khanna Publishers
12. Dr Harbans Singh Reyat, The Automobile, S. Chand and Company Ltd., New Delhi
13. Willard W. Pulkrabek, Engineering Fundamentals of Internal Combustion Engine, Prentice-Hall of India P. Ltd., New Delhi
14. V.M. Domkundwar, A Course in Internal Combustion Engine, Dhanpat Rai & Company, New Delhi
15. H. Gerscher, Technology for Automotive Trade Volume 1 & 2, GTZ
16. H.M. Sethi, Automotive Technology, Tata McGraw-Hill Publishing Company Ltd., New Delhi
17. S. Srinivasan, Automotive Mechanics, Tata McGraw Hill Publishing Company Limited, New Delhi

18. P. L. Kohli, Automotive Electrical Equipment, Tata Mc Graw Hill Publishing Company Limited, New Delhi

Practical

1. Petrol engine

- Safety precaution.
- Dismantling of engine.
- Identification and function of engine components
- Demonstration of operation of spark ignition engine.
- Operation of cooling system.
- Operation of lubrication system.
- Operation of air intake system.
- Inspection of engine components.
- Measurement of engine components (piston, crank shaft main and big end journals, cylinder bore, and cam shaft) by using micrometer and bore gauges.
- Assembling of engine ,(valve timing, ignition timing and valve clearance adjustment)

2. Fuel system

- Safety precaution.
- Identification and function of multipoint fuel injection system components.
- Lay out of multipoint fuel injection system.
- Working principle of MPFI system.
- Block diagram of MPFI
- Circuit diagram of MPFI system
- Continuity, voltage, resistance and short circuit test in MPFI system by using multimeter.
- Fault finding by using diagnostic tool.

2. Battery

- Safety precaution.
- Construction of battery
- Battery capacity.
- Checking electrolyte level.
- Testing specific gravity of electrolyte.
- Load (high discharge) test.
- Removal and installation of battery.
- Slow charging
- Quick charging.

4. Ignition system

- Safety precaution
- Identification and function of ignition system components.
- Lay out of ignition system
- Circuit diagram of ignition system.
- Inspection of ignition system components (battery. Ignition switch, ignition coil, condenser high tension cables and spark plugs).
- Continuity, voltage, resistance and short circuit test by multimeter in ignition system.
- Fault finding in ignition system by diagnostic tool.

5. Charging system

- Safety precaution.
- Dismantling of alternator.
- Identification and function of charging system components.
- Inspection of charging system components.
- Charging system circuit diagram.
- Operation of charging system
- Assembling of alternator.
- Alternator output test.
- Voltage regulator test
- Trouble shooting of charging system.

6. Starting system

- Safety precaution.
- Dismantling of starter motor.
- Identification and function of starting system components.
- Circuit diagram of starting system.
- Operation of starting system.
- Testing of starting circuit by multimeter.
- Inspection of starting system components-ignition switch, relays, carbon brushes, springs, field coils, armature winding, commutator, solenoid switch and drive pinion.)
- Assembling of starter motor.
- Testing of starter on test bench and on car

7. Auto-Electric Wiring

- Safety precautions
- Wiring symbols
- Circuit diagram

7.1 Head light system

- Head light wiring layout
- Identification of head light components

- Checking of components and circuits.
- Head light adjustment, repair and maintenance

7.2 Parking Light System

- Parking light wiring layout
- Identification of parking light components
- Checking of components and circuits, repair and maintenance

7.3 Back Light System

- Back light wiring layout
- Identification of back light components
- Checking of components and replace
- Repair and maintenance of circuits

7.4 Flasher and side indicator

- Flasher system wiring layout
- Identification of flasher system components
- Checking of components and replace
- Repair and maintenance of circuits

7.5 Cabin light, baggage compartment, bonnet and dashboard light

- Identification of components
- Wiring layout
- Checking/replace of components and circuits
- Repair and maintenance

7.6 Brake Light

- Wiring layout
- Identification of components
- Checking/replace components
- Repair and maintenance

7.7 Horn System

- Wiring layout
- Identification of components
- Checking/replace components
- Repair and maintenance
- Adjusting horn

8. Instruments and Indicators

8.1 Water Temperature Indicator

- Wiring layout
- Identification of components
- Checking/replace of components

- Repair and maintenance

8.2 Oil pressure indicator system

- Wiring layout
- Identification of components
- Checking/replace of components
- Repair and maintenance

8.3 Fuel indicator gauge system

- Wiring layout
- Identification of components
- Checking/replace of components
- Repair and maintenance

9. Wiper System

- Wiring layout
- Identification of components
- Checking and replace of components
- Repair and maintenance of circuit

10. Power windows

- Wiring layout
- Identification of components
- Checking and replace of components
- Repair and maintenance of circuit

Fluid Mechanics and Fluid Machines

EG 2102 ME

Year: II
Semester: II

Total: 5 hours/week
Lecture: 3 hours/week
Tutorial: 1 hours/week
Practical: hours/week
Lab: 1 hours/week

Course description:

This course deals with the general theories and equations of fluid mechanics. It also describes various applications of theories including water turbines and pumps.

Course objectives:

After completing this course the student will be able to explain:

- General properties of fluids
- Various characteristics of fluid at static and kinematics conditions
- Basic theories and equations of fluid mechanics with their applications
- Various phenomena of viscous flow
- Dynamic action of fluid
- Theories and working principles of fluid machines

Course contents:

Unit: 1	Properties of fluid	[3]
	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	
Unit 2:	Fluid static	[5]
	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	
Unit 3:	Kinematics of fluid	[2]
	3.1 Description of fluid motion, path line and stream line	
	3.2 Types of fluid displacement	
	3.3 General types of fluid flow	
Unit 4:	Basic equations of fluid flow	[7]

4.1	Continuity equation	
4.2	Bernoulli's equation	
4.3	Momentum equation	
4.4	Applications of basic equations of fluid flow	
Unit 5:	Viscous flow	[7]
5.1	Laminar and turbulent flow	
5.2	Reynold's number	
5.3	Flow of viscous fluid in circular pipe: Hagen-Poiseuille equation	
5.4	Velocity distribution	
5.5	Boundary layer concept	
5.6	Lift and drag on immersed body	
5.7	Resistance to flow and head losses in close conduits	
5.8	Flow over rectangular and triangular notches or weirs, co-efficient of discharge	
Unit 6:	Dynamic action of fluid	[5]
6.1	Dynamic force and power	
6.2	Force exerted by fluid jet on stationary and moving flat/ curved plates	
Unit 7:	Water turbines	[9]
7.1	Introduction of hydraulic machines	
7.2	History of development of water turbines	
7.3	Types of water turbines	
7.4	Working principles of Pelton, Francis, Kaplan, Axial flow and Cross flow turbines	
7.5	Head, efficiencies, specific speed and general characteristics curve of water turbines	
7.6	Introduction of water turbine governor and their functions	
Unit 8:	Pumps	[7]
8.1	Classification (positive displacement and roto-dynamic pumps)	
8.2	Working of centrifugal, axial and piston pumps	
8.3	Pump characteristics and selection of pump	
8.4	Hydraulic ram	
8.5	Similarity laws for turbine and pump	
Lab/Practical		
1.	Study of properties of fluid	[1]
2.	Validity of Bernoulli's theorem	[1]
3.	Losses in pipe flow through bends and fittings	[1]
4.	Performance characteristics of Pelton turbine	[1]
5.	Performance characteristics of Francis turbine	[1]
6.	Compare the characteristics of various pumps	[1]

Suggestions for instruction:

1. Give appropriate examples of surrounding.
2. Use SI units as well as possible.
3. Solving related problems in the class and give as home assignment.
4. Use as much as figures and diagrams with direction of flow.
5. Site visit of power plant, irrigation plant and drinking water supply system are advantage for this course.

References:

1. B.S. Massy, 1980, Fluid Mechanics, English Language Book Society and Van Nostrand Reinhold Company, London
2. F.M. White, 1986, Fluid Mechanics, Mc Graw-Hill Book Company, Singapore
3. J.F. Douglas, J. M. Gasiorek and J. A. Swaffield., 2002, Fluid Mechanics, Person Education Pvt. Ltd., Singapore
4. Dr. Jagdish Lal 2002, Fluid Mechanics and Hydraulics, Metropolitan Book Co. Private Ltd., New Delhi India
5. Dr. Jagdish Lal 1997, Hydraulic Machines, Metropolitan Book Co. Private Ltd., New Delhi India
6. R. K. Rajput, 1999, S Chand and Company Ltd. Fluid Mechanics and Hydraulics Machines, New Delhi
7. V. L. Streeter and E. B. Wylie., 1983, Mc Graw-Hill Book Company. Singapore

Body Shop Repair and Maintenance

EG 2202 AE (Elective)

Year: II
Semester: II

Total: 7 hours/week
Lecture: 2 hours/week
Tutorial: hours/week
Practical: 5 hours/week
Lab: hours/week

Course description:

This course is designed to provide knowledge and skills on vehicle denting & painting related work.

Course objectives:

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

- Carry out simple denting & painting work
- Use sheet metal working tools
- Be familiar with properties of sheet metals
- Apply appropriate techniques to repair dents.

Theory and Practical

Time allocation for the Project

1.	Study of the project	-	08 hrs.
2.	Actual shape of the dented part (free hand sketch)	-	08 hrs.
3.	Detail drawing & cost calculation	-	08 hrs.
4.	Preparation work (materials, tools etc.)	-	06 hrs.
5.	Denting & painting work	-	40 hrs.
6.	Final Check up & Report writing	-	20 hrs.

Unit 1. Identifying dents

1.1 Identify different types of dents

- Shallow dent
- Crease
- Sharp dent
- Collision dent

Unit 2. Familiarizing Dent repair tools

- 2.1 Dent hammers
- 2.2 Metal hammers
- 2.3 Soft hammers
- 2.4 Push rods
- 2.5 Push profiles
- 2.6 Up hold & down hold tools

Unit 3. Selecting materials and consumables

- 3.1. sand papers
- 3.2. soft brushes
- 3.3. soft cloths
- 3.4. masking paper
- 3.5. adhesives
- 3.6. touch paint

Unit 4. Performing Paint-less dent repair

- 4.1. cleaning and wiping the dent area
- 4.2. paper masking
- 4.3. use of tool blow (trial & error method)
- 4.4. finish & check the repaired dent

Unit 5. Performing collision dent repair

- 5.1. identify the dents (repairable)
- 5.2. dismantle or detach the dented part /s
- 5.3. perform hot/ cold denting as required
- 5.4. use appropriate tools
- 5.5. apply trial & error method till the dent is repaired
- 5.6. clean the repaired area with suitable grade of sand paper
- 5.7. wash and rinse the area
- 5.8. apply hot drying method
- 5.9. apply touch paint (Paint sample bought from the company)
- 5.10. polish wipe with soft cloth
- 5.11. finish & check

References:

1. Basic Sheet metal Practice
2. Dennis W. Parks, The Complete Guide to Auto Body Repair, Motorbooks International, 2008
3. http://www.nepdrt_whatish.htm
4. Ivan Law, Measuring and marking Metals, Workshop Practice Series, Argus Books Ltd.
5. James E. Duffy, Robert Scharff, Auto Body Repair Technology, 4th Edition, Cenage Learning,
6. John Pfan Stiehl, Automotive Paint Handbook: Paint Technology for Auto Enthusiastic and Body Shop Professional, HP Books, The Bakerly Publishing Group
7. John Van Nn Winden, Blacksmithing, Welding & Soldering, Rural Mechanic Course-2, Tool Foundation
8. Robert Scharft, Deve Caruso, Complete Automotive Welding Metals and Plastics, Demlar Automotive Series
9. Thin plate work

Motor Cycle Repair & Maintenance

EG 2202 AE (Elective)

Year: II
Semester: II

Total: 7 hours/week
Lecture: 2 hours/week
Tutorial: hours/week
Practical: 5 hours/week
Lab: hours/week

Course description:

This course deals with frame and control, engine, transmission and electrical systems of motorcycle

Course objectives:

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

- Explain the theory and functioning of motorcycle.
- Identify and list various systems in motorcycle.
- Demonstrate general overhaul and repair of motorcycle and their components.
- Perform repair and maintenance of motorcycle's electrical system
- Perform routine/preventative/periodical maintenance as well as minor and major repair of motorcycle.

Course content:

Unit 1: Motorcycle frame and control system

5 hrs

- 1.1. Introduction, purpose and types of frame
- 1.2. Introduction, purpose and types of wheels and tyres
- 1.3. Introduction, Purpose, Working principle and types of brake
- 1.4. Introduction, purpose and working principle of steering system
- 1.5. Faults and remedies of frame and control system
- 1.6. Safety Measures

Unit 2: Motorcycle Engine and Transmission

20 hr

2.1 Engine

- 2.1.1. working principle of four stroke cycle and two stroke cycle engine
- 2.1.2. Difference between two stroke and four stroke cycle engine
- 2.1.3. Valve timing mechanism and valve timing diagram
- 2.1.4. Importance and purpose of measurement
- 2.1.5. purpose, importance and uses of fuel system in motorcycle
- 2.1.6. Components of fuel system
- 2.1.7. Importance, purpose and uses of lubrication system

- 2.1.8. Different parts and components of lubrication system
- 2.1.9. Importance, purpose and types of cooling system
- 2.1.10. Fault and remedies of engine

2.2 Transmission

- 2.2.1. Introduction, purpose, types and function of transmission system
- 2.2.2. Working principle of clutch, gear box and drive chain.
- 2.2.3. Components and parts of clutch, gearbox and drive chain
- 2.2.4. Fault and remedies of transmission

Unit 3: Motorcycle Electrical

5 hrs

- 3.1. Introduction of Battery, purpose of battery, types of battery,
- 3.2. battery charging rating, battery charging connection, charging of battery
- 3.3. Introduction, purpose, principle and types of ignition system
- 3.4. Introduction, function and circuit layout of starting system
- 3.5. Introduction, purpose and function of lighting system
- 3.6. Types of lighting system (Head light, side light, parking light, brake light)
- 3.7. Bulb, fuse, relay, switch, Circuit layout
- 3.8. Introduction, purpose, function and circuit layout of charging system
- 3.9. Introduction, purpose and circuit layout of horn
- 3.10. Purpose, uses and circuit layout of Instrument panel/indicator
- 3.11. Fault and remedies of electrical system
- 3.12. Safety measures

Reference:

1. S. Srinivasan, Automotive Mechanics, Tata McGraw Hill Publishing Company Limited, New Delhi
2. P. L. Kohli, Automotive Electrical Equipment, Tata Mc Graw Hill Publishing Company Limited, New Delhi

Practical**75 hrs**

1. Perform servicing
2. Repair/maintain chassis
3. Repair/maintain suspension system
4. Repair/maintain brake and control system
5. Repair/maintain fuel supply system
6. Repair/maintain ignition system
7. Repair / maintain engine
8. Measure engine pats.
9. Repair / maintain clutch ,gear and drive chain
10. Repair / maintain lubrication system
11. Perform general wiring
12. Repair/maintain motorbike lighting and signaling system
13. Repair/maintain charging and starting system

Automobile Air Conditioning

EG 2202 AE (Elective)

Year: II
Semester: II

Total: 7 hours/week
Lecture: 2 hours/week
Tutorial: hours/week
Practical: 5 hours/week
Lab: hours/week

Course description:

This course deals with the study of refrigeration principle heating, ventilation, cooling and control system. It also imparts knowledge and skills on main components, and functions of air-conditioning systems used in automobile.

Course objectives:

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

- Explain the theory and functioning air conditioning System used in automobile vehicles.
- Identify and list various types of air conditioning system and their operational advantages and disadvantages.
- Explain working principle of air conditioning system.
- Service and repair of air conditioning system and components.
- Perform routine/preventative/periodical maintenance as well as minor and major repair of automobile air conditioning system.

Course content:

Unit 1. Refrigeration

6 hrs

1.1 Principles of refrigeration

3 hrs

1.1.1. Definition

1.1.2. Different Refrigeration Methods

1.1.3. Heat Pump and refrigerator

1.1.4. Units of Refrigeration / Refrigerating effect

1.1.5. Coefficient of performance (COP)

1.6. Rating of refrigeration machines

1.2. Refrigerants

3hrs

1.2.1. Properties of refrigerants

1.2.2. Different types of refrigerants

1.2.3. Hazards of refrigerants

1.2.4. Application of commonly used refrigerants

Unit 2. Air-conditioning

4 hrs

2.1. Introduction

2.2. Psychrometric properties

3.2.1. Dry and moist air

3.2.2. Dry Bulb Temperature and Wet Bulb Temperature

3.2.3. Humidity (specific, absolute and relative humidity)

- 2.3. Psychrometric process
 - 3.3.1. Heating
 - 3.3.2 Cooling
 - 3.3.3 Humidification
 - 3.3.4. Dehumidification
- 2.4. Human comfort
- 2.5. Applications of air-conditioning

Unit 3: Automotive AC system and components	13 hrs
3.1. AC system	3 hrs
<ul style="list-style-type: none"> • Introduction and basic principle • Type of AC system (Manual and automatic) • Lay out of air conditioning system. 	
3.2. Compressor	2 hrs
<ul style="list-style-type: none"> • Introduction, purpose and types of compressor (Types) • Working principle and components of compressor • Compressor oil filling process • Trouble shooting 	
3.3. Magnetic Clutch	2 hrs
<ul style="list-style-type: none"> • Introduction, purpose and working principle of magnetic clutch • Components of magnetic clutch • Trouble shooting 	
3.4. Condenser	1 hr.
<ul style="list-style-type: none"> • Introduction, purpose and working principle of condenser • Trouble shooting 	
3.5. Receiver Drier	1 hr.
<ul style="list-style-type: none"> • Introduction, purpose, working principle and components of Receiver drier • Trouble shooting 	
3.6. Expansion Valve	1 hr.
<ul style="list-style-type: none"> • Introduction, purpose and working principle of Expansion Valve • Trouble shooting 	
3.7. Evaporator	1 hr.
<ul style="list-style-type: none"> • Introduction, purpose and working principle of Evaporator • Trouble shooting 	
3.8. Refrigeration Pipe Line	1 hr.
<ul style="list-style-type: none"> • Purpose and types of pipe line • Trouble shooting 	

3.9. Refrigerant Gas and its refilling Process	1 hrs.
<ul style="list-style-type: none"> Refrigerant refilling equipment and process 	
Unit 4: Air Flow Control Systems	3 hrs.
4.1 Introduction	1hr.
<ul style="list-style-type: none"> Definition Lay out of air flow control system. Types, parts and components air flow control system 	
4.2. Blower Motor	1 hr.
<ul style="list-style-type: none"> Introduction and purpose of Blower Motor Working principle and components and parts Circuit of blower motor system Trouble shooting 	
4.3. Cooling fan	1 hrs
<ul style="list-style-type: none"> Introduction and purpose of Cooling Fan Working principle, Components and parts of Cooling Fan Trouble shooting 	
Unit 5: Heating Systems	2 hrs
5.1. Introduction, purpose, working principle and components of heating system	
5.2. Trouble shooting	
Unit 6: AC control panel unit	1 hrs
6.1. Introduction to various switches and knobs of ac control panel unit of dash board	
Unit 7: Diagnosis of Automotive AC	1 hrs

References:

1. J. K. Gupta, Textbook of Refrigeration & Air conditioning, S. Chand group, New Delhi
2. C. P. Arora, Refrigeration and Air Conditioning, Tata McGraw-Hill Publishing Company Ltd., New Delhi
3. Thomas W. Birch, Martin Duvic, Automotive Heating and Air Conditioning, Prentice Hall
4. Steven Daly, Automotive Air Conditioning and Climate Control System, 1st Edition, Butterworth-Heinemann
5. Warren M. Farnell, Automotive Heating, Ventilation and Air Conditioning Systems Package, 3rd Edition, Prentice Hall

Practical

75 hrs

1. Introduction

- Demonstrate and Identify of components and parts of AC system.

2. Compressor

- Identify and locate compressor
- Dismount compressor
- Test pressure, compressor oil, leakages
- Dismantle compressor
- Inspection of defective parts
- Repair and replace defective parts
- Refill oil
- Assemble compressor; testing of pressure
- Mount the unit in the vehicle
- Adjust and check the tension of AC Belt

3. Magnetic Clutch

- Identify and locate magnetic clutch
- Dismount magnetic clutch
- Test magnetic clutch
- Inspect short circuit, electric coil, pulley bearing
- Repair and replace defective parts
- Test electro-magnetic movement
- Mount the unit in the vehicle

4. Condenser

- Identify and locate condenser
- Detach condenser
- Test condenser; check leakages, blockages in fins
- Service/replace defective condenser
- Assemble the unit in the ac system

5. Receiver Drier

- Identify and locate of Receiver drier
- Dismount Receiver drier
- Inspect and test switch
- Replace defective parts or drier
- Assemble the unit in the vehicle

6. Expansion Valve

- Identify and locate Expansion Valve
- Dismount Expansion Valve
- Inspect of the valve
- Service and adjust valve
- Replace defective valve
- Assemble the components and parts in the system

7. Evaporator

- Identify and locate of Evaporator

- Detach Evaporator; check leakages, blockages on fins
- Service/replace defective Evaporator or fin sensor
- Assemble the unit in the ac system

8. Blower Motor

- Identify and locate Blower Motor
- Dismount blower motor unit
- Inspect parts; check switch, resistor, motor, relay, fuse, fan blade, ac filter, ventilation
- Service/repair/replace defective parts
- Assemble the unit in the ac system

Automobile Service Management

EG 2202 AE

Year: II
Semester: II

Total: 7 hours/week
Lecture: 2 hours/week
Tutorial: hours/week
Practical: 5 hours/week
Lab: hours/week

Course description:

This course includes the fundamental principle of Automobile Service Management and application in different automobile service sectors. Students will be able to know the basics of automobile workshop environment, workshop design, field service management, service advisor and technician responsibilities, warranty handling, disputes management and set different KPI used in service sector.

Course objectives:

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

- Learn the basic concept of Automobile Service Station design and its architecture.
- Installation of basic garage equipment, i.e. Hydraulics and Pneumatic systems tools for automobile service station set up.
- Know the essential criteria for being Manufacturer, Distributors and Dealerships
- Know the fundamental duties and responsibilities of Service Advisor and Technicians.
- Learn effective communication skills.
- Know the basic warranty procedures and documentations.
- Basic field service management, preparation of different case studies, writing DIR, QIR and FSR.
- Fundamentals about basic set up procedure of EV Charging port in service station.
- Set targets and goals for team members to achieve performance.
- Measure KPI performance outcome and achievements.
- Gain how to read the current market, understand customer needs & how to drive new sales.

Course contents:

Unit 1. Fundamentals of Automobile Service Management System	4 hrs.
1.1 History of Automobile Service System	
1.2 Automobile Service Station	
1.3 Classification of Automobile Service Station	
1.3.1 Close Shed Automobile Service Station	
1.3.2 Open Shed Automobile Service Station	
1.4 Size of Automobile Service Station	
1.5 Design of Automobile service Station	
1.6 Basic Architecture of Modern Service Station	
a) Fuel Filling Zone	

- b) Vehicle Entry Gate
- c) Security Supervisor Zone
- d) Service Reception Zone
- e) Customer Care zone
- f) Spare Parts Reception Zone
- g) Spare Parts Storage Zone
- h) Service Manager Zone
- i) Meeting Zone
- j) Training Hall
- k) Billing Zone
- l) Kids Zone
- m) Warranty Manager Zone
- n) Finance Department Zone
- o) Technical Officer Zone
- p) Work Shop Bay
- q) Washing Bay
- r) Body shop Zone
- s) Refreshment Zone
- t) Vehicle Parking Zone
- u) EV Plug in Charging Zone
- v) Vehicle Queuing Zone
- w) Garbage Zone
- x) Lubricant Waste Collection Zone
- y) Emergency Exit Gate

Unit 2: Basic Garage Equipment used in Automobile Service Sectors

5 Hrs

2.1 Hoist Equipment

- Post Hydraulic Lift
- Scissor Lift
- Post Hydraulic Lift

2.2 Service Bays

2.2.1 Pit Bay

2.2.2 Lift Bay

2.2.3 Metallic bay

2.2.4 Pneumatic System for general tools operation

- a) Reciprocating Air Compressor
- b) Screw Air Compressor
- c) PLC Based Repair and Maintenance of Air compressor
 - Checking of Air Receiver/Drier unit
 - Checking of Filter Regulator Lubricator (FRL) Units.
 - Pneumatic Guns and Moisture content
 - Compressor Oil Drainage System

- 2.2.5 Hydraulic System used in Automobile Service operation
 - 2.2.5.1 General introduction about hydraulic system operation
 - a) Hydraulic lifts
 - b) Hydraulic Cylinder
 - c) Hydraulic Pumps
 - d) Hydraulic Lines
 - e) Advantages and Disadvantages of Hydraulic system.

Unit 3: Automobile Manufacturers, Distributors, Dealerships

3 hrs.

- 3.1 Global Automobile Manufacturers
 - 3.1.1 History of Japanese Car Manufacturers
 - 3.1.2 History of European Car Manufacturers
 - 3.1.3 History of American Car Manufacturers
 - 3.1.4 History of Asian Car Manufacturers
- 3.2 Essential Criteria for being Automobile Manufacturer.
 - 3.2.1 Product
 - 3.2.2 No. of unit production
 - 3.2.3 Business Volume
 - 3.2.4 No. of employee
 - 3.2.5 Unique features
 - 3.2.6 Quality Management System (QMS) System
 - 3.2.7 Market Share
- 3.3 Essential Criteria for being Distributors
 - 3.3.1 Product
 - 3.3.2 No. of sales outlet
 - 3.3.3 No. of service outlets
 - 3.3.4 No. of spare parts outlet
 - 3.3.5 No. of Employee
 - 3.3.6 QMS Implementation
 - 3.3.7 Training and HR Management
 - 3.3.8 Market Share
- 3.4 Essential Criteria for being Dealerships
 - 3.4.1 Product
 - 3.4.2 No. of sales outlet
 - 3.4.3 No. of service outlets
 - 3.4.4 No. of spare parts outlet
 - 3.4.5 No. of Employee
 - 3.4.6 Quality Management System (QMS) Implementation
 - 3.4.7 Training and HR Management
 - 3.4.8 Market Share

Unit 4: Fundamentals of Service Management

3 hrs.

- 4.1 Fundamental of Service
- 4.2 6 step process of vehicle reception

- 4.2.1 Service Appointment
- 4.2.2 Service Reception
- 4.2.3 Repair order and Order monitoring
- 4.2.4 Job Execution
- 4.2.5 Service delivery and explanation
- 4.2.6 Post Service Follow-up

- 4.3 Service Advisor and essential quality of Service Advisor
 - 4.3.1 Integrity
 - 4.3.2 People Skills
 - 4.3.3 Empathy
 - 4.3.4 Ability to Articulate
 - 4.3.5 Mechanical Knowledge
 - 4.3.6 Superior communication skills
 - 4.3.7 Self-control
 - 4.3.8 A good work ethic
 - 4.3.9 Patience
- 4.4 Service Technician and essential quality of Service Technician
 - 4.4.1 Technicians
 - 4.4.2 Duties of Service Technicians
 - Fault finding
 - Estimating time and costs for jobs
 - Customer service
 - Repairing and replacing parts
 - Carrying out servicing and maintenance tasks and checks
 - 4.4.3 Essential Quality of Service Technicians
 - Product Knowledge
 - Finishing
 - Diagnosis and analysis
 - Repair Techniques
 - Appetite for Knowledge
 - Strong Customer Service Skills
 - Interpersonal Skills
 - Certification

Unit 5. Automobile Field Service Management

2 hrs

- 5.1 Breakdown Maintenance
- 5.2 Periodic Maintenance
- 5.3 Preventive Maintenance
- 5.4 Field Service Case Studies Development Method
 - 5.4.1 Field Service Report (FSR)
 - 5.4.2 Dealer Investigation Report (DIR)
 - 5.4.3 Quality Improvement Report (QIR)
- 5.5 Diagnosis from FSR, DIR, QIR
- 5.6 Practical Example of Case Studies

Unit 6. Automobile Warranty Claim System**2 hrs**

- 6.1 Introduction to Warranty System
- 6.2 Introduction to Manufacturing Defects
- 6.3 Criteria of Warranty Claim based on origin
- 6.4 Quality Investigation Report (QIR) and Findings
- 6.5 Database Management Software System (DMS) for warranty claim
- 6.6 Warranty Handling Method
- 6.7 Warranty Claim Method
- 6.8 Warranty Settlement Method
- 6.9 Physical Destroying of Warranty Parts
- 6.10 Warranty cases as topic for Research and Development

Unit 7. Conflict and Dispute Management in Service Sector**2 hrs**

- 7.1 Introduction to Conflict
- 7.2 Introduction to Disputes
- 7.3 Methods of Disputes Resolution
 - 7.3.1 Non-binding Resolution
 - 7.3.1.1 Negotiation
 - 7.3.1.2 Mediation
 - 7.3.1.3 Conciliation
 - 7.3.1.4 Dispute Boards
 - 7.3.1.5 Expert Determination
 - 7.3.1.6 Adjudication
 - 7.3.2 Binding Resolution
 - 7.3.2.1 Arbitration
 - 7.3.2.2 Litigation
- 7.4 An Example and Case study of Disputes Management

Unit 8. Essentials (Electric Vehicle) EV Charging Station**4 hrs**

- 8.1 Basic Concept of EV
- 8.2 Plug-in charging Method
- 8.3 Charging Station Design
 - 8.3.1 Charging Zone Parking
 - 8.3.2 Charging Station
- 8.4 Different Types of Chargers and Installation Process
 - 8.4.1 AC Connectors
 - 8.4.1.1 Type 1 AC Connector
 - 8.4.1.2 Type 2 AC Connector
 - 8.4.2 DC Connectors
 - 8.4.2.1 Type 1 Combined Charging System (CCS) Combo Charger
 - 8.4.2.2 Type 2 Combined Charging System (CCS) Combo Charger
 - 8.4.2.3 Chademo Charger
 - 8.4.3 DC-DC Fast Charger

Unit 9: Different Key Performance Indicators (KPI) used in Service Management 4 hrs

9.1 Introduction to Key Performance Indicators (KPI)

9.2 Different types of service KPIs

- a) Unit in Operation (UIO)
- b) No. of Vehicles
- c) Repair Orders (RO)
- d) No. of Technicians
- e) Spare Parts Sales
- f) Lubricant Sales
- g) Labor Sales
- h) Counter Sales
- i) Dent and Paint Sales
- j) Average Bill per RO
- k) Spare Parts Sales per RO
- l) Labor Sales per RO
- m) Lubricant Sales per RO
- n) Labor Sales per Technician
- o) Parts Sales to Labor Sales Ratio
- p) Same Day Delivery (SDD) Rate
- q) Bay Efficiency
- r) Customer Complain Rate
- s) Customer Satisfaction Index (CSI)
- t) RO per Day
- u) Pre Delivery Inspection (PDI)
- v) Service Interval
- w) Annual Maintenance Contract (AMC)

Unit 10: The next generation of Automobile service and parts strategy. 1 hr

References:

1. A text book of Automobile Service Management, Principles into Practice, 3rd Edition, ANDREW A. REZEN, Pearson, ISBN: 978-0-13-470985-7
2. THIJS. N. & STAES. P. (2008), European Primer on Customer Satisfaction Management, 5th European Quality Conference, French EU Presidency.
3. Customer Satisfaction Handbook, 2002, prepared by the Charter Oak Group, LLC.
4. Essential Skills Manual, Automobile Service Technician, NOC 7321
5. EV Charging station, Technical Installation Guide, 2nd Edition, August 2015, Hydro-Quebec.
6. Global Automobile Industry, Issue 2: Fall 2004, BERA, Boston Consulting Group, Oct 22, 2013.
7. Global automobile warranty survey report, James Rodger, Bearing Point, Management and Technology consultancy, 2009.
8. Managing conflict in organizations, 3rd edition, m. Afzalus Rahim, QUORUM Books, ISBN: 1-56720-262-4

9. Paper- Charging the future: Challenges and opportunities for electric vehicle adoption, Henry Lee, Alex Clark, Havard Kennedy School, BELFER CENTER for science and international affair, August, 2018.
10. Presentation on Disputes Resolution and conflict management, Ontario public school, Boards Association, www.thefletcherconsultancy.com
11. Text Book of Automobile Engineering Technician, AET, paper III YR2
12. Warranty Management, WNS Extending your enterprise, 2014, WNS Global services.

Practical

75 hrs

1. **Industrial Orientation and visit at different distributors/dealers of Nepal** **45 hrs**
 - Overview of different design and layout of service center
 - Overview of customer care operation
 - Overview of service receiving and execution
 - Overview of hydraulics and pneumatic systems
 - Overview of technician and service advisor's responsibility.
 - Overview of general safety measures taken in service dealerships.
2. **Industrial visit and Field Service Report and Dealer Investigation Report Preparation** **12 hrs**
 - Field Service Report preparation of any breakdown cases that occurred during vehicle in road.
 - Dealer Investigation Report preparation of any cases relating to fault finding and diagnosis.
3. **Industrial visit and Orientation on Warranty management system** **6 hrs**
 - Observation of warranty handling process
 - Observation of warranty claim in DMS system
4. **Industrial visit and Orientation on EV Charging system** **6 hrs**
 - Observation of different types of EV Charging ports
 - Observation of different methods of EV Charging system.
 - Observation of Fast charging DC-DC Charger
5. **Industrial visit Orientation on different KPI used in service station** **6 hrs**
 - Unit in Operation
 - Repair Orders
 - Average Bill per RO
 - Spare parts sales per RO
 - Labor Sales per RO
 - Lubricant Sales per RO
 - Labor Sales per technician
 - Parts sales to labor sales ratio

- Same Day Delivery Rate
- Customer satisfaction index
- Pre delivery inspection
- Service Interval
- Annual Maintenance contract.

Fifth Semester Subjects:

1. EG 3111 EE Control System
2. EG 3105 ME Computer Graphics (AutoCAD)
3. EG 3109 ME Fundamental of Hydraulics & pneumatics
4. EG 3110 ME Machine Design, Estimating & Costing
5. EG 3101 AE Automotive Technology III
6. EG 3102 AE Industrial Orientation
7. EG 3103 AE Automotive Electronics I
8. EG 3104 AE Occupational Health and Safety

Control System

EG 3111 EE

Year: III
Semester: I

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

Course Description:

The course deals with the major components, their characteristics and application of automatic control system.

Course Objectives:

After completing this course the students will be able to:

- understand the basic features of analog automatic control system
- understand the applications, characteristics and operation of various control system components and transducers
- enable to install and maintain different control systems

Course contents:

Unit 1. The general concept of control system

[4]

- 1.1 meaning of control
- 1.2 Practical example of control systems e.g. temperature control, traffic control etc.
- 1.3 open loop or manual control systems
- 1.4 The idea of close loop and automatic control system
- 1.5 Feedback and feed forward control in nature
- 1.6 actuator, controller, sensor and error detectors
- 1.7 effect of disturbances
- 1.8 task of control engineers

Unit 2. Transducers

[8]

- 2.1 principle of transducers
- 2.2 Accuracy considerations in measurements
- 2.3 strain gauges
- 2.4 Potentiometers
- 2.5 Tachometer and tachogenerator
- 2.6 thermocouples
- 2.7 photo –electric cells
- 2.8 electromagnetic flow meters

2.9 pneumatic displacement detectors

Unit 3. Simple (Introduction to) mathematical modeling of Linear time invariant systems[8]

- 3.1 Introduction
- 3.2 Derivation of mathematical model
- 3.3 Transfer function representation
- 3.4 Time response of first order system
- 3.5 Time response of second order system
- 3.6 Concepts of response oscillations and damping
- 3.7 Steady state error
- 3.8 Definition of stable and unstable systems

Unit 4. DC and Stepper Motors in Control Systems [6]

- 4.1 Explain how DC motors operate.
- 4.2 Select a motor based on mechanical and performance requirements.
- 4.3 Describe how DC motor control systems work.
- 4.4 Understand how stepper motors and their driver circuits work.

Unit 5. AC Motors in Control Systems [4]

- 5.1 Explain how AC motors operate.
- 5.2 Select a motor based on mechanical and performance requirements.
- 5.3 Describe how AC motor control systems work.

Unit 6. Controllers [5]

- 6.1 Transfer function for P, PI, PD and PID controller and their effects on time response
- 6.2 Electric P, PI, PD and PID controllers
- 6.3 Pneumatic P, PI, PD and PID controllers
- 6.4 Hydraulic controllers

Unit 7. Relay Logic and PLCs [5]

- 7.1 Explain how to tune a process control system.
- 7.2 Understand how analog and digital control circuits work.
- 7.3 Explain the operation of relays, counters, and sequencers.
- 7.4 Understand how PLCs work.
- 7.5 Interpret ladder logic diagrams.

Unit 8. Machine tool control [5]

- 8.1 Automatic co-ordinate positioning
- 8.2 Profile generation by copying
- 8.3 Introduction to computerized control

Laboratory Exercises: [7 × 2 hrs]

1. To study the construction and characteristics of strain gauge transducer.
2. To study the construction and characteristics of thermocouple
3. Demonstration for ON/OFF Temperature Control Using thermo-couple as sensor and operational amplifier as control switch
4. To study the construction and characteristics of permanent magnet DC Tachogenerator.
5. Demonstration for Open-loop and close loop Speed Control of DC servomotor
6. PID controller circuit using Operational Amplifier
7. Demonstration for Pneumatic PID controllers

Suggestions for instruction:

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

Text Books/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 forHVAC Technicians" Lama Books, ISBN: 41-0-88069-036-2

Computer Graphics (AutoCAD)

EG 3105 ME

Year: III
Semester: I

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

Course description:

This course deals with generation of two-dimensional and three-dimensional drawing using AutoCAD. It also deals with the inserting dimensions and text in drawing.

Course objectives:

After completing this course the students will be able to:

- draw two dimensional objects using AutoCAD,
- draw three dimensional objects using solid modeling, and
- Insert dimension and text on drawing.

Course contents:

Unit 1: Introduction

[2]

- 1.1 Loading AutoCAD, Screen organization
- 1.2 Communicate with AutoCAD using the keyboard, the cursor menu, the screen menu, the pull-down menu, the toolbar menu and the dialogue box
- 1.3 AutoCAD command and system variables, Command options and default
- 1.4 Setting UNITS and DRAWING LIMITS
- 1.5 Coordinate System: entering distances and angles

Unit 2: Basic Drawing Commands

[9]

- 2.1 LINE command and its options
- 2.2 POINT command
- 2.3 XLINE command and its options
- 2.4 ARC command and its options
- 2.5 CIRCLE command and its options
- 2.6 POLYGON command and its options
- 2.7 PLINE command and its options
- 2.8 MLINE command and its options
- 2.9 SPLINE command and its options

Unit 3: Modifying commands	[8]
3.1 Object selection methods	
3.2 ERASE, OOPS, UNDO, REDO commands	
3.3 OFFSET command	
3.4 COPY, MOVE, ROTATE, MIRROR, ARRAY commands	
3.5 SCALE, STRETCH commands	
3.6 CHAMFER, FILLET commands	
3.7 TRIM, EXTEND commands	
3.8 EXPLODE, BREAK, LENGTHEN, DIVIDE commands	
3.9 PEDIT command	
3.10 CHPROP command, ltype, ltscale, lweight and color	
3.11 DDSELECT, DDMODIFY commands	
3.12 Use of Grips	
Unit 4: Drawing Aids in AutoCAD	[5]
4.1 ORTHO, GRID, SNAP commands	
4.2 ROTATED SNAP, OSNAP commands	
4.3 Creation of layers and layer properties	
4.4 Point filter	
4.5 Use of Calculator	
Unit 5: Display commands	[2]
5.1 ZOOM, PAN, VIEW commands	
5.2 REGEN command	
5.3 Creating Viewports	
Unit 6: Inquiry Commands	[3]
6.1 HELP command	
6.2 ID, DIST, AREA commands	
6.3 MASSPROP command	
6.4 LIST, DBLIST, STATUS commands	
6.5 TIME command	
Unit 7: Fine tuning drawings	[2]
7.1 HATCH and BHATCH commands	
7.2 Creating Isometric drawing	
Unit 8: Grouping in AutoCAD	[2]
8.1 BLOCK, WBLOCK commands	
8.2 INSERT, MININSERT commands	
8.3 EXPLODE , BASE commands	

Unit 9: Working with text in AutoCAD [2]

- 9.1 TEXT, MTEXT, DTEXT commands
- 9.2 Justifying text and text fonts
- 9.3 STYLE command

Unit 10: Dimensioning in AutoCAD [2]

- 10.1 Dimensioning commands
- 10.2 Dimension styles and dimension setup
- 10.3 Dimension scale

Unit 11: 3-D solid modeling [6]

- 11.1 Creating solid box, solid cylinder, solid cone and solid sphere
- 11.2 Boolean operations: Union, Subtraction, Intersection
- 11.3 EXTRUDE command

Unit 12: Plotting drawings [2]

- 12.1 Layout management
- 12.2 Device information, pen parameters, paper size and orientation
- 12.3 Scale, rotation and origin
- 12.4 MVIEW, MVSETUP commands

Reference:

1. G. Omura; Mastering AutoCAD, Latest Edition

Fundamentals of Hydraulics and Pneumatics

EG 3109 ME

Year: III
Semester: I

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

Course Description:

This course deals with the basic fundamentals of hydraulics and pneumatics and provides basic concept associated with hydraulics and pneumatics equipment and their repair and maintenance

Course Objectives:

After completing this course the student will be able to:

1. Able to describe various kinds of hydraulic and pneumatic system.
2. Explain the operation of various kinds of hydraulic and pneumatic system and equipment.
3. Demonstrate basic knowledge of service, check, maintenance, diagnosis and testing of hydraulic and pneumatic system and equipment.

Course contents:

Unit 1: Fundamentals of Hydraulics & Pneumatics

[2]

- 1.1 Introduction to Industrial System
 - 1.1.1 Electrical System
 - 1.1.2 Hydraulic System
 - 1.1.3 Pneumatic System
- 1.2 Comparison of Electrical, Hydraulic & Pneumatic System
- 1.3 Development stage of Hydraulic & Pneumatic Equipment
- 1.4 Introduction to hydrostatics and hydrodynamics
- 1.5 Basic Principle of hydraulics and pneumatics
- 1.6 Advantages and disadvantages of hydraulic and pneumatic system
- 1.7 Application of hydraulics and pneumatics

Unit 2. Industrial Hydraulic System

[18]

- 2.1 Introduction & types of hydraulic system:
 - 2.1.1 Open Centre System
 - 2.1.2 Close Centre System
- 2.2 Hydraulic Fluids
 - 2.2.1 Property of hydraulic fluid
 - 2.2.2 Basic Requirement of Hydraulic Fluid
 - 2.2.3 Types of Hydraulic Fluid
 1. Petroleum base: Properties and Application
 2. Synthetic base: Properties and Application
 3. Water: Properties and Application

4. Mineral base: Properties and Application
- 2.3 Physical Components of Hydraulic System
 - 2.3.1 Hydraulic Pumps: Positive Displacement & Negative Displacement
 - 2.3.1.1 Introduction to Hydraulic Pump
 - 2.3.1.2 Types: Positive Displacement Pump
 1. Gear Pump: constructions, working principles, applications and trouble shooting
 2. Vane Pump: constructions, working principles, applications and trouble shooting
 3. Piston Pump: constructions, working principles, applications and trouble shooting
 4. Combination Pump: constructions, working principles, applications and trouble shooting
 - 2.3.1.3 Comparison of Pumps
 - 2.3.1.4 Hydraulic Pump Accessories
 - 2.3.1.5 Major Aspects in selection of hydraulic pump
 - 2.3.2 Hydraulic Cylinders
 - 2.3.2.1 Types of Hydraulic Cylinder: Constructions and Applications
 1. Piston Types: Single & Double Acting
 2. Vane type
 - 2.3.3 Hydraulic Piston: Introduction, Constructions, Working Principles, & Applications
 - 2.3.4 Hydraulic Valves
 - 2.3.4.1 Introduction, Purpose and Function
 - 2.3.4.2 Types:
 1. Pressure control valve: Construction, Working Principle & Application
 2. Flow control valve: Construction, Working Principle & Application
 3. Direction control valve: Construction, Working Principle & Application
 - 2.3.5 Hydraulic Motors
 - 2.3.5.1 Introduction
 - 2.3.5.2 Types
 1. Gear type: Construction, Working Principles, Comparisons & Applications
 2. Vane Type: Construction, Working Principles, Comparisons & Applications
 3. Piston type: Construction, Working Principles, Comparisons & Applications
 - 2.3.5.3 Fault finding and trouble shooting of hydraulic motor
 - 2.3.6 Hydraulic Filter
 - 2.3.6.1 Purpose of Filter
 - 2.3.6.2 Types of Hydraulic Filter based on Position
 1. Suction Side Filters
 2. Pressure Side Filters
 3. Return Side Filters
 4. Off Line Filters
 - 2.3.6.3 Types of Hydraulic Filter based on Filter Material
 1. Paper filter

- 2. Metallic filter
- 2.3.6.3 Types of Hydraulic Filter based on Flow
 - 1. Full Flow Filter
 - 2. Proportional Flow Filter
- 2.3.6.4 Contaminants & its Controls
- 2.3.7 Hydraulic Accumulator
 - 2.3.7.1 Introduction and Functions
 - 2.3.7.2 Types of hydraulic accumulator
 - 1. Spring Loaded Accumulator: Constructions, Working Principle, Applications, Comparisons and Trouble Shooting
 - 2. Weight Loaded Accumulator: Constructions, Working Principle, Applications, Comparisons and Trouble Shooting
 - 3. Pneumatic Accumulator: Constructions, Working Principle, Applications, Comparisons and Trouble Shooting
- 2.3.8 Hydraulic Reservoirs
 - 2.3.8.1 Introduction, Constructions and Function
 - 2.3.8.2 Basic Features of reservoirs
- 2.3.9 Hydraulic Oil Cooler and Heat Exchanger: Introductions, Constructions, Functions and Applications
- 2.3.10 Accessories of hydraulic system

Unit 3. Industrial Pneumatic System

[18]

- 3.1 Introduction to Pneumatics System
- 3.2 Compressed Air
 - 3.2.1 Air used in Pneumatic System
 - 3.2.2 Basic Requirement of Pneumatic Air
- 3.3 Physical Component of Pneumatic System
 - 3.3.1 Air Compressor: Introduction and Purpose
 - 3.3.1.1 Types
 - 1. Piston type compressors: constructions, working principles, applications and trouble shooting
 - 2. Vane type compressors: constructions, working principles, applications and trouble shooting
 - 3. Helical compressors: constructions, working principles, applications and trouble shooting
 - 4. Centrifugal compressors: constructions, working principles, applications and trouble shooting
 - 3.3.2 Air Cylinder: Introduction, Construction, Working Principles and Applications
 - 3.3.3 Air Motor
 - 3.3.3.1 Introduction
 - 3.3.3.2 Types of air motor
 - 1. Gear Type: Construction, Working, Application, Advantage & trouble shooting

2. Vane Type: Construction, Working, Application, Advantage & trouble shooting
3. Piston Type: Construction, Working, Application, Advantage & trouble shooting

3.3.3.3 Selection Criteria of air motor

3.3.4 Pneumatic Valves

3.3.4.1 Introduction

3.3.4.2 Types

- Direction Control: constructions, working principles, applications and trouble shooting
- Pressure Control: constructions, working principles, applications and trouble shooting
- Flow Control: constructions, working principles, applications and trouble shooting

3.3.5 Air Cooler: Introduction, Construction, Working Principles, & Applications

3.3.6 Air Receiver: Introduction, Construction, Working Principles, & Applications

3.3.7 Air Dryer: Introduction, Construction, Working Principles, & Applications

3.3.8 Air Filter

3.3.8.1 Introduction,

3.3.8.2 Types of air filter

- Dry Type: Introduction, Working Principle, Application, Advantage & Disadvantage
- Wet Type: Introduction, Working Principle, Application, Advantage & Disadvantage

3.3.9 Source of Contaminates

3.9.10 Accessories of Pneumatic System

Unit 4. Safety, Fault Finding and Diagnosis

[7]

4.1 Safety in Operation of Hydraulics & Pneumatics System

4.2 Possible Hazards, Risk and Danger & Its Assessments in Hydraulic & Pneumatic System

4.3 Commonly Encountered Safety Legislation

4.4 Cleanliness

4.5 Diagnosis Instruments

4.6 Diagnosis Process and Algorithm of pneumatic and hydraulic systems and equipment.

Lab/Practical

1. Identification of Physical Component of Hydraulic System.
2. Disassemble the hydraulic pump, identify the components and assemble.
3. Fault finding of hydraulic system
4. Identification of Physical Component of Pneumatic System.
5. Perform the servicing of the air compressor.
6. Performance test of reciprocating air compressor

7. Disassemble the air compressor, identify the components and assemble.
8. Fault finding of pneumatic system

Suggestion for instructions:

Note: every practical exercise [assignment] must be accompanied with performance report in A4 size paper. Assignments, Drawing, and Performance Report must be submitted for the work evaluation.

References:

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

Machine Design, Estimating and Costing

EG 3110 ME

Year: III
Semester: I

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

Course description:

Knowledge of method of finding shapes and sizes of machine element is very essential from their strength and stiffness / rigidity viewpoints. Also the knowledge of calculation of manufacturing cost of machine element is essential. After completion of the course students will be able to design and find out the cost of the simple machine element. Theory explanation is supported by applied numerical problems.

Course objectives:

After completing this course the students will be able to:

- Analyze the factors affecting choice of material, assuming knowledge of materials as covered in material science and strength of materials.
- Design the simple machine elements for axial and torsional loading.
- Calculate the total cost of manufacturing of simple machine element.

Course contents:

Unit 1. Fundamental Principles.

[9]

- 1.1 The difference between mechanism, machine element, and machine.
- 1.2 Design procedure – Gathering information and formulating design problems.
- 1.3 Basic requirements of machine elements, strength, stiffness, rigidity, wear resistance
- 1.4 Magnitude, direction, and type of load – axial, bending, torsion, and combination.
- 1.5 Strain and elasticity, stress, factor of safety.
- 1.6 Elastic and plastic behavior of ductile and brittle materials, modulus of elasticity and modulus of rigidity.
- 1.7 Fatigue, endurance limit, stress concentration, effects on factor of safety.
- 1.8 Materials availability, weight and dimensions, process-ability and standardization.

Unit 2. Design of following components under axial loading

[6]

- 2.1 Bolts under tension and both tension and compression, effect of initial tightening.
- 2.2 Riveted joints lap and butt for tie bar.
- 2.3 Welded connections, lap and butt weld.
- 2.4 Turn buckle

- 2.5 Pins
- 2.6 Helical springs.

Unit 3. Design of the following under torsional loading.

[6]

- 3.1. Shaft (circular only)
- 3.2. Rectangular taper sunk key.
- 3.3. Rigid flange coupling
- 3.4. Simple disk clutch.
- 3.5. Straight armed cast iron pulley.

Unit 4. Estimating and costing

[6]

- 4.1 Introduction – Purpose of estimating and costing.
- 4.2 Meaning of estimating and costing.
- 4.3 Elements of costs.
- 4.4 Component of costs.
- 4.5 Overheads.
- 4.6 Allocating of overheads.

Unit 5. Estimation of material cost.

[6]

- 5.1 Estimation of cost by volume.
- 5.2 Estimation of cost by weight.
- 5.3 Cost estimation of simple machine elements such as – pulley, spindle, wall bracket, Turn buckle.

Unit 6. Estimation in machine shop.

[6]

- 6.1 Set up time
- 6.2 Estimation of operation time: machine time for various operations – turning, facing, threading, drilling, milling and shaping.
- 6.3 Non machining time.
- 6.4 Down time

Unit 7. Estimation in following shops.

[6]

- 7.1 Welding shop: Gas welding and Arc welding.
- 7.2 Foundry shop: Pattern cost and casting cost.
- 7.3 Sheet metal shop: size of blank, blanking and punching time.

References

- 1. Rajendra Karwa, A Text Book of Machine Design, Laxmi publications.
- 2. SG Kulkarni, Machine Design, TMH Outline series.
- 3. Banga and Sharma, Estimating and Costing, Khanna Publishers Delhi.
- 4. TTTI Madras, Mechanical Estimating and Costing.

Automotive Technology III

EG 3101AE

Year: III
Semester: I

Total: 13 hours/week
Lecture: 4 hours/week
Tutorial: hours/week
Practical: 9 hours/week
Lab: hours/week

Course description:

This course includes diesel engines, other small engines and appliances, farm equipment, construction equipment, air pollution and vehicle wiring system.

Course objectives:

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

- Understand diesel engines
- Understand small engines, farm and construction equipment
- Understand engine characteristics
- Understand the working principle of supercharger, turbocharger and inertia charger and their construction and applications.
- Understand air pollution by vehicles and its regulation
- Understand vehicle wiring system.

Course contents:

Unit 1: Combustion chambers of Diesel Engine

5 hrs.

- 1.1 Introduction to combustion chambers
- 1.2 Types of combustion chambers
- 1.3 Direct injection combustion chamber
- 1.4 Indirect injection combustion chamber
- 1.5 Advantages of DI combustion chamber
- 1.6 Disadvantages of DI combustion chamber
- 1.7 IDI swirl type chamber
- 1.8 IDI pre chamber system type
- 1.9 Advantage and disadvantages of IDI combustion chamber
- 1.10 Fault findings

Unit 2: Pre-heating system (Diesel Engine/Glow plug)

3 hrs

- 2.1. Introduction of Pre-heating system
- 2.2. Circuit layout of Pre-heating system

- 2.3. Function of pre-heating system
- 2.4. Working principle, Purposes and uses
- 2.5. Fault findings

Unit 3: Small Engines and Appliances

4 hrs

- 3.1. Land mover
- 3.2. Generator
- 3.3. Compressor

Unit 4: Farm and Construction Equipment

5 hrs

- 4.1. Tractor
- 4.2. Dozer
- 4.3. Road building equipment

Unit 5: Non conventional Energy Vehicles

10 hrs

- 5.1. Battery operated vehicle
- 5.2. Alcohol operated
- 5.3. Bio diesel operated
- 5.4. LPG and CNG operated
- 5.5. Solar operated vehicle
- 5.6. Hybrid engine
- 5.7. Fuel cell vehicles

Unit 6: Engine characteristics

5 hrs

- 6.1. Introduction and types of characteristics
- 6.2. Speed characteristics of engines
 - External speed characteristics
 - Part load speed characteristics
- 6.3. Load characteristics of engine
 - Full load characteristics
 - Part load characteristics
- 6.4. Special Characteristics
 - Adjustment characteristics
 - Idle running characteristics

Unit 7: Super Charging and Turbo charging System

6 hrs

- 7.1. Introduction, purpose and function of super charger and turbo charger
- 7.2. Principle, components and application of super charging system
- 7.3. Principle, components and application of turbo charging system
- 7.4. Principle, components and application of inertia super charging system
- 7.5. Fault and remedies

Unit 8: Emission Control System**12 hrs**

- 8.1. Introduction to emission control system
- 8.2. purpose and importance of emission control system
- 8.3. pollution, pollutants and emission
- 8.4. pollution and its measurement
- 8.5. HSU and measurement
- 8.6. problems or issues of vehicle emission
- 8.7. Vehicle emission norms and standards
- 8.8. Function and working principle of emission control system and devices
- 8.9. Different components and devices used for emission control (EGR/SCR and Catalytic converter)
- 8.10. Fault findings

Unit 9: Other Electronic and Electrical System**10 hrs**

- Body Control Module (BCM)
- Anti-Lock Braking System(ABS)
- Heating Ventilation and Air Conditioning (HVAC) System
- Immobilizer System
- Center Door Locking (CDL)
- Supplementary Restraint System (SRS)
- Instrument cluster
- Electrical Power Assisted Steering (EPAS)
- Lighting System
- Wiper System
- Window Winding
- Revers Parking
- Radiator Fan
- Stop Reverse Side indicators/ Fog Lamp/DRL
- Controlled Area Network (Petrol/Diesel)
- Heated Rear window
- Power Mirror
- Horn System
- Infotainment System
- Automatic Manual Transmission (AMT)
- Electronic Steering Column lock.
- Fully Automatic Temperature control System (FATC)
- Four wheel drive system

Reference Books:

1. William H. Crouse, Automotive Engines, Tata McGraw Hill Company, New Delhi
2. William H. Crouse, Anglin, Automotive Mechanics, Tata McGraw Hill Company, New Delhi
3. T.R. Banga, Nathu Singh, A text book of Automobile Engineering,
4. Frederick C. Nash, KalmanBanitz, Automotive Technology
5. K. M. Moeed, Automobile Engineering, S. K. Kataria and sons, Ansari Road, Daryagunj, New Delhi, 110002
6. R.K. Mohanty, Automobile Engineering Volume I & II, Standard Book House, 1705A Naisarak, Delhi, 110006
7. P. S. Gill, A Text book of Automobile Engineering Volume I & II, S. K. Kataria and sons, Ansari Road, Daryagunj, New Delhi, 110002
8. Dr. Kripal Singh, Automobile Engineering Volume I & II, Standard Publishers Distributors, Naisarak, Post box 1066, Delhi, 110006
9. A. S. Rangwala, Trends in Automobile Engineering, New Age International Publishers
10. R.K. Singal, Automobile Engineering, S. K. Kataria and sons, Ansari Road, Daryagunj, New Delhi, 110002
11. S.K. Agarwal, Automotive Pollution, Ashish Publishing House, New Delhi 110026
12. G.B. S. Narang, Automobile Engineering, Khanna Publishers
13. Harbans Singh Reyat, The Automobile, S. Chand and Company Ltd., New Delhi
14. Willard W. Pulkrabek, Engineering Fundamentals of Internal Combustion Engine, Prentice-Hall of India P. Ltd., New Delhi
15. V.M. Domkundwar, A Course in Internal Combustion Engine, Dhanpat Rai & Company, New Delhi
16. H. Gerscher, Technology for Automotive Trade Volume 1 & 2, GTZ
17. Bosch, Diesel Fuel Injection, Society of Automotive Engineers (SAE), USA
18. H.M. Sethi, Automotive Technology, Tata MCGraw-Hill Publishing Company Ltd., New Delhi
19. Repair & Maintenance of Stationary Diesel Engines, Rural Mechanic Course-3, Tool Foundation

Practical

1. Diesel Engines

- Demonstrate the working principle of diesel engine
- Identification of parts and their functions
- Dismantling of engine
- Checking and replacement of defective parts
- Measurement of engine components
- Identification and maintenance of lubrication system
- Identification and maintenance of cooling system
- Assembling and testing engine.
- Setting valve timing and fuel Injection pump timing
- Trouble shooting
- Safety precautions

2. Diesel fuel system

- Identification and demonstration of various components of diesel fuel system
- Servicing of various components of diesel fuel system
- Demonstrate the working principle of fuel injection pump
- Dismantling injection pump
- Identification of parts and their function
- Inspection and replacement of defective parts.
- Assembling parts
- Testing injection pump on test bench
- Dismantling injection nozzle
- Identification of parts and their functions
- Checking and replacing defective parts
- Assembling and testing nozzle and set the pressure
- Trouble shooting
- Safety precautions

3. Auto-Electric Wiring

- Safety precautions
- Wiring symbols
- Circuit diagram

3.1. Head light system

- Head light wiring layout
- Identification of head light components
- Checking of components and circuits.
- Head light adjustment, repair and maintenance

3.2. Parking Light System

- Parking light wiring layout
- Identification of parking light components

- Checking of components and circuits, repair and maintenance

3.3. Back Light System

- Back light wiring layout
- Identification of back light components
- Checking of components and replace
- Repair and maintenance of circuits

3.4. Flasher and side indicator

- Flasher system wiring layout
- Identification of flasher system components
- Checking of components and replace
- Repair and maintenance of circuits

3.5. Cabin light, baggage compartment, bonnet and dashboard light

- Identification of components
- Wiring layout
- Checking/replace of components and circuits
- Repair and maintenance

3.6. Brake Light

- Wiring layout
- Identification of components
- Checking/replace components
- Repair and maintenance

3.7. Horn System

- Wiring layout
- Identification of components
- Checking/replace components
- Repair and maintenance
- Adjusting horn

3.8. Instruments and Indicators

- Water temperature indicator system:
- Wiring layout
- Identification of components
- Checking/replace of components
- Repair and maintenance

3.9. Oil pressure indicator system

- Wiring layout
- Identification of components
- Checking/replace of components
- Repair and maintenance

3.10. Fuel indicator gauge system

- Wiring layout
- Identification of components

- Checking/replace of components
- Repair and maintenance

3.11. Wiper System

- Wiring layout
- Identification of components
- Checking and replace of components
- Repair and maintenance of circuit

3.12. Power windows

- Wiring layout
- Identification of components
- Checking and replace of components
- Repair and maintenance of circuit

Industrial Orientation

EG 3102 AE

Year: III

Semester: I

Total: 3 hours/week

Lecture: hours/week

Tutorial: hours/week

Practical: 3 hours/week

Lab: hours/week

Course description:

The student will be assigned to various industries in Nepal on a full time /part time basis for duration of 45 hours. During this period; student will be acquainted with the prevailing condition of the industry. At the end of the course, student will submit a complete report conforming to a standardized format along with the daily diary.

Industrial Orientation shall consist of two aspects namely-skill & management. Considering this, student will observe the operation of the industry for the first two days. Following three days he/she will work as operator, machinist, mechanic or likewise responsibility given by the authority of the industry. However, the student will be closely guided and supervised by the respective supervisor. The remaining one day will be utilized for collection of essential and relevant information for preparing the report. The report shall be completed and duly endorsed by the industry prior to the submission to the department.

Format of the report must include the following;

1. Profile of the Industry
2. Profile of the Industry personnel
3. Plant & Machine lay out
4. Significant problem/s in the Industry
5. Suggestions for the improvement of selected aspects of problems; (production, Equipment, Material, Management, Staff etc.)
6. Appendix

Course objectives:

After completing the course the students will be able to:

- be familiar with Industry set up and Equipment lay out
- Understand technological aspects and production techniques
- know the essential managerial aspects
- establish a good rapport between Industry and Institution

Practical

Unit 1. Observing Industry rules and Norms.	16 hrs.
1.1. Safety and Workshop lay out	
1.1.1. Safety aspects (Personal, Plant & Product)	
1.1.2. Workshop lay out (Location, Plant Installation and Store etc.)	
Unit 2. Knowing Production process & Technology	24 hrs
2.1. Manufacturing process, tools & Equipment	
2.2.1. Applicable techniques for production	
2.2.2. Appropriate tools & Equipment	
Unit 3. Report writing (compilation)	5 hrs.
3.1. Maintaining Daily Diary & collecting information	
3.1.1. writing notes in the diary (daily)	
3.1.2. acquiring necessary information	
3.1.3. including appendix	

Automotive Electronics I

EG 3103 AE

Year: III
Semester: I

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

Course description:

This course is designed to impart knowledge and skills on automobile electronics systems used in automobile engineering.

Course objectives:

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

- Understand the fundamentals of basic automobile electronic system.
- Understand the working principle and application of electronics components, sensors, actuators etc.
- Understand the working principle and application of digital electronics system in automobile vehicles.
- Diagnose, test the auto electronics system of automobile vehicles.

Course content:

Unit 1: Automotive Fundamentals

4 hrs

- 1.1. Use of electronics in Automobile
- 1.2. Evolution of Electronics in the Automobile
- 1.3. The automobile Physical Configuration
 - Engine
 - Drive train (transmission, differential, axle)
 - Suspension
 - Steering
 - Brakes
 - Instrumentation
 - Electrical/electronic
 - Motion control
 - Comfort/convenience
 - Entertainment/communication/navigation

Unit 2: The Basics of Electronic Engine Control

12 hrs

- 3.1 Motivation for Electronic Engine Control
 - Exhaust Emissions

- Fuel Economy
- 3.2 Concept of electronic Engine Control System
- 3.3 Definition of General Terms
 - Parameters
 - Variables
- 3.4 Definition of Engine Performance Terms
 - Power
 - BSFC
 - Torque
 - Volumetric Efficiency
 - Thermal Efficiency
 - Calibration
- 3.5 Engine Mapping
 - Effect of Air/Fuel Ratio on Performance
 - Effect of Spark Timing on Performance
 - Effect of Exhaust Gas Recirculation on Performance
- 3.6 Control Strategy
- 3.7 Electronic Fuel Injection System (Petrol and Diesel Engine)
- 3.8 Electronic Fuel Control System
 - Engine Control Sequence
 - Closed-Loop Control
 - Closed-Loop Operation
 - Open Loop Mode
 - Analysis of Intake Manifold Pressure
 - Measuring Air Mass
- 3.9 Electronic Ignition System

Unit 3: Sensors and Actuators

12 hrs

- 3.1 Application of Sensors and Actuators
 - 3.1.1. Types of sensors based on variables measurement
 - Air flow sensor
 - Mass air flow (MAF) Sensor
 - Oxygen Sensor
 - Unheated Oxygen Sensor
 - Heated Oxygen Sensor
 - Throttle Position Sensor (TPS)
 - Crankshaft Position Sensor (CKP)
 - Camshaft Position Sensor
 - Coolant temperature Sensor
 - Intake air temperature Sensor
 - Manifold absolute pressure Sensor (MAP)
 - Differential particulate filter DPF sensor (Diesel)
 - Vehicle speed sensor

- Knock Sensor
- 3.1.2. Set of Switches and Relay:
- Air conditioner clutch engaged switch
 - Brake on/off
 - Wide open throttle
 - Closed throttle
 - Reed switch
 - Main Relay
 - Fuel Pump Relay
 - AC Blower Switch
- 3.1.3. Engine Crankshaft Angular Position Sensor
- Magnetic Reluctance Position Sensor
 - Hall-Effect Position Sensor
 - Optical Crankshaft Position Sensor
- 3.1.4. Throttle Angle Sensor
- Electronic Throttle Control System
 - Types of Air flow sensor
- 3.1.5. Temperature Sensors
- Engine Coolant Temperature Sensor
 - Intake Air Temperature Sensor
 - Engine Oil Temperature Sensor
- 3.1.6. Sensor for Feedback Control
- Oxygen Sensor
 - Knock Sensors
- 3.1.7. Automotive Engine Control Actuators
- Fuel pump
 - Fuel Injectors
 - Piezoelectric Injectors
 - Transistorized Injectors
 - IAC valve
 - Exhaust Gas Recirculation Actuator
 - Purge canister valve
 - Ignition System
 - Oil Control valve (OCV)
 - Cooling Fan
 - MIL, Indicators

Unit 4: Digital Engine Control system

5 hrs

- 5.1. Digital Engine Control Features
- 5.2. Control Modes for Fuel Control
 - 4.2.1. Engine Crank
 - 4.2.2. Engine Warm-Up
 - 4.2.3. Open-Loop Control
 - 4.2.4. Closed-Loop Control
- 5.3. EGR Control
- 5.4. Integrated Engine Control System
 - 4.5.1. Secondary Air Management
 - 4.5.2. Evaporative Emissions Canister Purge
 - 4.5.3. Torque Converter Lock-up Control
 - 4.5.4. Automatic System Adjustment
- 5.5. Improvements in Electronic Engine Control
 - 4.6.1. Integrated Engine Control System
 - 4.6.2. Oxygen Sensor Improvements
 - 4.6.3. Fuel Injection Timing

Unit 5: Vehicle Motion Control

10 hrs

- 5.1. Typical Cruise Control System
 - 5.1.1. Speed Response Curves
 - 5.1.2. Digital Cruise Control
 - 5.1.3. Throttle Actuator
- 5.2. Cruise Control Electronics
 - 5.2.1. Stepper Motor-Based Actuator
 - 5.2.2. Vacuum-Operated Actuator
- 5.3. Antilock Braking System
 - Hydraulic Modulator
 - Solenoids
 - Electronic Parking Brake (EPB)
 - Electronic Brake force Distribution (EBD)
- 5.4. Electronic Suspension System
- 5.5. Electronic Steering Control
 - Electrostatic Column Lock
 - Electronic Power steering
 - Electronic Stability Program (ESP)
- 5.6. Air Bag system
 - Impact Sensors
 - SRS Control Module
 - Clock Spring Operation
 - Passenger Air Bag Operation
 - Driver Air Bag Operation
 - Curtain Air Bag Operation

- Seat Belt Pretensioners
- Seat Belt Operation

Unit 8: Future Trends Automotive Electronic systems

2 hr.

Reference books:

1. William B. Ribbens, Understanding Automotive Electronics, Society of Automotive Engineers Inc.
2. Robert Bosch GmbH, Automotive Electrics Automotive Electronics, John Wiley & Sons
3. Ronald K. Juren, Automotive Electronics Handbook, McGraw Hill Company Ltd.
4. Tracy Martin, How to Diagnose & Repair Automotive Electrical System, Motorbooks Workshop, MBI Publishing Company, USA
5. V.A. W. Hillers, Hiller's Fundamentals of Automotive Electronics, The Institute of Motor Industry
6. S.K. Agarwal, Automotive Pollution, Ashish Publishing House, New Delhi 110026
7. Dr. Kripal Singh, Automobile Engineering Vol I & II, Standard Publishers Distributors, New Delhi
8. Willard W. Pulkrabek, Engineering Fundamentals of Internal Combustion Engine, Prentice-Hall of India P. Ltd., New Delhi
9. H. Gerscher, Technology for Automotive Trade Volume 1 & 2, GTZ
10. Bosch, Diesel Fuel Injection, Society of Automotive Engineers (SAE), USA
11. H.M. Sethi, Automotive Technology, Tata McGraw-Hill Publishing Company Ltd., New Delhi
12. Bosch, Automotive Brake Systems, Society of Automotive Engineers (SAE), USA

Practical

45 hrs

1. EFI/EMS (Diesel and Petrol)

35 hrs

- Parts identification and location
- Circuit layout
- Use of scanner
- Diagnosis code reading using scanner and malfunction light
- Inspect system and components
- Identification of defective parts
- Replace of defective parts and components
- Testing of components and system
- Safety measures

2. Anti-lock brake systems (ABS)

6 hrs

- Parts identification and location
- Circuit layout
- Checking system and component
- Identification of defective parts

- Replace of defective parts and components
- Testing of components and system
- Safety measures

3. Accessories

4 hrs

Identification, location, and testing of accessories:

- Car audio system
- Seat belt alarm
- Electronic mirror
- Centre locking system
- Power window
- Remote control keyless entry
- Air bag system

Occupational Health and Safety

EG 3104 AE

Year: III

Semester: I

Total: 3 hours/week

Lecture: 3 hours/week

Tutorial: hours/week

Practical: hours/week

Lab: hours/week

Course description:

Awareness about hygiene and safety is the most important thing which every operator, worker, technician and engineer must always bear in mind while working in the industry. Human life is very precious and the organization of the industry must pay full attention to health and safety of workers. This course deals with various industrial hazards and their prevention.

Course objectives:

After completing this course the students will be able to:

- induce safety awareness
- locate unsafe locations and activities on shop floor and take corrective actions
- understand statutory requirements regarding industrial hygiene and safety
- manage industrial safety

Course content:

Unit 1: Introduction to industrial hygiene and safety [6]

- 1.1 Scope of industrial hygiene and safety
- 1.2 Cost and liability of industrial hygiene and safety
- 1.3 Accident, causes of accident and accident prevention methods
- 1.4 Principles and practices of safety management

Unit 2: Industrial Environment [4]

- 2.1 Sanitation in industry
- 2.2 Ventilation system
- 2.3 Lighting system
- 2.4 Heating system

Unit 3: Electrical safety [6]

- 3.1 Effects of electric current on health
- 3.2 Electrical accidents
- 3.3 Electrical safety standards and regulations
- 3.4 Prevention of electrical accidents
- 3.5 Safety requirements for electric installation
- 3.6 Protective equipment for electrical safety

Unit 4: Fire Prevention and control	[4]
4.1 Fire hazards	
4.2 Accident prevention principle	
4.3 Fire control methods	
Unit 5: Noise Pollution and its control	[4]
5.1 Effect of noise on health	
5.2 Standard requirements for industrial noise levels	
5.3 Noise control principle and methods	
5.4 Personal protective equipment	
Unit 6: Air Pollution	[2]
6.1 Classification of pollutants in industry	
6.2 Sources of pollutants	
6.3 Permissible limits	
6.4 Control of the environment	
Unit 7: Electromagnetic Radiation	[4]
7.1 Health hazards due to electromagnetic radiation	
7.2 Permissible limits of electromagnetic radiation	
7.3 Electromagnetic radiation protection principle	
7.4 Personal protective equipment	
Unit 8: Industrial Vibration	[2]
8.1 Causes of vibration	
8.2 Personal protective devices	
Unit 9: Material Handling	[4]
9.1 Factors affecting selection of means for handling of materials	
9.2 Mechanical material handling	
9.3 Handling of dangerous chemicals	
Unit 10: Machine Guarding	[4]
10.1 Legal requirements	
10.2 Assessment of guards	
10.3 Types of guards	
10.4 Design aspect of guards	
Unit 11: Physical and chemical hazards and Safety measures in various operations	[5]
11.1 Arc welding and gas welding	
11.2 Forging	
11.3 Casting	
11.4 Machining	
11.5 Automotive works	

Suggestions for instructions:

1. Demonstration of protective devices
2. Visit to industries
3. Demonstration of using various instruments and equipment

References:

1. William Handley, Industrial Safety handbook, Mc-Graw Hill
2. H. V. Krishnan, An introduction to Safety Engineering and Management
3. M. K. Polter, Occupational Health & Safety in Manufacturing Industries, Mir Publishers, Moscow
4. H. W. Henrich, Industrial Accident Prevention, Mc-Graw Hill

Sixth Semester Subjects:

1. EG 3201 AE Automotive Electronics II
2. EG 3202 MG Personnel Management
3. EG 3201 MG Entrepreneurship Development
4. EG 3202 AE Automotive Technology IV
5. EG 3103 AE Vehicle Driving Practice
6. EG 3204 AE Industrial Attachment

Automotive Electronics II

EG 3201 AE

Year: III
Semester: II

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

Course description:

This course is designed to impart knowledge and skills on auto electronics systems used in automobile engineering.

Course objectives:

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

- Understand the fundamentals of automobile electronics.
- Understand the working principle and application of electronics components, sensors, actuators used in CRDI System, Body Control System and Automatic Transmission system.
- Understand basic about Controller Area Network (CAN) system used in automobile vehicles.
- Basic knowledge of SCANNER operation, Programming of Ignition key, ECU Replacement , Injector Replacement and different simulation using scanner.

Course content:

Unit 1: Automobile diesel fuel electronics system	10 hrs
1.1 Introduction to Common Rail Direct Injection System (CRDI)	
1.1.1 Fuel Pump Operation (Low Pressure Circuit)	
1.1.1.1 Fuel Filter	
1.1.1.2 Fuel Pump	
1.1.1.3 Pressure Relief valve	
1.1.2 High Injection Pump System (High Pressure Circuit)	
1.1.2.1 Common Rail	
1.1.2.2 Rail Pressure Sensor	
1.1.2.3 High Pressure Pump	
1.1.2.4 Pressure Relief valve	
1.1.2.5 High Pressure Injectors	
1.1.2.6 Return Lines	
Unit 2: Automobile Transmission Control System Components	10 hrs
2.1 Transmission Control Unit (TCU)	
2.1.1 Input Parameters	
2.1.1.1 Vehicle Speed Sensors (VSS)	

- 2.1.1.2 Wheel Speed Sensors (WSS)
- 2.1.1.3 Throttle Position Sensors (TPS)
- 2.1.1.4 Turbine Speed Sensors (TSS)
- 2.1.1.5 Transmission Fluid temperature Sensor (TFTS)
- 2.1.1.6 Kick Down switch
- 2.1.1.7 Brake Light Switch
- 2.1.1.8 Traction Control System
- 2.1.1.9 Cruise Control Module
- 2.1.1.10 Input from other Controllers (CAN input)

2.1.2 Output Parameters

- 2.1.2.1 Shift Locks
- 2.1.2.2 Shift Solenoids
- 2.1.2.3 Pressure Control Solenoids
- 2.1.2.4 Torque Converter Clutch Solenoids
- 2.1.2.5 Output to Electronic Control Unit (ECU)
- 2.1.2.6 Output to Other Controllers
- 2.1.2.7 Clutch Wear Indicators and Shift Pressures
- 2.1.2.8 Malfunction Indicator Lamp (MIL)

Unit 3: Body Control Module (BCM)

10 hrs

- 3.1 Block Diagram of BCM
- 3.2 Components of BCM
- 3.3 Operation of BCM
 - 3.3.1 Power Window operation
 - 3.3.2 Instrument Cluster
 - 3.3.3 Anti theft System
 - 3.3.4 Immobilizer System
 - 3.3.5 Immobilizer Coding
 - 3.3.6 Push Button start
 - 3.3.7 Rear View Mirror
 - 3.3.8 Global Positioning System (GPS)- Navigation System
 - 3.3.9 Bluetooth Communication System

Unit 4: Vehicle Controller Area Network (CAN) System

10 hrs

- 4.1 Relation between data transfer rate and bus length
- 4.2 CAN Protocol
- 4.3 Carrier Sense Multiple Access/ Collision Detection (CSMA/CD)
- 4.4 CAN Message Frame Format
 - 4.4.1 Standard Frame
 - 4.4.1.1 Start of Frame (SOF) field
 - 4.4.1.2 Arbitration field
 - 4.4.1.3 Control Field
 - 4.4.1.4 Data Field

- 4.4.1.5 Cyclic Redundancy Check (CRC) field,
 - 4.4.1.6 Acknowledge (ACK) field
 - 4.4.1.7 End of Frame (EOF) field
- 4.4.2 Extended Frame
- 4.5 International Organization for Standardization/ Open System Interconnection (ISO/OSI) Reference Model
 - 4.5.1 Application layer
 - 4.5.2 Presentation layer
 - 4.5.3 Session layer
 - 4.5.4 Transport layer
 - 4.5.5 Network layer
 - 4.5.6 Data Link layer,
 - 4.5.7 Physical layer
- 4.6 CAN standards
 - 4.6.1 CAN High Speed according to ISO-11898
 - 4.6.2 CAN Low Speed according to ISO-11519
- 4.7 CAN Nodes Allocation
 - 4.7.1 Nd1 – Controls all rear lighting loads
 - 4.7.2 Nd2 – Controls electric windows
 - 4.7.3 Nd3 – Controls the windscreen wipers.
 - 4.7.4 Nd4 – Controls all front lighting loads
- 4.8 CAN Implementation Method
 - 4.8.1 Micro-controller (MCU)
 - 4.8.1.1 Application
 - 4.8.1.2 Higher Layer Protocol
 - 4.8.1.3 Additional Message Filter
- 4.9 CAN Controller
 - 4.9.1 MCU Interface
 - 4.9.2 CAN Protocol Controller
 - 4.9.3 Message Acceptance Filter
 - 4.9.4 Message Memory
- 4.10 CAN Transceiver
 - 4.10.1 Bus Failure Management
 - 4.10.2 Signaling
- 4.11 CAN Bus
 - 4.11.1 Transmission between Nodes
- 4.12 CAN Main Controller Software
 - 4.12.1 CAN main controller software flowchart

Unit 5. Automobile Diagnosis System

5Hrs

- 5.1 Automobile On-board diagnostics (OBD) Systems.
- 5.2 Different Scanner Devices used in automobiles.
 - 5.2.1 X431 Launch Scanner
 - 5.2.1 Worldwide Diagnosis System

- 5.3 Techniques of reading and extracting current data.
- 5.4 Analysis of Sensors/Actuators through OBD.
- 5.5 Simulation in OBD.
- 5.6 Programming through OBD
 - 5.6.1 Automobile Ignition Key Programming
 - 5.6.2 Automobile Injector Replacement Programming
 - 5.6.3 Automobile ECU Replacement Programming
 - 5.6.4 Automobile Fuel System Air Bleeding through OBD.

Reference books:

1. William B. Ribbens, Understanding Automotive Electronics, Society of Automotive Engineers Inc.
2. Robert Bosch GmbH, Automotive Electronics Automotive Electronics, John Wiley & Sons
3. Ronald K. Jurgens, Automotive Electronics Handbook, McGraw Hill Company Ltd.
4. Tracy Martin, How to Diagnose & Repair Automotive Electrical System, Motorbooks Workshop, MBI Publishing Company, USA
5. V.A. W. Hillers, Hiller's Fundamentals of Automotive Electronics, The Institute of Motor Industry
6. S.K. Agarwal, Automotive Pollution, Ashish Publishing House, New Delhi 110026
7. Dr. Kripal Singh, Automobile Engineering Vol I & II, Standard Publishers Distributors, New Delhi
8. Willard W. Pulkrabek, Engineering Fundamentals of Internal Combustion Engine, Prentice-Hall of India P. Ltd., New Delhi
9. H. Gerscher, Technology for Automotive Trade Volume 1 & 2, GTZ
10. Bosch, Diesel Fuel Injection, Society of Automotive Engineers (SAE), USA
11. H.M. Sethi, Automotive Technology, Tata McGraw-Hill Publishing Company Ltd., New Delhi
12. Bosch, Automotive Brake Systems, Society of Automotive Engineers (SAE), USA

1. EFI/EMS (Diesel and Petrol)
 - Using common rail injection tester (CIT) for diagnosis of CRDI System
2. Automatic Transmission System
 - Diagnosis through Scanner and identify operation of
 - Solenoids
 - Transmission Control System
3. Body Control Module Programming
 - Fault finding through Scanner in BCM
 - Basic CAN Structure overview
4. Programming through Scanner
 - Ignition Key Programming
 - Injector Replacement and Coding
 - Diesel Fuel System Air Bleeding through Scanner
 - ECU Replacement and Programming
 - Simulation of different actuators.

Personnel Management

EG 3202 MG

Year: III

Semester: II

Total: 2 hours/week

Lecture: 2 hours/week

Tutorial: hours/week

Lab: hours/week

Course description:

The personnel management is concerned with the use of definite principles for organizing and treating individuals at work and to develop them to the full as individuals and member of the group so that they give best results to the enterprise. Men, materials, machines and money are the four important factors of production. Among these four factors human beings constitute the organization at all levels and are regarded as only dynamic factors of production. So manpower planning, their proper selection, recruitment and training is an important aspect of personnel management.

This course deals with basic concepts and principles of personnel/human resources management applied to factory management. The course models human resources management (HRM) as a system and discusses the importance of “people” dimension in organizational growth. HRM as a system consists of input, processing, output and feedback. It has both external and internal environment. The input components to HRM system are human energy and competencies, organization plan, human resource plan, management inventory, job analysis, labor market, etc. the processing components are acquisition, development, utilization and maintenance of personnel. Outputs of HRM system are goal achievement, Quality of work life (QWL), productivity, profits and readiness for change. Feedback provides information to redesign HRM inputs and processing based on the effectiveness of outputs. In addition to this, organizational goals, HRM policies, organization structure, reward system and organization climate are related to internal environment of HRM system. External environment of HRM system includes national politics, economic policy and condition, socio-cultural and technological level. The course tends to develop knowledge and skills in students regarding above mentioned areas essential for productivity improvement and industrial growth.

Course objectives:

General:

After completing the course the student will understand the Human Resource Management System and be able to apply basic principles of personnel management in industrial activities.

Specific:

After completing the course the student will be able to

- Understand Human Resources Management System.
- Describe the acquisition process of human resources in an industry.
- Explain the development processes of human resources in an industry.
- Discuss the motivation processes on human resources in an industry.
- Describe the maintenance aspects of human resources in an industry.

Course content:

- Unit 1 Introduction to Personnel/Human Resource Management [3]**
- 1.1 Review of organization & management (from previous course related to industrial management)
 - 1.2 Definitions of personnel/human resource management (HRM)
 - 1.3 Importance of personnel/HR management
 - 1.4 Functions of personnel management
 - 1.5 Principles of personnel management
 - 1.6 Organization chart of a personnel department in an industry
 - 1.7 HRM as a system
- Unit 2 Acquisition of Human Resources [6]**
- 2.1 Manpower planning
 - 2.2 Job analysis
 - 2.3 Recruiting sources
 - 2.4 Manpower Selection Process
 - 2.5 Selection devices
 - 2.6 Socializing the new employee
 - 2.7 Manpower selection practices in Nepal
- Unit 3 Development of Human Resources [6]**
- 3.1 Definition of training
 - 3.2 Organizational plan for annual activities
 - 3.3 Determining training needs
 - 3.4 Personnel development plan to achieve goals
 - 3.5 Employee training methods
 - 3.6 Foreman or supervisory training
 - 3.7 Career development
 - 3.8 Personal opportunities
- Unit 4 Motivation of Human Resources [8]**
- 4.1 Definition of Motivation
 - 4.2 Theories of motivation
 - 4.3 Job design and motivation
 - 4.4 Performance appraisal
 - 4.5 Rewarding productive employee
- Unit 5 Maintenance of Human Resources [7]**
- 5.1 Compensation administration
 - 5.2 Benefits and services
 - 5.3 Disciplinary problems facing managers

- 5.4 Occupational Safety and health
- 5.5 Trade unions
- 5.6 Labor relations
- 5.7 Collective bargaining

Suggestions for Instruction:

- 1. Lectures
- 2. Guest speakers from industries
- 3. Student's presentations
- 4. Case studies from Industries
- 5. Industrial Visits

Note: the above given topics and sub topics are basic guidelines to drive the course for initial stage. The course improvement is a continuous process based on the feedback of the industries. Therefore related authorities are recommended to review the course continuously to address the future needs more effectively.

References:

- 1. Agrawal, G.R. (2001). Dynamics of Human Resource Management in Nepal. M. K. Publishers and Distributors, Kathmandu, Nepal.
- 2. Agrawal, G. R. (2003). Principles of Management in Nepal. M. K. Publishers and Distributors, Kathmandu, Nepal.
- 3. Davar, R. S. (1996). Personnel Management and Industrial Relations, latest edition, Vikash Publishing House Pvt. Ltd., Delhi.
- 4. Decenzo, David A. & Robbins, Stephen P. (1997). Personnel/Human Resource Management (3rd ed). Prentice Hall of India, New Delhi.
- 5. Dessler, Gary (2002). A Framework for Human Resource Management latest edition, Pearson Education Asia, India.
- 6. Mahajan, M. (2002). Industrial Engineering and Production Management latest edition, Dhanpat Rai and Co. (Pvt.) Ltd. Delhi
- 7. Sharma, S.K & Sharma, Savita (2002). A course in Industrial engineering and operations management. S.K. Kataria and Sons, Delhi, India.

Entrepreneurship Development

EG 3201 MG

Year: III
Semester: II

Total: 5 hours/week
Lecture: 3 hours/week
Tutorial: hours/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:

- Understand the concept of business and entrepreneurship
- Explore entrepreneurial competencies
- Analyze business ideas and viability
- Learn to formulate business plan with its integral components
- Manage small business

Course Contents:

Theory

Unit 1: Introduction to business & entrepreneurship **[9 Hours]**

1. Overview of entrepreneur and entrepreneurship
2. Wage employment , self- employment and business
3. Synopsis of types and forms of enterprises
4. Attitudes, characteristics & skills required to be an entrepreneur
5. Myths about entrepreneurs
6. Overview of MSMEs (Micro, Small and Medium Enterprises) in Nepal

Unit 2: Exploring and developing entrepreneurial competencies **[10 Hours]**

1. Assessing individual entrepreneurial inclination
2. Assessment of decision making attitudes
3. Risk taking behavior and risk minimization
4. Creativity and innovation in business
5. Enterprise management competencies

Unit 3: Business identification and selection **[4 Hours]**

1. Sources and method of finding business idea(s)
2. Selection of viable business ideas

3. Legal provisions for MSMEs in Nepal

Unit 4: Business plan formulation

[17 Hours]

1. Needs and importance of business plan
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. Business operation plan
 - Process of product or service creation
 - Required fix assets
 - Level of capacity utilization
 - Depreciation & amortization
 - Estimation office overhead and utilities
4. Organizational and human resource plan
 - Legal status of business
 - Management structure
 - Required human resource and cost
 - Roles and responsibility of staff
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
6. Business plan appraisal
 - Return on investment
 - Breakeven analysis
 - Risk factors

Unit 5: Small business management

[5 Hours]

1. Concept of small business management
2. Market and marketing mix

3. Basic account keeping

Practical

Unit 1: Overview of business & entrepreneurship [2 Hours]

1. Collect business information through interaction with successful entrepreneur

Unit 2: Exploring and developing entrepreneurial competencies [2 Hours]

1. Generate innovative business ideas

Unit 3: Product or service identification and selection [2 Hours]

1. Analyze business ideas using SWOT method

Unit 4: Business plan formulation [22 Hours]

1. Prepare marketing plan
2. Prepare operation plan
3. Prepare organizational and human resource plan
4. Prepare financial plan
5. Appraise business plan
6. Prepare action plan for business startup

Unit 5: Small business management [2 Hours]

1. Prepare receipt and payment account
2. Perform costing and pricing of product and service

पाठ्यपुस्तक :

- क) प्रशिक्षकहरुका लागि निर्मित निर्देशिका तथा प्रशिक्षण सामग्री, प्राविधिक शिक्षा तथा व्यावसायिक तालीम परिषद्, २०६९
- ख) प्रशिक्षार्थीहरुका लागि निर्मित पाठ्यसामग्री तथा कार्यपुस्तिका, प्राविधिक शिक्षा तथा व्यावसायिक तालीम परिषद् (अप्रकाशित), २०६९

Reference book:

Entrepreneur's Handbook, Technonet Asia, 1981.

Automotive Technology IV

EG 3201AE

Year: III
Semester: II

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

Course description:

This course provides knowledge and skills on repairing and maintenance of vehicle and their diagnosis procedures. It helps to develop driving skill of students and helps to know motor vehicle acts and rules.

Course objectives:

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

- Understand technical condition of vehicles and diagnosis procedure.
- Understand the fundamental of motor vehicle.
- Understand vehicle service and repair process.
- Understand workshop management procedure.
- Understand about parts, tools and equipment management.
- Understand about workshop layout and organizational structure.
- Read and interpret traffic rules, regulations and acts.

Course content:

Unit 1: Diagnosis of vehicles

20 Hrs

- 1.1 Diagnosis of petrol and diesel engine
- 1.2 Diagnosis of Engine Management system (EMS) petrol and diesel
- 1.3 Diagnosis of Transmission System
- 1.4 Diagnosis of brake system
- 1.5 Diagnosis of Steering system
- 1.6 Diagnosis of Suspension system
- 1.7 Diagnosis of Advance Electrical and Electronic System
 - Body Control Module (BCM)
 - Anti-Lock Braking System(ABS)
 - Heating Ventilation and Air Conditioning (HVAC) System
 - Immobilizer System
 - Center Door Locking (CDL)

- Supplementary Restraint System (SRS)
- Instrument cluster
- Electrical Power Assisted Steering (EPAS)
- Controlled Area Network (Petrol/Diesel)

Unit 2: Concept of Maintenance, Repairs and Wear in Vehicles

8 Hrs

- 2.1. Introduction to maintenance
- 2.2. Importance of maintenance
- 2.3. Types of maintenance
- 2.4. Activities of maintenance
- 2.5. Repair and its purpose
- 2.6. Overhaul and running repair

Unit 5: Fundamental of Motor Vehicles

8 Hrs

- 5.1. General on braking dynamics
- 5.2. Braking distance
- 5.3. Cross country ability of a motor vehicle
 - General on cross country ability with examples of 4×4,6×6 types of wheel formula
- 5.4. Smoothness of run of a motor vehicle
 - Introduction
 - Characteristics of the smoothness of run
 - Effects of design factors on smooth running: effects of advantage of independent suspension, pneumatic suspension, torsion suspension
- 5.5. Effective (brake) Characteristics of Engine
- 5.6. Effective braked power
- 5.7. Mechanical losses
- 5.8. Specific effective fuel consumption

Unit 6: Driving

4 Hrs

- 6.1. Traffic rules and regulation
- 6.2. Traffic signs and symbols
- 6.3. Plain driving
- 6.4. Night driving
- 6.5. Hill driving
- 6.6. City driving
- 6.7. Reverse
- 6.8. Parking

Unit 10: Motor Vehicles Acts and Rules

5 Hrs

Reference books:

1. William H. Crouse, Automotive Engines, Tata McGraw Hill Company, New Delhi
2. William H. Crouse, Anglin, Automotive Mechanics, Tata McGraw Hill Company, New Delhi
3. T.R. Banga, Nathu Singh, A text book of Automobile Engineering,
4. Frederick C. Nash, KalmanBanitz, Automotive Technology
5. K. M. Moeed, Automobile Engineering, S. K. Kataria and sons, Ansari Road, Daryagunj, New Delhi, 110002
6. R.K. Mohanty, Automobile Engineering Volume I & II, Standard Book House, 1705A Naisarak, Delhi, 110006
7. P. S. Gill, A Text book of Automobile Engineering Volume I & II, S. K. Kataria and sons, Ansari Road, Daryagunj, New Delhi, 110002
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17. H.M. Sethi, Automotive Technology, Tata McGraw-Hill Publishing Company Ltd., New Delhi
18. S. Srinivasan, Automove Mechanics, Tata Mc Graw Hill Publishing Company Limited, New Delhi
19. P. L. Kohli, Automotive Electrical Equipment, Tata Mc Graw Hill Publishing Company Limited, New Delhi

Practical

1. Fault finding, repair and maintenance of chassis, frame and control system.
2. Fault finding, repair and maintenance and overhaul of Petrol Engine.
3. Circuit diagram analysis of different types of EMS-Petrol.
4. Fault finding in EMS (Petrol) by using multimeter.
5. Fault finding in EMS (Petrol) by using diagnostic tools.
6. Fault finding, repair and maintenance and overhaul of Diesel Engine
7. Fault finding, repair and maintenance and overhaul of Diesel Engine.
8. Fault finding in Engine Management System (EMS)-Diesel.
9. Circuit diagram analysis of different types of EMS-Diesel.
10. Fault finding in EMS (Diesel) by using multimeter.
11. Fault finding in EMS (Diesel) by using diagnostic tools.
12. Circuit Diagram analysis, Circuit analysis and fault finding using multimeter, diagnostic tools of the following system.
 - Body Control Module (BCM)
 - Anti-Lock Braking System(ABS)
 - Heating Ventilation and Air Conditioning (HVAC) System
 - Immobilizer System
 - Center Door Locking (CDL)
 - Supplementary Restraint System (SRS)
 - Charging and Starting System
 - Instrument cluster
 - Electrical Power Assisted Steering (EPAS)
 - Lighting System
 - Wiper System
 - Window Winding
 - Revers Parking
 - Radiator Fan
 - Stop Reverse Side indicators/ Fog Lamp/DRL
 - Controlled Area Network (Petrol/Diesel)
 - Heated Rear window
 - Power Mirror
 - Horn System
 - Infotainment System
 - Automatic Manual Transmission (AMT)
 - Electronic Steering Column lock.
 - Fully Automatic Temperature control System (FATC)
 - Four wheel drive system

Vehicle Driving Practice

EG 3203 AE

Year: III
Semester: II

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

Course description:

This course is designed to help the students in acquainting knowledge and skills on vehicle driving.

Course objectives:

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

- Demonstrate the skills required for the vehicle driving.
- Apply control system while vehicle driving.
- Perform pre inspection, during and post check up of vehicle to drive.

Course content:

Practical

1. Perform pre starting check up of vehicle.
2. Start the engine
3. Perform pre driving check up of the vehicle.
4. Control steering practice in the field.
5. Carry out driving practice from stationary.
6. Perform running practice in first gear on the field.
7. Perform running practice in second gear on the field.
8. Perform full driving practices on the field.
9. Perform full driving practice on the road.
10. Perform straight reverse driving practice.
11. Perform bend reverse driving practice.
12. Perform bent reverse parking practice in various patterns.
13. Read traffic Rules and regulations.
14. Interpret traffic sign and symbols.

Industrial Attachment

EG 3204 AE

Total: 14 hours/week

Year: III

Semester: II

Course description:

The student will be assigned to various industries in Nepal on a full time /part time basis for duration of 210 hours. During this period; students will be acquainted with the prevailing condition of the industry. At the end of the course, student will submit a complete report conforming to a standardized format along with the daily diary signed by the supervisor of industry under whom they have been working.

Industrial Attachment shall consist of two aspects namely-skill & management. Considering this, student will observe the operation of the industry, he/she will work as operator, machinist, mechanic or other responsibility given by the authority of the industry. However, the student will be closely guided and supervised by the respective supervisor. During this period, students should observe industry rules and norms, workshop layout, safety aspects and also production process, technology, tools and working methods and techniques of the related work in the industry. The report shall be completed by collecting necessary information and duly endorsed by the industry prior to the submission to the department.

Format of the Main report must include the following;

1. Profile of the Industry
2. Profile of the Industry personnel
3. Plant & Machine lay out
4. Daily Works and skill gained
4. Significant problem/s in the Industry
5. Suggestions for the improvement of selected aspects of problems; (production, Equipment, Material, Management, Staff etc.)
6. Appendix

Course objectives:

After completing the course the students will be able to:

- be familiar with Industry set up and Equipment lay out
- Explain technological aspects and production techniques
- Identify essential managerial aspects
- establish a good rapport between Industry and Institution
- Prepare the daily report and present to the supervisor daily

Evaluation system

The student's performances will be evaluated based on their performances during industrial attachment, and for that the weightage for the evaluation will be as following:

S.N	Who does evaluate?	Marks
1	Supervisor of the host organization in which the student is placed for Industrial Attachment	150
2	Supervisor from Training Institute	50
3	CTEVT or its Nominee (external)*	100
	Total	300

*** Students are required to secure 40 percent marks in the internal and external examination conducted by CTEVT to pass the course.**

Experts Involved in Curricula Development, 2008

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5. Mr. Nripa Dhoj Khadka- IOE, Pulchok
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8. Mr. N. R. Bhattarai - IOE, Pulchok
9. Mr. Prasanta Ghimire- IOE, Pulchok
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12. Mr. Ram Chandra Sapkota- IOE, Pulchok
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2. Mr. Sunny Pradhan, IOE, Senior Instructor, IOE Thapathali Campus
3. Mr. Laxman Palikhel, HOD, Automobile Section, IOE Thapathali Campus
4. Mr. Prem Nakarmi, Senior Instructor, IOE Thapathali Campus
5. Mr. Binay Manandhar, Senior Instructor, IOE Thapathali Campus
6. Mr. Ajay Kumar Singh, HOD, Automobile, Korea Nepal Institute for Technology, Butwal
7. Raj Kumar Choudhary, Senior Instructor, Korea Nepal Institute for Technology, Butwal
8. Mr. Prakash Shakya, Hyundai Motor Service
9. Mr. Rudra Mani Ghimire, IOE Pulchok

Experts Involved in Curriculum Revision, 2019

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1	Dr. Krishna Prasad Shrestha	Asst. Professor	Kathmandu University
2	Ram Prasad Bhatta	Instrutor	Sipradi Trading Pvt.Ltd
3	Dipesh Poudel	Training Manager	Sipradi Trading Pvt.Ltd
4	Dinesh Kumar Mandal	Instrutor	KNIT, Butwal
5	Manoj Bashyal	Instrutor	KNIT, Butwal
6	Raj Kumar Chaulagain	Lecturer	Thapathali Campus
7	Prem Lal Tamang	Service Manager	Laxmi Intercontinental, (Hyundai)
8	Sanny Pradhan	Instrutor	Thapathali Campus
9	Alok Kumar Chaudhary	Mechanical Engineer	Ministry of Defense
10	Dr. Surya Prasad Adhikari	Asst. Professor	Thapathali Campus
11	Subash Kumar Ghimire	Lecturer	Thapathali Campus
12	Laxman Palikhel	Assst. Instrutor	Thapathali Campus
13	Mahesh Kumar Sah	Training Manager	C.G. Motor Corporation