

**CURRICULUM
DIPLOMA
Engineering All**

First Year (First and Second Semester)



Council for Technical Education and Vocational Training (CTEVT)
Curriculum Development and Equivalence Division
Sanothimi, Bhaktapur
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Introduction

The first year (First and Second Semester) curriculum is designed for all 3-years Engineering programme of Diploma level. In these curriculum foundational subjects such as Nepali, English, Mathematics, Physics, Chemistry and Computer Application are offered to build the academic base. The disciplinary subjects such as Engineering Drawing, Workshop Practice and Applied Mechanics are included in order to lure them to their respective field. Most of the subjects offered in first year (First and Second Semester) are of theoretical nature with some lab practices in basic science & applied mechanics. Practical exercises have been included in computer application, workshop practice and engineering drawing to provide them the practical exposure. The first-year courses fulfil the academic requirements to enter bachelor degree in engineering.

Entry Criteria

- SLC Pass or SEE with minimum C grade in Compulsory Mathematics & Science and D+ in English.
- Pre-diploma in Civil Engineering with minimum 67.00%.
- Should pass entrance examination administered by CTEVT.

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 lab, practical/demonstration
- 1:6 for bench work
- 75 % of the technical teachers must be full timer

Qualification of Teachers and Instructors

- The program coordinator should be a master's degree holder in the related area.
- The disciplinary subject related teacher and demonstrators should be a bachelor's degree holder in the related area.
- The foundational subject related teacher (refer to course code 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, multimedia, Slides 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; lecture, illustrated talk, tutorial, group discussion, demonstration, simulation, guided practice, self-practice, fieldwork, block study, industrial practice, report writing, term paper presentation, heuristic and other independent learning exercises.

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

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

Mode of Education

There will be inductive and deductive mode of education.

Examination and Marking Scheme

a. Internal assessment

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

b. Final examination

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

c. Requirement for final practical examination

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

d. Final practicum evaluation will be based on:

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

e. Pass marks:

- The students must secure minimum 40% marks in theory and 50% 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

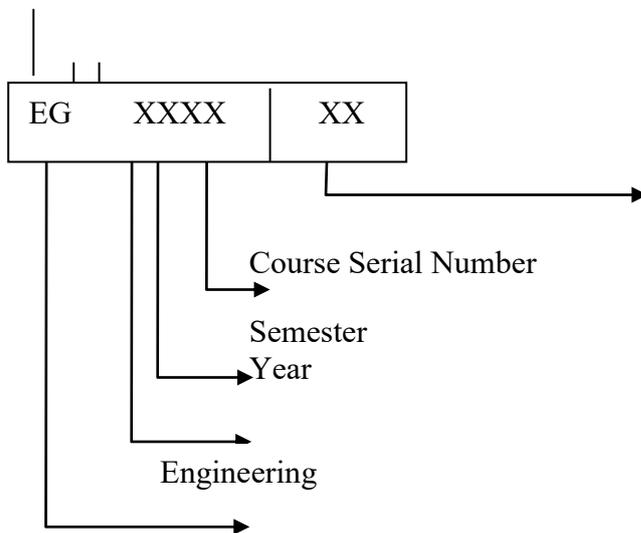
There will be the provision of back paper but a student must pass all the subjects of all semester within six years from the enrollment.

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.

Subjects Codes

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



Offering Departments:

- AE: Agricultural Engineering
- AR: Architecture
- CE: Civil Engineering
- CT: Computer Engineering
- EE: Electrical Engineering
- EX: Electronics Engineering
- HE: Hydropower Engineering
- ME: Mechanical Engineering
- MG: Management
- SH: Science and Humanities

Course Structure:

YEAR: I

SEMESTER I

S.N.	Code No.	Subjects	Mode				Total Hours	DISTRIBUTION OF MARKS						Total Marks	Remarks
			L	T	P	Lab		Theory			Practical				
								Assmt. Marks	Final Marks	Time Hours	Assmt. Marks*	Final Marks	Time Hours		
1	EG 1101 SH	Applied Nepali	4				4	20	80	3				100	*Continuous assessment
2	EG 1102 SH	Applied English	4				4	20	80	3				100	
3	EG 1103 SH	Engineering Mathematics I	4	2			6	20	80	3				100	
4	EG 1104 SH	Engineering Physics I	4	2		2	8	20	60	3	10	10	2	100	
5	EG 1105 SH	Engineering Chemistry I	4	2		2	8	20	60	3	10	10	2	100	
6	EG 1101 AR	Engineering Drawing I	1		4		5	0	0		60	40	4	100	
7	EG 1101 CT	Computer Application	2		2		4	10	40	1.5	30	20	3	100	
TOTAL			23	6	6	4	39	110	400		110	80		700	

YEAR: I

SEMESTER II

S.N.	Code No.	Subjects	Mode				Total Hours	DISTRIBUTION OF MARKS						Total Marks	Remarks
			L	T	P	Lab		Theory			Practical				
								Assmt. Marks	Final Marks	Time Hours	Assmt. Marks*	Final Marks	Time Hours		
1	EG 1201 SH	Engineering Mathematics II	4	2			6	20	80	3				100	*Continuous assessment
2	EG 1202 SH	Engineering Physics II	4	2		2	8	20	60	3	10	10	2	100	
3	EG 1203 SH	Engineering Chemistry II	4	2		2	8	20	60	3	10	10	2	100	
4	EG 1201 CE	Workshop Practice I	2		6		8	0	0		60	40	4	100	
5	EG 1201 AR	Engineering Drawing II	0		4		4	0	0		60	40	4	100	
6	EG 1202 CE	Applied Mechanics	3	2		2/2	6	20	60	3	20	0		100	
TOTAL			17	8	10	5	40	80	260		160	100		600	

First Year
[First and Second Semesters]

First Semester

Subjects:

- 1 EG 1101 SH Applied Nepali
- 2 EG 1102 SH Applied English
- 3 EG 1103 SH Engineering Mathematics I
- 4 EG 1104 SH Engineering Physics I
- 5 EG 1105 SH Engineering Chemistry I
- 6 EG 1101 AR Engineering Drawing I
- 7 EG 1101 CT Computer Application

एपलाइड नेपाली
इजि ११०१ एस.एच.

वर्ष: प्रथम
खण्ड: प्रथम

जम्मा: ४ घण्टा/हप्ता
प्रवचन: ४ घण्टा/हप्ता

कोर्षको परिचय:

यस विषयमा विद्यार्थीहरूले भावी व्यावसायमा प्रभावकारी ढङ्गले सञ्चार गर्नका लागि आवश्यक पर्ने ज्ञान र सीपसँग सम्बन्धित नेपाली सञ्चारात्मक भाषा, लेखन सीप अन्तर्गतका शीर्षक र कृति परिचयको ढाँचा गरी जम्मा ८ वटा एकाइहरू समावेश गरिएका छन्।

कोर्षको उद्देश्य:

यस पाठ्यांशको अध्ययनबाट विद्यार्थीहरूले निम्न लिखित भाषिक क्षमता विकास गर्न सक्नेछन्:-

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

एकाइ १: संचारात्मक नेपाली भाषा र नेपाली व्याकरण

१४ घण्टा

१.१ भाषिक भेदको परिचय

३ घण्टा

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

१.२ वर्णको परिचय

२ घण्टा

- नेपाली वर्णहरूको पहिचान
- ध्वनि र वर्ण
- स्वर वर्ण
- व्यञ्जनवर्ण

१.३ वर्ण विन्यास

२ घण्टा

- ह्रस्व र दीर्घ हुने नियम
- हलन्त र अजन्तको प्रयोग सम्बन्धी नियम
- शिरबिन्दु र चन्द्रबिन्दु सम्बन्धी नियमहरू
- पदयोग र पद वियोग सम्बन्धी नियम
- लेख्य चिह्नहरूको परिचय र प्रयोग सम्बन्धी नियमहरू

१.४ शब्द भण्डार

३ घण्टा

- स्रोतका आधारमा शब्दको वर्गीकरण
- बनोटका आधारमा
- कार्यका आधारमा

१.५. शब्द रूपायन

२ घण्टा

- रूपायनको परिचय
- नामको रूपायन
- सर्वनामको रूपायन
- विशेषणको रूपायन
- क्रियापदको रूपायन

१.६ वाक्य संश्लेषण र वाक्य विश्लेषण

१ घण्टा

- वाक्य संश्लेषण
- वाक्यविश्लेषण

१.७ पदसङ्गति

१ घण्टा

<ul style="list-style-type: none"> • पदसङ्गतिको परिचय • पदसङ्गतिका प्रकार 		
एकाइ दुई: लेखन सिप		२२ घण्टा
२.१ लेखन सिप		६ घण्टा
<ul style="list-style-type: none"> • बोधको ज्ञान र अभ्यास 		
२.२ लेखन सिप		३ घण्टा
<ul style="list-style-type: none"> • बुँदाटिपोट • सारांश लेखन 		
२.३ लेखन सिप		३ घण्टा
<ul style="list-style-type: none"> • संवाद लेखन • अनुच्छेद लेखन 		
	(कुनै एक)	
२.४ लेखन सिप		४ घण्टा
<ul style="list-style-type: none"> • निमन्त्रणापत्र • सूचना • सम्पादकलाई चिठी • निवेदन • विज्ञापन • बधाई ज्ञापन 		
	(कुनै एक)	
२.५ लेखन सिप		४ घण्टा
<ul style="list-style-type: none"> • निबन्ध लेखन 		
२.६ लेखन सिप		२ घण्टा
<ul style="list-style-type: none"> • प्रतिवेदन लेखन 		
एकाइ ३: कृति/पाठ परिचय र कृति समीक्षा		२४ घण्टा
३.१ निम्नलिखित ढाँचामा तलका कृति/पाठको परिचय लेख्ने अभ्यास		६ घण्टा
क) कृतिहरू:		
<ul style="list-style-type: none"> • म कसरी हाँछु (नाटक) • माइतघर (उपन्यास) • राष्ट्रनिर्माता (खण्डकाव्य) 	<ul style="list-style-type: none"> गोविन्दबहादुर मल्ल गोठाले लैनसिंह वाङ्देले माधवप्रसाद घिमिरे 	
ख) कृति परिचयको ढाँचा		
<ul style="list-style-type: none"> • कृति/पाठको नाम: • कृति/पाठको रचनाकारको नाम: • कृति/पाठको मुख्य विषय: (एक अनुच्छेद) • कृति/पाठको महत्व: (एक अनुच्छेद) • कृति/पाठले आफूलाई पारेको प्रभाव: (छोटो एक अनुच्छेद) • कृति/पाठको भाषाशैली: (छोटो एक अनुच्छेद) • कृति/पाठको कमी, कमजोरी र सुझाव: (छोटो एक अनुच्छेद) 		
३.२ कृति समीक्षा		१८ घण्टा
क) कथाखण्ड		५ घण्टा
<ul style="list-style-type: none"> • हरिदत्त: • बितेका कुरा: • मृगतृष्णा: 	<ul style="list-style-type: none"> विश्वेश्वरप्रसाद कोइराला रुपनारायण सिंह माया ठकुरी 	
ख) निबन्ध खण्ड		५ घण्टा
<ul style="list-style-type: none"> • पहाडी जीवन: 	लक्ष्मीप्रसाद देवकोटा	

- एक पत्र— सम्पादकलाई: शङ्कर लामिछाने
- भान्सा भो हजुर: भैरव अर्याल

ग) कविता खण्ड

४ घण्टा

- साहित्य सुधा: धरणीधर कोइराला
- हामी: भूपी शेरचन
- नचिनिने भएछौं: अगमसिंह गिरी

घ) एकाङ्की

४ घण्टा

- भावना: भीमनिधि तिवारी

सिकाइ सामग्रीहरू

- कृष्णप्रसाद पराजुली: राम्रो रचना मीठो नेपाली, सहयोगी प्रेस
- दयाराम श्रेष्ठ र मोहनराज शर्मा: नेपाली साहित्यको सङ्क्षिप्त इतिहास, साझा प्रकाशन
- डा. मोहन बिक्रम थापा: साहित्य परिचय, साझा प्रकाशन
- विश्वेश्वरप्रसाद कोइराला: दोषी चस्मा कथा सङ्ग्रह, साझा प्रकाशन
- माधवप्रसाद घिमिरे: राष्ट्र निर्माता खण्डकाव्य, साझा प्रकाशन
- लैनसिंह वाङ्देले: माइतघर उपन्यास, रत्न पुस्तक भण्डार
- गोविन्दबहादुर मल्ल गोठाले: भोको घर एकाङ्की सङ्ग्रह, साझा प्रकाशन
- व्यावहारिक नेपाली, टीकाहरि बराल, अस्मिता बुक्स पब्लिसर्स एण्ड डिस्ट्रिब्युटर्स प्रा.लि.पुतलीसडक काठमाडौं
- गोरखापत्र, कान्तिपुर आदि पत्रिका सम्पादकीय, टिप्पणी र लेखहरू
- प्रशिक्षकहरूले आफ्नो पुस्तक तयार गर्न वा बाजारमा पाइने सामग्री छानेर पढाउन सक्ने

विशिष्टीकरण तालिका

एकाइ	शीर्षक	समय	पूर्णांक
१	संचारात्मक नेपाली भाषा र नेपाली व्याकरण	१४ घण्टा	पूर्णाङ्क (२४)
	१.१ भाषिक भेदको परिचय	३ घण्टा	पूर्णाङ्क (४)
	१.२ वर्णको परिचय	१ घण्टा	पूर्णाङ्क (२)
	१.३ वर्णविन्यास	३ घण्टा	पूर्णाङ्क (४)
	१.४ शब्द भण्डार	३ घण्टा	पूर्णाङ्क (२)
	१.५ शब्द रूपायन	२ घण्टा	पूर्णाङ्क (४)
	१.६ वाक्य संश्लेषण र वाक्य विश्लेषण	३ घण्टा	पूर्णाङ्क (४)
	१.७ पदसङ्गति	३ घण्टा	पूर्णाङ्क (४)
२	लेखन सीप	२२ घण्टा	पूर्णाङ्क (३२)
	२.१ लेखन सीप (बोधको ज्ञान)	६ घण्टा	पूर्णाङ्क (८)
	२.२ लेखन सीप (बुँदा लेखन, सारांश लेखन)	३ घण्टा	पूर्णाङ्क (४)
	२.३ लेखन सीप (संवाद लेखन, अनुच्छेद लेखन)	३ घण्टा	पूर्णाङ्क (४)
	२.४ लेखन सीप (निमन्त्रणा पत्र, सूचना, सम्पादकलाई चिठी, निवेदन, विज्ञापन, बधाई ज्ञापन)	४ घण्टा	पूर्णाङ्क (४)
	२.५ लेखन सीप (निबन्ध लेखन)	४ घण्टा	पूर्णाङ्क (८)
	२.६ लेखन सीप (प्रतिवेदन लेखन)	२ घण्टा	पूर्णाङ्क (४)
३	कृति/पाठको परिचय लेख्ने अभ्यास	२४ घण्टा	पूर्णाङ्क (२४)
	३.१ कृति/पाठको परिचय लेख्ने अभ्यास	६ घण्टा	पूर्णाङ्क (८)
	३.२ कृति समीक्षा	१८ घण्टा	पूर्णाङ्क (१६)
	क. कथा खण्ड	५ घण्टा	पूर्णाङ्क (४)
	ख. निबन्ध खण्ड	५ घण्टा	पूर्णाङ्क (४)
	ग. कविता खण्ड	४ घण्टा	पूर्णाङ्क (४)
	घ. एकाङ्की	४ घण्टा	पूर्णाङ्क (४)

Applied English
EG 1102 SH

Year: I
Semester: I

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

Course Description:

This course is designed with a view to provide students techniques in using English for academic and communicative purposes, train them in the comprehending varieties of texts, terminologies, grammatical and communicative areas of English language, make them see the relationship between structure and meaning. This guides the students from general to comprehensive understanding of language.

Course Objectives:

On completion of the course the students will be enabled to:

1. Construct sensible sentences applying the grammatical structures.
2. Answer the questions given after the comprehension passage.
3. Use terminologies vocabularies to construct sensible sentences.
4. Conduct a dialogue in given situation.
5. Write paragraphs on people, place and events correctly and meaningfully.
6. Analyze the literary texts.

Section One: Language Development **[40 Hrs.]**

Unit 1: Technology **[4 Hrs.]**

- 1.1 Reading comprehension: Hyper loop
 - 1.1.1 Use of technological terms
 - 1.1.2 Use of prefixes
 - 1.1.3 Question- answer
- 1.2 Issuing a press release
- 1.3 Subject Verb agreement
- 1.4 Summarizing
- 1.5 Project Work

Unit 2: Money and Economy **[4 Hrs.]**

- 2.1 Reading comprehension: QR Code
 - 2.1.1 Use of terminologies
 - 2.1.2 Abbreviations
 - 2.1.3 Vowel sounds
 - 2.1.4 Question- Answer
- 2.2 Writing a news article
- 2.3 Questions:
 - 2.3.1 Yes/no questions
 - 2.3.2 Wh - questions
 - 2.3.3 Indirect and direct questions
- 2.4 Expressing necessity
- 2.5 Project Work

Unit 3: Human Culture **[4 Hrs.]**

- 3.1 Reading Comprehension: Land of Plenty
 - 3.1.1 Word Formation: Root, Prefixes and prefixes

- 3.1.2 Question-answer
- 3.2 Writing:
 - 3.2.1 Paragraph
 - 3.2.2 Letter to the editor
- 3.3 Adjectives and Adverbs
- 3.4 Making comparison and contrast
- 3.5 Project Work

Unit 4: Ecology and Environment **[4 Hrs.]**

- 4.1 Reading Comprehension: Living in a Redwood Tree
 - 4.1.1 Terminologies used in ecology
 - 4.1.2 Compound words
 - 4.1.3 Question - answer
- 4.2 Writing a book/film review
- 4.3 Reported Speech
- 4.4 Reporting
- 4.5 Project Work

Unit 5: Career Opportunities **[4 Hrs.]**

- 5.1 Reading Comprehension: Presenting Yourself
 - 5.1.1 Employment-related terminologies
 - 5.1.2 Answering questions
- 5.2 Writing job application with CV
- 5.3 Conditional Sentences
- 5.4 Clarifying
- 5.5 Project Work

Unit 6: Human Rights **[4 Hrs.]**

- 6.1 Reading Comprehension: “I am Sorry”- The Hardest Three Words to Say
 - 6.1.1 Word formation
 - 6.1.2 Question-answer
- 6.2 Writing Paragraphs on Steps on making education equal
- 6.3 Connectives
- 6.4 Group work: Criticizing
- 6.5 Project Work

Unit 7: War and Peace **[4 Hrs.]**

- 7.1 Reading comprehension: Train to Pakistan
 - 7.1.1 Terminologies
 - 7.1.2 Question -answer
 - 7.1.3 Vowels: Monophthongs and diphthongs
- 7.2 Describing People, place or event
- 7.3 Past simple, Past continuous, Past perfect, Past perfect continuous tense
- 7.4 Group work: Making Announcements
- 7.5 Project Work

Unit 8: Music and Creation **[4 Hrs.]**

- 8.1 Reading Comprehension: A Life of Sound and Silence
 - 8.1.1 Terminologies used in music
 - 8.1.2 Word Stress
 - 8.1.3 Question -answer

- 8.2 Writing a bibliography.
- 8.3 Preposition of time
- 8.4 Group work: Predicting
- 8.5 Project Work

Unit 9: Migration and Diaspora [4 Hrs.]

- 9.1 Reading Comprehension: Dediasporization: Homeland and Hostland
 - 9.1.1 Consonants: Voiced and voiceless sounds
 - 9.1.2 Stressed and unstressed syllable
 - 9.1.3 Question - answer
- 9.2 Interpreting data in charts and graphs
- 9.3 Would/ Used to
- 9.4 Narrating past events
- 9.5 Project Work

Unit 10: Power and Politics [4 Hrs.]

- 10.1 Reading Comprehension: An Open Letter to Mary Daly
 - 10.1.1 Terminologies used in politics
 - 10.1.2 Consonant cluster
 - 10.1.3 Question- answer
- 10.2 Writing an article for a newspaper
- 10.3 Adjective order
- 10.4 Pair work: Denying
- 10.5 Project Work

Section Two: Literature [20 Hrs.]

Unit One: Short Stories

1. The Treasure in the Forest - H. G. Wells
2. My Old Home - Lu Xun
3. The Half-closed Eyes of the Buddha and the Slowly Sinking Sun -Shankar Lamichhane
4. A Very Old Man with Enormous Wings - Gabriel Garcia Marquez

Unit Two: Poems

1. The Awakening Age - Ben Okri
2. Soft Storm – Abhi Subedi

Unit Three: Essays

1. Knowledge and Wisdom - Bertrand Russell
2. Humility - Yuval Noah Harari
3. Human Rights and the Age of Inequality - Samuel Moyn

References:

1. Panday, Ram Kumar. *Yeti Tells*. SajhaPrakashan.3rd edition. Kathmandu, 2050.
2. Ancient Tales.Ed, Lohani, Shreedhar P, Adhikari Rameshwar P and Subedi, Abhi N. Educational Enterprises Pvt Ltd: Kathmandu,1996.
3. Grade 12 English. Centre for Curriculum Development, Government of Nepal: Sano Thimi, 2077.
4. Poudel, R.C., A Manual to Communicative English, K.P. Pustak Bhandar, Kathmandu, 1956/57.

5. Shah, B.L., A text book of writing skills in English, First edition Hira Books Enterprises, Kathmandu,
6. Fruehling, R. T. and Oldham N. B., Write to the point, McGraw- Hill, Inc. New York NY 10020
7. Taylor, G., English conversation practice, 1975.
8. Maharjan L. B., A textbook of English sounds and Structures, Vidyarthi Pustak Bhandar, Kathmandu,2000.
9. Blundell, Jon, Higgins, Jonathan & Middlemiss, Nigel, Function of English, Oxford University Press
10. Better English Pronunciation, Cambridge University Press, New edition
11. Link English, Central Department of English, Tribhuvan University
12. 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.
13. The related institute may develop its own textbook and approve from the related authority so as to have a prescribed textbook of this subject.

Evaluation Scheme

Units	Title	Hours	Mark distribution*
Language Development			
1.	Technology	4	5
2.	Money and Economy	4	5
3.	Human Culture	4	5
4.	Ecology and Environment	4	5
5.	Career Opportunities	4	4
6.	Human Rights	4	5
7.	War and Peace	4	5
8.	Music and Creation	4	4
9.	Migration and Diaspora	4	5
10.	Power and Politics	4	5
Total		40	48
Literature			
1.	The Treasure in the Forest - H. G. Wells	3	7×2
2.	My Old Home - Lu Xun	3	
3.	The Half-closed Eyes of the Buddha and the Slowly Sinking Sun -Shankar Lamichhane	3	
4.	A Very Old Man with Enormous Wings - Gabriel Garcia Marquez	3	
5.	The Awakening Age - Ben Okri	1	6×1
6.	Soft Storm – Abhi Subedi	1	
7.	Knowledge and Wisdom - Bertrand Russell	2	6×2
8.	Humility - Yuval Noah Harari	2	
9.	Human Rights and the Age of Inequality - Samuel Moyn	2	
Total		20	32

Any four questions out of five groups should be attempted from literature.

Engineering Mathematics I
EG 1103 SH

Year: I
Semester: I

Total: 6 hours /week
Lecture: 4 hour/week
Tutorial: 2 hours/week
Practical: hours/week
Lab: hours/week

Course Description:

This course consists of five units namely: Set and Function, Trigonometry, Calculus, Algebra, Coordinate Geometry; which are basically necessary to develop mathematical knowledge and helpful for understanding as well as practicing their skills in the related engineering fields.

Course Objectives:

On completion of this course, students will be able to understand the concept of the following topics and apply them in the related fields of different engineering areas:

- Ideas of real number system and functional relation between parameters
- Trigonometric equations, inverse circular functions and properties of triangles
- Progressions, permutations and combinations, binomial theorem, exponential and logarithmic series
- Straight lines, pair of lines and circle, Limit and continuity, derivatives and anti-derivatives

Course Contents:

Unit 1: Set, Functions and Graphs **[7 Hrs.]**

- Cardinality of set, Power set, Properties of set algebra, De Morgan's laws,
- Real number systems, intervals and absolute value
- Relations and Functions, idea of domain and range
- Types of functions, exponential and logarithmic functions with their graphs

Unit 2: Trigonometry **[11 Hrs.]**

2.1. Revision: Basic trigonometric formulae, Identities and conditional identities, Height and distance

2.2. Trigonometric Equations and Inverse Circular Functions

- General solutions of the equations of type $\sin x = k$, $\cos x = k$ and $\tan x = k$
- Formulae involving inverse circular functions
- Simple identities and equations involving circular functions

2.3. Properties of Triangles

- The Sine, Cosine and projection laws (with proofs)
- The half angle formulae, Tangent laws and area of a triangle (without proofs)
- Simple cases on solution of triangles

Unit 3: Calculus **[18 Hrs.]**

3.1. Limit and Continuity

- Limit of functions, Indeterminate forms (only $\frac{0}{0}$, $\frac{\infty}{\infty}$ and $\infty - \infty$)
- Algebraic properties of limits (without proof)

- Theorems on limits (without proof)
 - Continuity and discontinuity of function, types of discontinuity
- 3.2. Derivatives**
- Definition, geometrical and physical meanings of derivative
 - Derivatives from definition of simple functions like:
 $x^n, (ax+b)^n, \sin(ax+b), e^{ax}, a^x$ and $\log x$
 - Rules of derivatives (sum, difference, product, quotient and chain rules)
 - Derivatives of trigonometric, parametric and implicit functions
 - Higher order derivatives
- 3.3. Integration**
- Definition and notation, Basic rules of integration
 - Fundamental integrals and Integration by substitution
 - Integration by parts and Definite integrals

Unit 4: Algebra

[12 Hrs.]

4.1. Progressions

- Arithmetic, Geometric and Harmonic Progressions
- Sum of infinite geometric series, Sum of First natural numbers
- Sum of squares and cubes of First n natural numbers (without proof)

4.2. Permutations and Combinations

- Principle of counting, Types of Permutation
- Combination and its properties (without proof)

4.3. The Binomial Theorem

- Binomial theorem (without proof)
- Expansion of binomial expressions, general terms, middle terms and terms free from variables
- Expansion of binomial expression for any index
- Expansion of exponential and logarithmic functions (without proof)

Unit 5: Coordinate Geometry

[12 Hrs.]

5.1. Straight Lines

- Three standard forms of a line, general form: $ax + by + c = 0$, the line through the intersection of two lines, the concurrency of lines, area of triangle
- Angle between two lines, bisector of angle between two lines
- and length of perpendicular from a point on a line

5.2. Pair of Lines

- Homogeneous equation of second degree
- General equation of second degree representing two lines
- Angle between a pair of lines and bisectors of the angles for a line pair (without proof)
- Condition for general equation of second degree to represent a line pair (without proof)
- Lines joining the origin to the points of intersection of a curve and a line

5.3. The Circle

- Standard and central forms
- General and Diameter forms (without proof)
- Tangent and normal to the circle
- Condition of tangency of a straight line to a circle (without proof)

Tutorial	[30 Hrs.]
1. Set, function and graphs	[2 Hrs.]
2. Trigonometry	[5 Hrs.]
• Trigonometric Equations and Inverse Circular Functions	[2 Hrs.]
• Properties of Triangles	[3 Hrs.]
3. Calculus	[10 Hrs.]
• Limit and Continuity	[2 Hrs.]
• Derivatives	[4 Hrs.]
• Integration	[4 Hrs.]
4. Algebra	[7 Hrs.]
• Progressions	[2 Hrs.]
• Permutations and Combinations	[2 Hrs.]
• The Binomial Theorem	[3 Hrs.]
5. Coordinate Geometry [6 Hrs.]	
• Straight Lines	[2 Hrs.]
• Pair of Lines	[2 Hrs.]
• The Circle	[2 Hrs.]

Evaluation Scheme

Unit wise Marks division for Final

S. N.	Units	Short questions (2 marks)	Long questions (4 marks)	Total Marks
1	Set, function and graphs	2x2=4	1x4=4	8
2	Trigonometry	3x2=6	2x4=8	14
3	Calculus	4 x 2 = 8	4 x 4 = 16	24
4	Algebra	3 x 2 = 6	3 x 4 = 12	18
5	Coordinate Geometry	2 x 2 = 4	3 x 4 = 12	16
		14 x 2 = 28	13 x 4 = 52	80

Reference Books

1. Thapa et al., Engineering Mathematics (Volume I, Three Years Diploma), Sukunda Pustak Bhawan, Bhotahity, Kathmandu, Nepal
2. Bajracharya et al., Basic Mathematics (Grade XI/XII), Sukunda Pustak Bhawan, Bhotahity, Kathmandu, Nepal
3. Nath et al., Engineering Mathematics I, Vidhyarthi Publisher and distributors, Bhotahity, Kathmandu, Nepal
4. Other references selected by the related lecturer(s) from among the texts available in the market that meet the content of this subject.

Engineering Physics I EG 1104 SH

Year: I
Semester: I

Total: 8 hours /week
Lecture: 4 hour/week
Tutorial: 2 hours/week
Practical: hours/week
Lab: 2 hours/week

Course Description

This course in physics is designed to provide students with an understanding of the scientific laws of our physical world, and how physics contributes to life's activities in modern society. The course emphasizes both quantitative and qualitative aspects of physics, involving mathematical models and equations. The application of physics to social and environmental situations is well illustrated.

The practical component of this course is designed to supplement learning through the application of learned theory. The students will handle simple apparatus to do simple measurements, demonstrate simple electrical circuits, and apply their knowledge of physics to real life examples.

Course Objectives

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

- Sustain interest in physics and its applications related to everyday experiences of their life
- Identify the social, economic, environmental and other implications of physics
- Describe physics as a coherent and developing framework of knowledge based on fundamental theories of the structures and processes of the physical world
- Demonstrate the skills of experimenting, observing, interpreting data and evaluating evidence to formulate generalizations and models
- Apply knowledge of physical principles to familiar and unfamiliar situations
- Apply facts, vocabulary and conventions to unit measurements and common measuring instruments
- Explain the definitions, laws, concepts, theories and models presented in this course.
- Describe the applications and implications of physical facts and principles.
- Explain the basic concept of Physics relevant to problems for the understanding and practicing related in engineering works.

Course content

Unit 1: Mechanics

[22 Hrs.]

Sub-Unit 1.1: Units and Measurement

[2 Hrs.]

- Physical concept of mass, length and time.
- Various systems of units and their conversion
- Derived units in terms of fundamental units.
- Precise and accurate measurement
- Dimensional formula for various physical quantities.
- Applications of dimensional equations.
- Simple Numerical Problems

Sub-unit 1.2: Scalars and Vectors

[3 Hrs.]

- Scalars and vectors with examples.
- Resolution of a vector.

- Triangle and parallelogram law of vectors
 - Multiplication of vectors
 - Simple Numerical Problems
- Sub unit 1.3: Kinematics** **[2 Hrs.]**
- Revision of equations of motion
 - Projectile motion
 - Concepts of relative velocity
 - Simple Numerical Problems
- Sub-unit 1.4: Newton's Laws of motion** **[2 Hrs.]**
- Newton's first, second and third laws of motion.
 - Principle of conservation of linear momentum.
 - Applications of inertia and impulse.
 - Laws of solid friction, angle of friction and angle of repose
 - Simple Numerical Problems
- Sub unit1.5: Uniform circular Motion** **[3 Hrs.]**
- Angular displacement and velocity
 - Derivation of the relation $v = \omega r$.
 - Vector nature of velocity and change the direction of velocity in circular motion.
 - Derivation of centripetal acceleration and force.
 - Motion of a body in a vertical circle.
 - Motion of cyclist and motion of vehicle in banked road
 - Simple numerical problems
- Sub-unit 1.6: Work, Energy and power** **[3 Hrs.]**
- Definition and units of work, energy and power and its meaning in Physics
 - Potential and kinetic energy.
 - Work energy theorem.
 - Conservation of energy i.e. change of KE into PE giving example of freely falling body.
 - Transformation of energy into different forms.
 - Conservative and non-conservative forces.
 - Simple numerical problems.
- Sub-unit 1.7: Gravity and Gravitation** **[3 Hrs.]**
- Newton's law of gravitation.
 - Acceleration due to gravity and its variation due to height, depth and latitude
 - Motion of satellites: Escape velocity, orbital velocity, geostationary satellite
 - Weightlessness condition in a lift
 - Simple numerical problems
- Sub unit 1.8: Simple Harmonic Motion** **[2 Hrs.]**
- Simple harmonic motion and its characteristics
 - Time period, frequency, amplitude of simple harmonic motion
 - Speed and acceleration in simple harmonic motion
 - Energy of simple harmonic motion
 - Simple pendulum and its time period
 - Simple numerical problems
- Sub unit 1.9: Rotation of Rigid bodies** **[2 Hrs.]**
- Forces in equilibrium, center of gravity, center of mass
 - Torque, work done by torque, couple
 - Moment of inertia

- Angular momentum and its conservation
- Simple numerical problems

Unit 2: Heat and Thermodynamics [18 Hrs.]

Sub unit 2.1: Heat phenomena and Quantity of heat [3 Hrs.]

- Concepts of temperature and thermal equilibrium
- Different scales of temperature and their relations
- Quantity of heat gain and heat loss
- Specific heat capacity and its determination by method of mixture
- Newton's laws of cooling and its explanation
- Simple Numerical Problems

Sub unit 2.2: Change of Phase and Hygrometry [2 Hrs.]

- States of matter, fusion, vaporization, evaporation and boiling
- Determination of specific latent heat of fusion and vaporization
- Saturated and unsaturated vapors
- Variation of melting and boiling points with pressure
- Triple point, dew point and humidity
- Simple Numerical Problem

Sub unit 2.3: Thermal Expansion [3 Hrs.]

- Coefficients of linear, superficial and cubical expansion of a solid and relation between them
- Real and apparent expansions of liquids and their relation
- Variation of density due to change in temperature
- Simple Numerical Problems

Sub unit 2.4: Transfer of Heat [2 Hrs.]

- Methods of heat transfer
- Thermal conduction, conductivity and determination of thermal conductivity
- Radiation
- Black body and its practical realization
- Stefan's law of black body radiation
- Simple Numerical Problems

Sub unit 2.5: Gas Laws and Kinetic Theory of Gas [3 Hrs.]

- Boyle's law, Charle's law and ideal gas equations
- Universal gas constant, Avogadro's number and Boltzmann's constant
- Volume and pressure coefficients of ideal gas
- Pressure exerted by ideal gas according to kinetic theory
- RMS speed and mean energy of a molecule of an ideal gas
- Simple Numerical Problems

Sub units 2.6: Thermodynamics [5 Hrs.]

- First law of thermodynamics
- Thermodynamic processes: Isothermal, adiabatic, isobaric and isochoric
- Equation of adiabatic process.
- Work done in isothermal and adiabatic process.
- Specific and molar heat capacities at constant pressure and constant volume with their relation
- Second law of thermodynamics, working of ideal engine and refrigerator
- Simple Numerical Problems

Unit 3: Optics	[12 Hrs.]
Sub unit 3.1: Reflection by plane surface	[2 Hrs.]
<ul style="list-style-type: none"> • Laws of reflection • Deviation produced by plane mirror • Effect on reflected ray due to rotation of mirror • Minimum size of mirror to see full image of a person. • Real and virtual images 	
Sub unit 3.2: Reflection by spherical surfaces	[2 Hrs.]
<ul style="list-style-type: none"> • Reflection by concave and convex mirrors • Formation of image by concave and convex mirrors • Derivation of mirror formula for concave and convex mirrors • Uses of spherical mirrors • Simple numerical Problems 	
Sub unit 3.3: Refraction through Plane Surfaces	[3 Hrs.]
<ul style="list-style-type: none"> • Laws of refraction of light • Speed of light in different media • Principle of reversibility of light • Lateral Shift • Real and apparent depths • Total internal reflection and critical angle • Simple Numerical Problems 	
Sub unit 3.4: Refraction through Prism and Lenses	[5 Hrs.]
<ul style="list-style-type: none"> • Deviation through prism and minimum deviation • Refraction through lenses • Formation of images by lenses • Lens formula and lens maker's formula • Combination of two thin lenses • Power and magnification of lenses • Uses of lenses in compound microscope and Astronomical telescope • Simple Numerical Problems 	
Unit 4: Magnetism	[8 Hrs.]
Sub unit 4.1: Magnets and magnetic fields	[3 Hrs.]
<ul style="list-style-type: none"> • Magnetic poles, magnetic moments, magnetic axis, magnetic meridian, real and effective length of magnet • Magnetic field, magnetic lines of force, Coulomb's law in magnetism • Magnetic field intensity on axial and equatorial line due to magnetic poles of bar magnet • Neutral points and Tangent's law • Simple Numerical Problems 	
Sub unit 4.2: Terrestrial Magnetism	[2 Hrs.]
<ul style="list-style-type: none"> • Horizontal and vertical components of earth's magnetic field • Angle of declination and angle of dip • Total intensity of earth's magnetic fields • Simple Numerical Problems 	
Sub unit 4.3: Magnetic Properties of Materials	[3 Hrs.]
<ul style="list-style-type: none"> • Molecular and modern theory of magnetism • Dia, Para and Ferromagnetic materials 	

- Permeability, susceptibility and intensity of magnetization
- Domain theory of ferromagnetism
- Magnetic Hysteresis

Tutorial:

The instructors should practice the numerical problems of following topics as indicated by credit hours.

S. N.	Units	Sub Units	Credit Hrs.	
1	Mechanics	Units and Measurements	1	13
		Scalars and Vectors	1	
		Kinematics	2	
		Newton's Law of Motion	2	
		Works, Energy and Power		
		Gravity and Gravitation	1	
		Uniform Circular Motions	1	
		Simple Harmonic Motion	2	
		Rotation of Rigid Bodies		
		Heat phenomena and quantity of heat	2	
		Change of State and Hygrometry	1	
2	Heat and Thermo Dynamics	Thermal Expansion	2	10
		Transfer of Heat	2	
		Gas Laws and Kinetic theory of Gas		
		Thermodynamics	1	
		Reflection through Plane Surface	2	
		Reflection through Spherical Surface	2	
		Refraction through Plane Surface	1	
3	Optics	Refraction through prism and lenses	-	4
		Magnet and Magnetic Fields	1	
		Terrestrial Magnetism	1	
		Magnetic properties of Materials	2	
4	Magnetism	Permeability, susceptibility and intensity of magnetization	2	3
		Magnetic Hysteresis	1	
Total credit hour			30	

Engineering Physics Practical I

[30 Hrs.]

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

Prescribed Books

1. Engineering Physics –I, 5th edition, Devkota Binaya, Poudyal Khem Nath, Poudyal Dhan Prasad, Gupta Suresh Prasad, Laxmi publication Kathmandu.
2. Advanced level physics by Nelkon and Parker, 5th and later editions
3. College physics by sears, Zemansky and Young, Fourth and later editions
4. Physics practical by S.K. Neupane

Learning materials:

1. Reference to be selected by the related lecture(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.

Evaluation Scheme

There will be questions covering all the chapters in the syllabus. The evaluation scheme for the questions will be as indicated as in the table below.

S. N.	Units	Sub Units	Credit Hrs.	Total marks			
1	Mechanics	Unit and Measurement	2	9	8		
		Scalars and Vectors	3				
		Kinematics	2				
		Newton's Law of Motion	2				
				Works, Energy and Power	3	13	16
				Gravity and Gravitation	3		
				Uniform Circular Motions	3		
				Simple Harmonic Motion	2		
				Rotation of Rigid Bodies	2		
2	Heat and Thermal Dynamics	Heat phenomena and quantity of heat	3	18	16		
		Change of State and Hygrometry	2				
		Thermal Expansion	3				
		Transfer of Heat	2				
		Gas Laws and Kinetic theory of Gas	3				
		Thermodynamics	5				
3	Optics	Reflection through Plane Surface	2	12	12		
		Reflection through Spherical Surface	2				
		Refraction through Plane Surface	3				
		Refraction through prism and lenses	5				
4	Magnetism	Magnets and Magnetic Fields	3	8	8		
		Terrestrial Magnetism	2				
		Magnetic properties of Materials	3				
Total credit hour			60	60	60		

Engineering Chemistry-I
EG 1105 SH

Year: I
Semester: I

Total: 8 hours /week
Lecture: 4 hour/week
Tutorial: 2 hours/week
Practical: hours/week
Lab: 2 hours/week

Course Description:

This subject consists of three units related to language of chemistry, general chemistry and system of classification.

Course Objectives:

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

- Develop a basic knowledge and concept of chemical reactions.
- Solve simple numerical problems related on atomic weight, molecular weight, mole concept.
- Explain the different theories of acid and base and to know the concept of pH and buffer solution.
- Know about atomic structure, periodic table and chemical bonding.
- Prepare different concentration of solution and solve simple numerical problem.
- Describe the laws of electrolysis and solve related numerical problems.
- Explain the basic concept of Chemistry relevant to problems for the understanding and practicing related in engineering works.

Course Content

Unit 1: Language of Chemistry	[8 Hrs.]
1.1. Symbol	[1 Hr.]
<ul style="list-style-type: none">• Introduction• Definition• Name and symbol of elements up to atomic number 30• Concept of symbol which were derived from Latin or other languages such as Potassium, sodium, iron, copper, gold, lead, mercury, silver, and tin etc.• Significances of symbol (qualitative and quantitative)	
1.2. Formula, valency and radicals	[2 Hrs.]
<ul style="list-style-type: none">• Introduction• Definition of molecular formula & Structural formula• Qualitative and quantitative significances of molecular formula• Concept of valency in terms of combining capacity with H₂, O₂ and Cl₂• Variable valency (ref Fe, Sn, Cu, Pb, Hg, S, N)• Radicals<ul style="list-style-type: none">– classify the radicals as electro- positive and electro – negative with examples– concept of simple, compound and complex radicals• Methods of writing the molecular formula	
1.3. Chemical equation	[5 Hrs.]
<ul style="list-style-type: none">• Introduction• Essentials of chemical equation	

- Significance of chemical equation (qualitative and quantitative)
- Limitation of chemical equation
- Making the chemical equation more informative
- Balancing chemical equation by
 - hit and trial method
 - partial equation method (ref. reaction involving HNO_3 , MnO_2 , KMnO_4 , $\text{K}_2\text{Cr}_2\text{O}_7$ etc.)
- Types of chemical reaction:
 - combination, decomposition, displacement, double displacement, acid base, hydrolysis, polymerization
- Conditions of bringing about chemical reactions

Unit 2: General Chemistry **[16 Hrs.]**

2.1. Atom and molecule **[2 Hrs.]**

- Definition
- Postulates of Dalton's atomic theory
- Modern position of the theory
- Limitations of Dalton's atomic theory

2.2. Atomic weight **[4 Hrs.]**

- Introduction
- Definition
- Atomic weight of an element
- Atomic mass unit
- Gram atomic mass unit
- Concept of fractional atomic mass unit (ref giving example of chlorine)
- Dulong and Petit's method and its limitations
- Steps involved for the determination of atomic weight by Dulong and petit's method
- Solving related simple numerical problems

2.3. Molecular weight **[4 Hrs.]**

- Introduction
- Definition of molecular weight of an elements or compounds
- Gram molecular weight
- Concept of Avogadro's hypothesis
- Application of Avogadro's hypothesis:
 - determination of atomicity of an elementary gas like H_2 , Cl_2 , O_2 , and N_2
 - determination of relationship between molecular Weight & Vapour density
 - determination of gram molecular volume of all gases is equal to 22.4 litres at NTP
 - determination of gram molecular weight of any gas contains same no of molecules
- Avogadro's number
- Determination of molecular weight by Victor Meyer's method
- Solving related simple numerical problems

2.4. Equivalent weight **[4 Hrs.]**

- Introduction
- Definition of equivalent weight of element, acid, base and salt
- Gram equivalent weight
- Relation between equivalent weight, atomic weight and valency

- Determination of equivalent weight of metals by
 - by hydrogen displacement method
 - by direct and indirect oxide method
 - Solving related simple numerical problems
- 2.5. Simple mole concept** **[2 Hrs.]**
- Introduction
 - mole of an atom, mole of a molecule, molar volume
 - Solving related simple numerical problems
- Unit 3: System of Classification** **[36 Hrs.]**
- 3.1. Acids, Bases and Salts** **[5 Hrs.]**
- Introduction
 - Characteristics of acid and base
 - Arrhenius concept of acid and base and its limitations
 - Lowry and Bronsted concept of acid and base and its limitations
 - Conjugate acid and base pair
 - Amphoteric nature of water
 - Lewis concept of acid and base and its limitations
 - Salt
 - Types of salts (normal, acidic and basic)
 - pH and POH and its mathematical expression
 - pH scale
 - prove that $\text{pH} + \text{pOH} = 14$
 - Simple numerical problem on pH
 - Buffer solution with examples and its types (No buffer mechanism is required)
- 3.2. Volumetric analysis** **[5 Hrs.]**
- Introduction
 - Titration, acidimetry and alkalimetry
 - Indicator and their colour and selection of indicators in acidic and basic medium
 - End point
 - Standard solution, unknown solution, normal solution
 - Preparation of normal solution, decimolar solution, molar solution
 - Normality factor
 - Different ways of expressing the concentration of solution:
 - normality, molarity, gram per litre and percentage
 - Concept primary standard substance and secondary standard substances
 - Primary standard solution and secondary standard solution
 - Volumetric equation
 - Solving related simple numerical problems
- 3.3. Electronic theory of valency** **[4 Hrs.]**
- Introduction
 - Valence electron and valence shell, core electron, inert gas
 - Concept of lewis dot symbol
 - Octet rule
 - Basic assumptions of electronic theory of valency
 - Chemical bond
 - Types of chemical bond

- Definition of electrovalent bond (ionic bond), electrovalency and electrovalent compounds (ionic compound) and electrovalent compounds like NaCl, MgO, CaS, MgCl₂ etc. with electron dot structure showing the formation of electrovalent compounds
- General properties of ionic compounds
- Definition of covalent bond, covalency and covalent compounds and covalent compounds H₂, Cl₂, O₂, N₂, CH₄, H₂O, NH₃, CO₂, CH₄, C₂H₂ etc. with electrons dot structure showing the formation of covalent compounds
- General properties of covalent compounds
- Definition of coordinate covalent bond (dative bond), coordinate covalency and coordinate covalent compounds and coordinate covalent compounds like SO₂, SO₃, NH₄⁺, H₂SO₄, NaNO₃, CaCO₃, Na₂CO₃, Na₂SO₄ etc. with electron dot structure to represent the formation of coordinate covalent compounds
- General properties of coordinate covalent compounds

3.4. Electrolysis

[6 Hrs.]

- Introduction
- Definition
- Electrolytes
- Types of electrolytes:
 - weak and strong and non-electrolytes
- Faraday laws of electrolysis
- Faraday
- Relation between Faraday, chemical equivalent and electrochemical equivalent
- Application of electrolysis
- Solving related simple numerical problems
 - Corrosion
 - Types of corrosion (chemical corrosion, bio-corrosion, electrochemical corrosion)
 - Rusting of iron (no explanation required the theory of rusting)
 - Prevention of corrosion
 - Electrochemical series
 - Introduction
 - Applications of electrochemical series

3.5. Periodic table

[4 Hrs.]

- Introduction
- Mendeleev's periodic table(law)
 - Main features of Mendeleev's periodic table (Explanation of short and long periods, groups, sub groups, zero group, VIII group)
 - Advantages of Mendeleev's periodic table (Systematic study of elements, prediction of new elements and correction of doubtful atomic weight)
 - Anomalies of Mendeleev's periodic table (position of hydrogen, position of isotopes, position of anomalous pair of elements, position of lanthanides and actinides, separation of similar elements and grouping of dissimilar elements)
- Modern periodic table(law)
 - Advantages of Modern periodic table (Position of hydrogen, position of isotopes, position of anomalous pair of elements)

3.6. Oxidation and reduction

[6 Hrs.]

- Introduction

- Classical and electronic concept of oxidation and reduction
- Classical and electronic concept of oxidizing agent (oxidant) e.g. O₂, O₃, halogens, HNO₃, MnO₂, K₂Cr₂O₇, KMnO₄ etc. and reducing agent (reductants) eg. H₂, HBr, HI, H₂S etc.
- Redox reaction (concept of split into oxidation half and reduction half)
- Oxidation and reduction go side by side
- Oxidation number
- General rule for assigning oxidation number
- Methods of calculation the oxidation number of an atom in a compound
- Oxidation and reduction in terms of oxidation number
- Auto-oxidation eg. H₂O₂, HNO₂, SO₂
- Balancing of simple chemical equation by oxidation number method

3.7. Atomic structure

[6 Hrs.]

- Introduction
- Concept subatomic particles like electron, proton and neutron concerning their charge, mass and location in atom (no explanation of cathode ray experiment is required)
- Rutherford's α - rays scattering experiment and its observations
- Rutherford's atomic model and its drawbacks
- Postulates of Bohr's atomic model
- Atomic number and mass number
- Isotopes, isobars and isotones
- Bohr - Bury Scheme
- Aufbau principle
- Electronic Configuration of atoms (atomic number 1-30)
- Hund's rule of maximum multiplicity
- Quantum number and its types (principal, azimuthal, magnetic and spin)
- Pauli's exclusion principle

Tutorial

Unit 1: Practice on writing the significances of symbol, molecular formula, chemical equation, balancing of chemical equation by hit and trial and partial methods.

[4 Hrs.]

Unit 2: Practice on application of Avogadro's hypothesis, relation between atomic weight, equivalent and valency, Solve numerical problem on atomic weight, molecular weight, equivalent weight and mole concept.

[8 Hrs.]

Unit 3: Practice on different theories of acid, base, types of salt, pH and pOH value, preparation of different types of solution, Faradays laws of electrolysis, different types of chemical bond and their electron dot structure, Mendeleev's periodic table and modern periodic table, different concept of oxidation and reduction, balancing of chemical equation by oxidation number method, Rutherford's and Bohr's atomic model, electronic configuration of atoms, solve numerical problem on pH, volumetric analysis, electrolysis

[18 Hrs.]

Evaluation Scheme

There will be questions covering all the chapters in the syllabus. The evaluation scheme for the questions will be as indicated as in the table below.

Unit	Chapter	Hours	Marks distribution
1	Symbol, formula, valency and radicals	3	4
	Chemical equation	5	4
2	Atom, molecule, Atomic weight	6	4
	Molecular weight	4	4
	Equivalent weight, mole concept	6	8
3	Acid, Base and salts	5	4
	Volumetric analysis	5	4
	Electronic theory of valency	4	4
	Electrolysis	6	4
	Periodic table	4	4
	Oxidation and reduction	6	8
	Atomic structure	6	8
	Total		60

Note: There may be minor deviation in marks distribution. Choice question can be asked from the same chapters.

Engineering Chemistry Practical I

[30hrs]

- Simple Glass Working [6hrs]
 - cut the glass tube into three equal parts and round up their shape edges
 - bore a hole through a cork
 - bend the glass tubing into acute, obtuse and right angle
 - draw a jet and capillary tube
 - fit up a wash bottle
- Neutralize dilute sulphuric acid with sodium hydroxide solution, and to recover crystals of sodium sulphate.
- Obtain pure and dry precipitate of barium sulphate by treating dilute sulphuric acid with barium chloride solution. [2hrs]
- Separate sand and copper sulphate crystals in pure and dry state from the mixture of sand and copper sulphate. [2hrs]
- Separate sand and calcium carbonate in pure and dry state from the mixture of sand and calcium carbonate. [2hrs]
- Prepare pure water from supplied impure water by distillation and to test the purity of the sample prepared. [2hrs]
- Determine the equivalent weight of reactive metal by hydrogen displacement method. [2hrs]
- Prepare primary standard solution of sodium carbonate and to use it to standardize an approximate decinormal acid solution. [2hrs]
- Standardize given unknown acid (Approx N/10) solution by preparing standard alkali solution. (Expression of strength in different ways) [2hrs]
- Standardize given unknown alkali (approximately N/10) solution with the help of by preparing standard acid solution. (Expression of strength in different ways) [2hrs]

11. Determine the pH of different unknown solution and using pH paper and universal indicator. [2hrs]
12. Investigate the composition of water by electrolysis by using Hofmann's apparatus. [2hrs]
13. Carry out conductivity experiments on solids and liquids (CuSO₄, Zn, Mg, Al, Fe, CCl₄, C₆H₆, C₂H₅OH) [2hrs]

Prescribed Books:

1. Foundations of Chemistry, Vol. 1, M.K. Sthapit and R.R. Pradhananga, Taleju Prakashan, Kathmandu
2. A Textbook of Engineering Chemistry, vol. I, Prakash Paudel, Siddhartha Publication, Kathmandu
3. Engineering Chemistry, Vol.1 M.L. Sharma, K. M. Shrestha, PN, Choudhary, Ekta Book, Kathmandu.
4. A Text book of Chemistry, Jha and Guglani, Surya publication, India
5. Fundamentals of Chemistry, K.R. Palak, Ratnapustak Bhandar, Kathmandu
6. Elementary Practical Chemistry, M.K. Sthpit, Taleju Prakashan, Kathmandu
7. Practical Engineering Chemistry for diploma level, Sumitri Bajracharya, Sabina Shrestha, Kathmandu Institute of Technology

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. The related institute may develop its own textbook and approve from the related authority so as to have a prescribed textbook of this subject.

Engineering Drawing I
EG 1101 AR

Year: I

Semester: I

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

Course description:

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

General objectives:

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

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

Course Contents:

Theory

Unit 1: Introduction of Engineering Drawing: [2 Hrs.]

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

Unit 2: Lettering, scales and dimensions: [4 Hrs.]

- 2.1. Lettering [1 Hr.]**
 - 2.1.1 Introduction of single stroke letter and their ratio between height and breadth.
 - 2.1.2 Introduction of upper- and lower-case letter.
 - 2.1.3 Introduction of Vertical and inclined (*italic*) letter (with inclined angle).
 - 2.1.4 Practical exercise of letter writing using the guide lines of vertical and italic letter, (Sheet No 2).
- 2.2. Scale [1.5 Hrs.]**
 - 2.2.1 Introductions of scale and importance
 - 2.2.2 Types of scale (full, reducing and enlarge)
 - 2.2.3 Construction of scale using the representative factor.
- 2.3. Dimensioning [1.5 Hrs.]**
 - 2.3.1 Introduction of dimensioning.
 - 2.3.2 Terminology of dimensioning i.e. Dimension line, extension line leaders line etc.
 - 2.3.3 Termination of dimension line using arrowhead, slash and dot.

- 2.3.4 Dimensioning System-Aligned system, unidirectional system and base line dimensioning.
- 2.3.5 Principles of dimensioning.
- 2.3.6 Dimensioning pictorial views and orthographic view

Unit 3: Geometrical constructions: [2 Hrs.]

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

Unit 4: Engineering Curve: [1 Hr.]

Introduction of following curves:

- 4.1 Involute
- 4.2 Spiral
- 4.3 Cycloid
- 4.4 Helices

Unit 5: Conic- Section: [1 Hr.]

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

Unit 6: Orthographic Projection:

6.1 Introduction of orthographic projection [2 Hrs.]

- 6.1.1. Theory of projection
- 6.1.2. Four quadrant, plane of projection
- 6.1.3. Introduction of co-ordinate or three-dimensional axis
- 6.1.4. System of orthographic projection
- 6.1.5. Making of orthographic view
- 6.1.6. Analysis of object and its view

6.2 Point and line projection [0.5 Hr.]

- 6.2.1. Notation system on HP, VP and PP
- 6.2.2. Location of point /line i, e. where it is and projection on plane of projection
- 6.2.3. Position of line: - Perpendicular to one plane and parallel to the other, parallel to both plane and inclined to one or both planes

6.3 Plane projection [0.5 Hr.]

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

6.4 Projection of solids

[2 Hrs.]

- 6.4.1. Orthographic projection of geometrical solid i.e. prism, cylinder and cone in simple Position. (simple position means axis- perpendicular to one plane (HP) and parallel to (VP) axis parallel to both planes)
- 6.4.2. Orthographic projection of different model or work pieces. (at least 10 to 15 model pieces)

Practical (Class work sheet)

Sheet No 1:

[6 Hrs.]

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

Sheet No 2:

[6 Hrs.]

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

Sheet No 3:

[3 Hrs.]

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

Sheet No 4:

[9 Hrs.]

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

Sheet No 5:

[6 Hrs.]

Draw:

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

Sheet No 6:**[6 Hrs.]**

Draw:

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

Sheet No 7:**[6hrs]**

Perform/draw:

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

Sheet No 8:**[3 Hrs.]**

Perform/draw:

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

Sheet No 9:**[3 Hrs.]**

Perform/draw:

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

Sheet No 10:**[12 Hrs.]**

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

References:

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

**Computer Application
EG 1101 CT**

Year: I
Semester: I

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

Course Description:

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

Course Objectives:

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

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

Course Contents:

Theory

Unit 1	Introduction to Computers: 1.1 History of computers 1.2 Generation and type of computers 1.3 Computer hardware and software	[2 Hrs.]
Unit 2	Hardware Components: 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: <ul style="list-style-type: none">• Magnetic storage like floppy disk, hard disk, magnetic tape etc.• Optical storage like CD-ROM, DVD• Pen drive, flash memory card etc.	[6 Hrs.]
Unit 3	Introduction to Operating System Software: 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	[6 Hrs.]

- | | |
|---|--------------|
| 6. Microsoft Access | (2 sessions) |
| a. Creating and manipulating data tables | |
| b. Query | |
| c. Forms/Reports | |
| 7. Using Multimedia and Internet/Email | (1 session) |
| 8. Creating effective presentation using Microsoft PowerPoint | (1 session) |
| 9. Project Work | (3 sessions) |

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

Textbooks:

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

References:

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

Second Semester

Subjects:

1	EG 1201 SH	Engineering Mathematics II
2	EG 1202 SH	Engineering Physics II
3	EG 1203 SH	Engineering Chemistry II
4	EG 1201 CE	Workshop Practice I
5	EG 1201 AR	Engineering Drawing II
6	EG 1202 CE	Applied Mechanics

Engineering Mathematics II
EG 1201 SH

Year: I
Semester: I

Total: 6 hours /week
Lecture: 4 hour/week
Tutorial: 2 hours/week
Practical: hours/week
Lab: hours/week

Course Description:

This course consists of five units namely: Algebra, Conic sections, Geometry, Vectors, Statistics and Probability; which are basically necessary to develop mathematical knowledge and helpful for understanding as well as practicing their skills in the related engineering fields.

Course Objectives:

On completion of this course, students will be able to understand the concept of the following topics and apply them in the related fields of different engineering areas

- Ideas of algebraic relations between variables, complex number system, Matrices and determinants, linear equations and inequalities, linear programming
- Two- and three-dimensional geometry, Vectors and their products
- Statistics and Probability

Unit 1: Algebra

[18 Hrs.]

1.1 Polynomial equations

Quadratic equations, nature and relation between two roots, formation of quadratic equation, condition of common roots

1.2 Complex numbers

Definition, algebra, geometric representation, modulus, conjugate of complex numbers, square root, polar form, product and quotient of complex numbers, De Moivre's theorem and its applications to find the roots of complex numbers, properties of cube root of unity

1.3 Matrices and Determinants

Definitions, orders, types, algebraic operations, transpose of matrices and their properties without proofs. Definition, expansion and properties of determinants (without proofs), inverse of matrix

1.4 Solution of system of linear equations

Cramer's rule, inverse matrix method, row equivalent method

1.5 Linear inequalities and graphs up to two variables

1.6 Linear programming by graphical method

Unit 2: Conic Sections

[6 Hrs.]

2.1 Parabola

- Standard equation of parabola
- Equation of parabola vertex at any point (without proof)
- General equation (simple problems to find vertex, focus and equation of directrix)

2.2 Ellipse and Hyperbola

- Standard equation of ellipse and hyperbola (without proof)
- Equation of ellipse and hyperbola center at any point (without proof)
- Center, vertex, foci, directories of ellipse and hyperbola

Unit 3: Geometry **8hrs**

3.1 Coordinate in Space

- Rectangular Cartesian co-ordinates
- Distance and section formulas (without proofs)
- Direction cosine and ratio of a line, Projections
- Angle between two lines

3.2 Planes

- General equation of plane (without proofs)
- Equation of plane in intercept and normal forms (without proofs)
- Equation of plane through a point
- Angle of between two planes
- Length of perpendicular from a point on a plane

Unit 4: Vectors **10hrs**

4.1 Definitions and Algebra of Vectors

- Definitions, notations and representations of vectors
- Modulus and direction cosines of a vector
- Algebra of vectors, Types of vectors
- Linear dependent and independent vectors, Coplanar vectors

4.2 Product of Two Vectors

- Scalar product of two vectors, geometrical meaning, properties and angle between two vectors without proofs, simple applications in plane trigonometry
- Vector product of two vectors, geometrical meaning, properties and angle between two vectors without proofs, determinant form of vector product, simple applications in plane trigonometry, vector equation of a straight line

Unit 5: Statistics and Probability **[18 Hrs.]**

5.1 Statistics

- Revision: measures of central tendency (Mean, median, mode, quartiles, deciles and percentiles)
- Measure of dispersion (Range, mean deviation, quartile deviation and standard deviation)
- Skewness, Correlation (Karl Pearson's method), Regression analysis

5.2 Probability

- Basic terms of probability theory
- Concept of mutually exclusive events
- Definitions and basic laws of probability (without proofs)
- Probability in terms permutation and combination

5.3 Theoretical Probability Distributions

- Random and discrete random variables
- Binomial and normal distributions

Tutorial

1. Algebra

- Polynomial equations [2 Hrs.]
- Complex numbers [3 Hrs.]
- Matrices and Determinants [4 Hrs.]
- Solution of system of linear equations [2 Hrs.]
- Linear inequalities and graphs up to two variables and linear programming by graphical method [1Hr]

2. Conic Sections	[3 Hrs.]
• Parabola	[2 Hrs.]
• Ellipse and Hyperbola	[1 Hrs.]
3. Geometry	[4 Hrs.]
• Coordinate in Space	[2 Hrs.]
• Planes	[2 Hrs.]
4. Vectors	[5 Hrs.]
• Definitions and Algebra of Vectors	[2 Hrs.]
• Product of Two Vectors	[3 Hrs.]
5. Statistics and Probability	[6 Hrs.]
• Statistics	[3 Hrs.]
• Probability	[2 Hrs.]
• Theoretical Probability Distributions	[1 Hrs.]

Evaluation Scheme

Unit wise Marks division for Final

S. No.	Units	Short questions (2 marks)	Long questions (4 marks)	Total Marks
1	Algebra	4 x 2 = 8	4 x 4 = 16	24
2	Conic Sections	2 x 2 = 4	2 x 4 = 8	12
3	Geometry	2 x 2 = 4	2 x 4 = 8	12
4	Vectors	3 x 2 = 6	2 x 4 = 8	14
5	Statistics and Probability	3 x 2 = 6	3 x 4 = 12	18
		14 x 2 = 28	13 x 4 = 52	80

Reference Books

1. Thapa G. B. et al., Engineering Mathematics (Volume II, Three Years Diploma), Sukunda Pustak Bhawan, Bhotahity, Kathmandu, Nepal
2. Bajracharya D. R. et al., Basic Mathematics (Grade XI/XII), Sukunda Pustak Bhawan, Bhotahity, Kathmandu, Nepal
3. Bajracharya B. C., Mathematics and Statistics for Economics, M K publishers and distributors, Bhotahity, Kathmandu, Nepal
4. A Text book of Statistics – B.C. Bajracharya
5. Elementary Statistics – H. C. Saxena
6. Nath et al., Engineering Mathematics II, Vidhyarthi Publisher and distributors, Bhotahity, Kathmandu, Nepal
7. Other references selected by the related lecturer(s) from among the texts available in the market that meet the content of this subject.

Engineering Physics II
EG 1202 SH

Year: I
Semester: II

Total: 8 hours /week
Lecture: 4 hour/week
Tutorial: 2 hours/week
Practical: hours/week
Lab: 2 hours/week

Course Description

This course in physics is designed to provide students with an understanding of the scientific laws of our physical world, and how physics contributes to life's activities in modern society. The course emphasizes both quantitative and qualitative aspects of physics, involving mathematical models and equations. The application of physics to social and environmental situations is well illustrated.

The practical component of this course is designed to supplement learning through the application of learned theory. The students will handle simple apparatus to do simple measurements, demonstrate simple electrical circuits, and apply their knowledge of physics to real life examples.

Course objectives

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

- Sustain interest in physics and its applications related to everyday experiences of their life
- Identify the social, economic, environmental and other implications of physics
- Describe physics as a coherent and developing framework of knowledge based on fundamental theories of the structures and processes of the physical world
- Demonstrate the skills of experimenting, observing, interpreting data and evaluating evidence to formulate generalizations and models
- Apply knowledge of physical principles to familiar and unfamiliar situations
- Apply facts, vocabulary and conventions to unit measurements and common measuring instruments
- Explain the definitions, laws, concepts, theories and models presented in this course.
- Describe the applications and implications of physical facts and principles.
- Explain the basic concept of Physics relevant to problems for the understanding and practicing related in engineering works.

Course Contents

Theory

Unit 1: Electrostatics, Current and Electromagnetism **[20hrs]**

Sub-Unit 1.1: Electrostatics and capacitors **4hrs]**

- Elementary charges, charging by induction
- Faraday's Ice-pail experiment, electric field, lines of force
- Coulomb's law, intensity of electric field
- Electrostatic potential, equipotential surfaces, action of points
- Capacitors, types of capacitors
- Grouping of capacitors, action of dielectrics

- Simple Numerical Problems
- Sub-unit 1.2: Current Electricity** **[7 Hrs.]**
- D.C. current, strength of current
 - Potential difference across a conductor
 - Ohm' law and its verification
 - Resistance and resistivity
 - Connection of resistances
 - Galvanometer and its conversion into ammeter and voltmeter
 - Potentiometer and its use to measure emf
 - Wheat stone bridge
 - Kirchhoff's laws and their uses in simple circuits
 - Joule's law of heating
 - The rate of heating from the concept of p.d.
 - See- beck effect, Peltier effect, Thomson effect
 - Simple Numerical Problems
- Sub- unit 1.3: Magnetic effect of current and electromagnetism** **[6 Hrs.]**
- Magnetic forced and magnetic field of current
 - Force experienced by a charge moving in magnetic field
 - Force acting of current carrying conductor
 - Statement of Biot - Savart's law
 - Magnetic field due a long straight conductor and due to a circular coil
 - Force acting between two current carrying parallel conductors
 - Application of Ampere's law to calculate magnetic field due to a solenoid
 - Faraday's laws of electromagnetic induction
 - Lenz's law
 - Self- induction and mutual induction in coils
 - Working of transformer
 - Simple Numerical Problems
- Sub- unit 1.4: Alternating current** **[3 Hrs.]**
- Generation of A.C. by A.C. generator
 - Instantaneous and effective values of current and voltage
 - Relation between voltage and current in R and L circuit
 - Phase between current and voltage
 - Resonance and power in A.C. circuit
 - Simple Numerical Problems
- Unit 2: Waves and optics** **[13 Hrs.]**
- Sub- unit 2.1: Wave motion** **[3 Hrs.]**
- Wave motion and its type
 - Characteristics of wave motion
 - Wavelength, frequency and speed of waves
 - Velocity of waves in different media
 - Simple Numerical Problems
- Sub- unit 2.2: Sound waves** **[5 Hrs.]**
- Reflection, refraction, diffraction, interference
 - Beats and beat frequency
 - Determination of beat frequency
 - Progressive waves, stationary waves and their equations

<ul style="list-style-type: none"> • Waves in pipes and strings • Fundamental mode and overtones in pipes and strings • Intensity of sound, intensity level and inverse square law • Simple Numerical Problems 	
Sub-unit 2.3: Physical	[5 Hrs.]
<ul style="list-style-type: none"> • Coherent sources of light and interference • Phase difference and path difference • Young's double slit experiment • Diffraction and polarization of light • Brewster's law • Huygen's principle • Simple Numerical Problems 	
Unit 3: Properties of matter	[10 Hrs.]
Sub unit 3.1: Elasticity	[4 Hrs.]
<ul style="list-style-type: none"> • Elasticity; Hooke's law • Stress, strain, Young's modulus, Bulk modulus and shear modulus. • Energy stored in stretched string • Simple Numerical Problems 	
Sub-unit 3.2: Surface Tension	[3 Hrs.]
<ul style="list-style-type: none"> • Intermolecular attraction in liquid, surface tension • Cohesion and adhesion, angle of contact • Surface energy, capillary action • Simple Numerical Problems 	
Sub-unit 3.3: Viscosity	[3 Hrs.]
<ul style="list-style-type: none"> • streamline and turbulent flows • Idea of liquid layers, velocity gradient, coefficient of viscosity • Viscous forces, Stoke's law, terminal velocity • Simple Numerical Problems 	
Unit 4: Modern Physics	[17 Hrs.]
Sub-unit 4.1: Atomic Physics	[9 Hrs.]
<ul style="list-style-type: none"> • Motion of charged particles in electric and magnetic fields • e/m for electrons, Millikan's oil drop experiment • Photons, photoelectric effect, Stopping potential for photoelectrons • Einstein's photoelectric equation • Bohr's model for hydrogen atom • Energy level diagram and spectral series • X-rays; production, properties and applications • Introduction of Laser • Simple Numerical Problems 	
Sub-unit 4.2: Semiconductors	[5 Hrs.]
<ul style="list-style-type: none"> • Valence electrons and Energy bands in solids • Intrinsic and doped p-type, n-type semiconductors • Charge carriers in semiconductors • Acceptors, donors, p-n junction diode • Depletion layer, forward and reverse biasing • Rectifying properties of a diode 	

- Simple Numerical Problems

Sub-unit 4.3: Nuclear Physics

[3 Hrs.]

- Laws of radioactive disintegration
- Half-life, mean-life and decay constant
- Stable and radioactive nuclei
- Binding energy, nuclear fission, critical mass and nuclear fusion
- Simple Numerical Problems

Tutorial:

The instructors should practice the numerical problems of following topics as indicated by credit hours

S. N.	Units	Sub Units	Credit hours	
1	Electricity	Electrostatics and Capacitors	4	14
		Current Electricity	5	
		Magnetic effect of current and Electromagnetism	3	
		Alternating Current	2	
2	Waves	Wave motions	2	8
		Sound waves	1	
		Physical Optics	2	
		Elasticity	3	
3	Properties of Matter	Viscosity	1	5
		Surface Tension	1	
		Semi-conductors	3	
4	Modern Physics	Nuclear Physics	3	3
Total Hours			30	30

Engineering Physics Practical II

[30 Hrs.]

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 characteristics curves of npn transistor.
10. Determine unknown resistance by Wheatstone bridge method.

Learning materials:

1. Advanced level physics by Nelkon and Parker, 5th and later editions
2. College physics by sears, Zemansky and Young, Fourth and later editions

Textbooks for laboratory work:

1. Physics Practical book by S.K. Neupane.

Other learning materials:

1. Reference to be selected by the related lecture(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.

Evaluation Scheme

There will be questions covering all the chapters in the syllabus. The evaluation scheme for the questions will be as indicated as in the table below.

S. N.	Units	Sub Units	Credit hours		Total marks
1	Electricity	Electrostatics and Capacitors	7	20	12
		Current Electricity	4		
		Magnetic effect of current and Electromagnetism	6		12
		Alternating Current	3		
2	Waves	Wave motions	3	13	12
		Sound waves	5		
		Physical Optics	5		
3	Properties of Matter	Elasticity	4	10	8
		Viscosity	3		
		Surface Tension	3		
4	Modern Physics	Atomic Physics	9	17	16
		Semi-conductors	5		
		Nuclear Physics	3		
Total credit hours			60	60	60

Engineering Chemistry II
EG1203SH

Year: I
Semester: II

Total: 8 hours /week
Lecture: 4 hour/week
Tutorial: 2 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 polymers.

Course Objectives:

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

- Know about causes of hardness of water and its remedy.
- Develop the knowledge of physical and chemical properties of different materials.
- Explain about the manufacturing process of ammonia, Nitric acid and sulphuric acid.
- Know about alkali metals, alkaline earth metals and coinage metals and their properties.
- Prepare laboratory method and their properties of different compounds.
- Write IUPAC naming of organic compounds.
- Provide the student's background of basic concepts of chemistry required for understanding and practicing related in engineering works.

Course Content:

Unit 1: Non-metals and their compounds:

[30 Hrs.]

1.1 Water:

[4 hours]

- Introduction
- Sources of water
- Types of water
- Causes and types of hardness of water
- Methods of removal of temporary hardness by:
 - Boiling and Clark's methods
- Methods of removal of permanent hardness by:
 - Washing soda and permutit process and its advantages
- General concept on Water treatment for domestic and industrial purpose
 - Water for drinking purposes, water for boiler purposes, water for washing purposes
- Conditions of potable water
- Concept of amphoteric and universal solvent of water

1.2 Ammonia:

[4 Hrs.]

- Introduction
- Laboratory preparation of ammonia gas
- Manufacture of ammonia by Haber's process (ref. principle, condition for higher yield and process)
- Physical Properties
- Chemical properties:
 - Basic nature, dissociation, auto-ionization
 - Reduction reaction

- Combustion, catalytic oxidation of ammonia, oxidation of heated copper oxide
- Action with halogens(chlorine)
- Action with metals (Na Or K)
- Action with metallic salts solution like Iron, aluminum, zinc and chromium
- Formation of complex amines with the salts solutions of d block transitional elements like copper, silver, Nickel and Cobalt
- Action with Carbon dioxide
- Action with bleaching powder

- Uses

1.3 Nitric acid:

[8 Hrs.]

- Introduction
- Manufacture of nitric acid by Ostwald's process (ref. principle, process and advantages)
- Physical Properties
- Chemical properties:
 - Action of heat
 - Acidic character
 - Oxidizing character
 - action on non-metals like carbon, Sulphur, phosphorus and iodine
 - action on metalloids like arsenic and antimony
 - action on inorganic compounds like Sulphur dioxide, hydrogen sulphide and acidified ferrous sulphates
 - action on metals like Zinc, Magnesium, Iron, copper, mercury and silver
 - action on noble metals like gold and platinum (with aqua regia)
- uses
- Nitrogen cycle (explain with flow chart diagram)
- Nitrogen fixation and it occurs (natural and artificial)
- Fertilizers
 - Types of fertilizers
 - Functions of essential nutrients
 - Characteristics of fertilizers
 - Classification of chemical fertilizers (ref N,P,K and mix)
- Pollution and pollutant(introduction)
- Oxides of nitrogen and Sulphur as pollutant and acid rain

1.4 Halogens (Chlorine):

[3hrs]

- Introduction
- Laboratory preparation of chlorine
 - by applying heat
 - without application of heat
- Physical Properties
- Chemical properties:
 - action with hydrogen
 - action with water
 - action with sodium hydroxide, potassium hydroxide and calcium hydroxide
 - action with ammonia
 - oxidizing character:
 - action of chlorine in presence of water (ref Hydrogen sulphide, Sulphur dioxide, acidified ferrous sulphate)
 - action of chlorine in absence of water (ref, ferrous chloride, stannous chloride)

- Bleaching character
- Action with bromides and iodides
- Action with metals like copper, zinc, aluminum and iron
- Action with metalloids like arsenic and antimony
- Action with non-metals like Sulphur and phosphorus
- Action with organic compounds like methane and ethene

- uses

1.5 Hydrochloric acid:

[2 Hrs.]

- Introduction
- Laboratory preparation of HCl gas and aqueous HCl
- Physical Properties
- Chemical properties:
 - acidic character
 - action with ammonia
 - reducing character (action with oxidizing agents)
 - action with manganese dioxide, potassium permanganate and potassium dichromate
 - action with AgNO₃
 - formation of aqua regia
 - action with lead acetate
 - action nonmetals
 - action with air
- uses

1.6 Hydrogen sulphide:

[2 Hrs.]

- Introduction
- Laboratory preparation of hydrogen sulphide (pure and dry state)
- Physical Properties
- Chemical properties:
 - Acidic character
 - Dissociation
 - Reducing properties
 - action with ferric chloride, halogens, acidified potassium permanganate, acidified potassium dichromate, Sulphur dioxide, sulphuric acid and nitric acid
 - Action with metals
 - Action with lead acetate
 - Precipitation of metals sulphide (acidic and basic medium)
- uses

1.7 Sulphuric acid:

[4 Hrs.]

- Introduction
- Manufacture by contact process (ref principle, condition and process)
- Physical Properties
- Chemical properties:
 - action of heat
 - acidic nature
 - precipitation reaction
 - oxidizing agent (ref. nonmetals like Sulphur, carbon, phosphorus, hydrogen halide, hydrogen sulphide, metals)
 - dehydrating action, (ref. sugar, starch, formic acid, oxalic acid, alcohol, copper sulphates crystals)

– action with SO_3

- uses

1.8 Carbon and its compounds:

[3 Hrs.]

- Introduction
- Allotropy
- Allotropic form of carbon (just give flow sheet)
- Structure, properties and uses of diamond and graphite
- Oxides of carbon (Ref. sources of carbon dioxide & carbon mono oxide and its effect)
- Concept of greenhouse effect and global warming

Unit 2: Metals and their compounds

[15 Hrs.]

2.1 General study of Metals and their components:

[5 Hrs.]

- Introduction
- Distinguish between metals and non-metals (ref. physical and chemical properties: at least any fifteen differences)
- Occurrence of metals
- Definition and types of alloys (ref. ferrous and non-ferrous alloys)
- Purpose of making alloys
- Metalloids
- Amalgam
- Chemistry of metallic carbonate
 - General methods of preparation of metallic carbonate
 - by passing carbon dioxide into oxides or hydroxides
 - by heating bicarbonates
 - by double decomposition (preparation of insoluble carbonates)
 - General properties of metallic carbonates
 - action with water
 - action of heat
 - action with acids
- Chemistry of metallic sulphate
 - General methods of preparation of metallic sulphate
 - by treating metals with sulphuric acid
 - by treating the oxides, hydroxides, carbonates and sulphides of metals with sulphuric acid
 - by double decomposition (preparation of insoluble sulphates)
 - by roasting of sulphides
 - General properties of metallic sulphates
 - action with water
 - action of heat
- Chemistry of metallic chlorides
 - General methods of preparation of metallic chlorides (hydrated)
 - by treating metals with hydrochloric acid
 - by treating the oxides, hydroxides, carbonates and sulphides of metals with hydrochloric acid
 - by double decomposition (preparation of insoluble chlorides)
 - by treating metals with aqua regia
 - General properties of metallic chlorides
 - action with water
 - action of heat

- action with acid
- Chemistry of metallic nitrate
 - General methods of preparation of metallic nitrate
 - by treating metals with nitric acid
 - by treating the oxides, hydroxides and carbonates of metals with nitric acid
 - by double decomposition
 - General properties of metallic nitrate
 - action with water
 - action of heat

2.2 Alkali metals

[2 Hrs.]

- Introduction
- Periodic position
- General characteristic properties of alkali metals (ref. physical and chemical properties)
 - Physical properties:
 - Physical appearance, size of atoms, melting and boiling point, oxidation state, metallic character and electronegativity
 - Chemical properties:
 - Action of air, action of water, action with hydrogen, action with halogen
- Sodium
 - Introduction
 - Physical Properties
 - Chemical properties:
 - action with air, water, hydrogen, hydrogen chloride, ammonia, chlorine, Sulphur, carbon dioxide
 - reducing action
 - uses

2.3 Alkaline earth metals

[2 Hrs.]

- Introduction
- Periodic position
- General characteristic properties of Alkaline earth metals (ref. physical and chemical)
 - Physical properties:
 - Physical appearance, size of atoms, melting and boiling point, oxidation state, metallic character and electronegativity
 - Chemical properties:
 - Action with air, water, hydrogen, nitrogen, halogen, acids, non-metals
 - formation of alloys
- Distinguish between alkali and alkaline earth metals
- Calcium
 - Introduction
 - Physical Properties
 - Chemical properties:
 - action with oxygen, water, hydrogen chloride, sulphuric acid, hydrogen, nitrogen, chlorine, carbon
 - uses

2.4 Coinage metals

[2 Hrs.]

- Introduction
- Periodic position

- General characteristic properties of coinage metals (ref. physical and chemical properties)
 - Physical properties:
 - Physical appearance, size of atoms, melting and boiling point, malleability, ductility, conductivity, variable valency
 - Chemical properties:
 - Action with air, water and acids
 - Action of salt solution with metals like Zn, Mg, and Fe
 - Formations of alloys
- Copper
 - Introduction
 - Physical properties
 - Chemical properties:
 - action with air, water, acids, ammonia, chlorine, Sulphur
 - reducing action
 - displacement reaction
 - uses

2.5 Aluminum **[1 Hr.]**

- Introduction
- Physical Properties
- Chemical properties:
 - action with air, water, Nitrogen, chlorine, carbon, Sulphur, acids, sodium hydroxide
- uses

2.6 Zinc **[1 Hr.]**

- Introduction
- Physical Properties
- Chemical properties:
 - action with oxygen (philosopher's wool), water, sodium hydroxide, acids, chlorine, Sulphur
 - displacement reaction
- uses

2.7 Iron **[1 Hr.]**

- Introduction
- Physical Properties
- Chemical properties:
 - action with air, water, chlorine, acids, Sulphur, carbon monoxide
 - displacement reaction
- uses

2.8 Lead **[1 Hr.]**

- Introduction
- Physical Properties
- Chemical properties:
 - action with air, water (plumbosolvency), acids, chlorine, Sulphur, sodium hydroxide, acetic acid
- uses

Unit3: Organic compounds and polymers **[15 Hrs.]**

3.1 Organic compounds **[5 Hrs.]**

- Introduction
- vital force theory and downfall of vital force theory
- Classification of organic compounds
- Functional groups
- Homologous series
 - Definition
 - Characteristics of homologous series
- Nomenclature of organic compounds
- Concept of word root, suffix and prefix
- IUPAC naming of simple aliphatic compounds:
 - alkane, alkene, alkyne, halogen derivatives (monohalo only), alcohol, (monohydric alcohol only), ethers, aldehydes, ketones, carboxylic acid (mono carboxylic acid), nitroalkane, alkyl cyanides, alkyl isocyanides, amines
- writing the simple structural formula from the name of the compound (IUPAC)

3.2 Alkanes

[2 Hrs.]

- Introduction
- Hydrocarbon
 - Aliphatic hydrocarbon
 - saturated and unsaturated hydrocarbon
 - aromatic hydrocarbon
- Methane
- Introduction
- Physical properties
- Chemical properties
 - halogenation, nitration, action with air and steam, pyrolysis
- uses

3.3 Alkene

[2 Hrs.]

- Introduction
- **Ethylene**
- Physical properties
- Chemical properties:
 - addition reaction
 - addition of hydrogen, halogens, hydrogen chloride, water, sulphuric acid,
 - ozonolysis
 - Markonikov's rule and peroxide effect
 - oxidation reaction
 - with alkaline KMnO_4 , with acidified KMnO_4 , oxidation by air
 - polymerization
- uses

3.4 Alkyne

[2 Hrs.]

- Introduction
- Acetylene
- Physical properties
- Chemical properties:
 - Addition reaction
 - addition of hydrogen, halogens, halogens acid water, sulphuric acid, hydrogen cyanides, acetic acid
 - Ozonolysis
 - Substitution reaction

- action with sodium, ammoniacal silver nitrate, ammoniacal cuprous chloride
- Oxidation reaction
 - with alkaline KMnO_4 , with chromic acid, oxidation by air
- Polymerization
- uses

3.5 Benzene

[3 Hrs.]

- Introduction
- Distinguish between aliphatic and aromatic compounds
- Aromaticity
- Huckel rule
- Physical properties of benzene
- Chemical properties of benzene:
 - Substitution reaction
 - Halogenations, nitration, Sulphonation, Friedel craft reaction
 - Addition reaction
 - Addition of hydrogen halogens and ozone
 - Oxidation reaction
 - action with air and combustions
- uses

3.6 Polymers

[1Hr]

- Introduction
- Polymers and polymerization
- Classification of polymer:
 - natural polymer
 - synthetic polymer
- Polythene
 - preparation and uses
- Polyvinyl chloride
 - preparation and uses
- Rubber
 - preparation and uses of natural rubber (ref. isoprene unit) and synthetic rubber (ref. Neoprene rubber)

Tutorial

Unit 1:

[14hrs]

Practice on causes, types and method of removal of hardness of water, Lab preparation of ammonia, chlorine, hydrogen chloride, hydrogen sulphide, Manufacture of ammonia, nitric acid and sulphuric acid, nitrogen cycle and chemical fertilizers, oxides of nitrogen and Sulphur as pollutant and acid rain, chemical properties of ammonia, nitric acid, chlorine, hydrogen chloride, hydrogen sulphide and sulphuric acid, allotropes of carbon, structure and properties of Diamond.

Unit 2:

[9 Hrs.]

Practice on difference metals and non-metals, preparation and properties of metallic carbonate, chlorides, sulphate and nitrates, types and purpose of making of alloys, general characteristics of alkali metals, alkaline earth metals and coinage metals, chemical properties of different metals like sodium, calcium, aluminium, copper, Zinc, iron and lead

Unit 3:

[7 Hrs.]

Practice on homologues series, functional group, IUPAC naming of simple aliphatic compounds, saturated and unsaturated hydrocarbon, chemical properties of methane, alkene,

alkyne and benzene, Huckel's rule, homopolymers and copolymers, preparation and uses of polyethene, polyvinyl chloride and rubber.

Engineering Chemistry Practical II:

[30 Hrs.]

1. Prepare and study the properties of hydrogen gas. [2hrs]
2. Prepare and study the properties of ammonia gas. [2hrs]
3. Prepare and study the properties of hydrogen Sulphide gas. (This gas should not be prepared individually in a Woulf bottle but in Kipp's apparatus commonly) [2hrs]
4. Detect the acid radicals (Cl^- , NO_3^- , SO_4^{2-} , CO_3^{2-}) by dry and wet ways. (4hrs)
5. Detect the basic radicals (Cu^{++} , Al^{+++} , Fe^{+++} , Zn^{++} , CO^{++} , Ni^{++} , Ca^{++} , Ba^{++} , Mg^{++}) by wet ways. [6hrs]
6. Detect the acid and basic radicals (complete salt analysis). [6hrs]
7. Investigate the action of acids on some metals (Zn, Mg, Fe, Al, Sn & Cu) (acids: HCl, H_2SO_4 (dil.) & HNO_3 (dil.)) [2hrs]
8. Compare the hardness of different types of water. [2hrs]
9. Prepare Bakelite (resin) in the laboratory. [2hrs]
10. Determine the condition in which corrosion takes place. [2hrs]

References Books:

1. Foundations of chemistry, Vol-2, M.K. Sthapit and R.R. Pradhananga, Taleju prakashan, Kathmandu
2. A Text book of Engineering Chemistry-vol II, Prakash Paudel, Siddhartha publication, Kathmandu
3. Engineering Chemistry, M.L. Sharma, K.M. Shrestha, P.N. Choudhary, Ekta Book,
4. A Text book of Chemistry, Jha and Guglani, surya publication, India
5. Elementary qualitative analysis, M.K. Sthapit and C.B. Tuladhar, Taleju Prakashan
6. Elementary practical chemistry, M.K. Sthapit, Taleju Prakashan
7. Practical engineering chemistry for diploma level, Sumitri Bajracharya, Sabina Shrestha, Kathmandu institute of technology.

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. The related institute may develop its own textbook and approve from the related authority so as to have it prescribed as a textbook of this subject.

Evaluation Scheme

There will be questions covering all the chapters in the syllabus. The evaluation scheme for the questions will be as indicated as in the table below.

Units	Chapter	Hours	Marks distribution
1	Water	5	4
	Ammonia	4	4
	Nitric acid	8	8
	Halogens (Chlorine),	3	4
	Hydrochloric acid, Hydrogen sulphide	4	4
	Sulphuric acid, Carbon and its compound	7	8
2	General study of metals and their components: Alloys	5	4
	Alkali metals, sodium, Aluminium	3	4
	Alkaline earth metals, calcium, Zinc	3	4
	Coinage metals, copper, Iron, lead	4	4
3	Organic compounds, alkane	6	4
	Alkene, Alkyne	4	4
	Benzene, polymer	4	4
	Total	60	60

Note: There may be minor deviation in marks distribution. Choice question can be asked from different chapters.

**Workshop Practice I
EG 1201 CE**

Year: I

Semester: II

Total: 8hours /week

Lecture: 2 hours/week

Tutorial: hours/week

Practical: 6 hours/week

Lab: hours/week

Course description:

This course intends to impart basic knowledge and skills on electricity and bench works.

Course objectives:

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

1. Define electricity;
2. Familiarize with metal works;
3. Perform house wiring works.
4. Perform simple metal works.

Part I: Electricity

Total: 4hours /week

Lecture: 1 hour/week

Tutorial: hours/week

Practical: 3 hours/week

Course description:

This part of the course focuses on familiarization of electricity and its application. It intends to impart knowledge and skills on Electrical accessories, Electrical energy, Electric symbols, House appliances and building wiring.

Course objectives:

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

1. Define electricity;
2. Identify electric symbols and accessories;
3. Identify tools/equipment and its safety requirement of wiring system;
4. Identify major components of electrical system and its installation procedure and
5. Connect lighting circuits and signal circuits.

Course Contents:

Theory

Unit 1: Electricity

[1 Hr.]

- 1.1. Introduction
- 1.2. History of electricity
- 1.3. Generation of electricity
- 1.4. Scope of electricity
- 1.5. Types of current

Unit 2: Fundamentals of electric circuits

[4 Hrs.]

- 2.1. Definition of voltage, current, resistance and their relationship
- 2.2. Types of conductors

- 2.3.Types of circuits
 - 2.3.1. Series circuit
 - 2.3.2. Parallel circuit
- 2.4 Measurement of current, voltage, resistance and power
 - 2.4.1. Ampere meter
 - 2.4.2. Volt meter
 - 2.4.3. Ohm meter
 - 2.4.4. Power meter/ Watt meter/Energy meter
- 2.5 Related numerical problems on circuits

Unit 3: Electrical Energy Transformation **[2 Hrs.]**

- 3.1.Transformer, its function and application
- 3.2.Isolator, its function and application
- 3.3.Electric poles, its function and application
- 3.4.Safety and precautions

Unit 4: Measuring Instruments and Protecting Devices **[1 Hr.]**

- 4.1.Foot and meter/scale (Linear measuring instruments)
- 4.2.Vernier caliper/caliper
- 4.3.Standard wire gauge
- 4.4.Feeler gauge/radius gauge
- 4.5.Micrometer/voltmeter
- 4.6.Minature Circuit breaker (MCB)
- 4.7.Fuses and fuse types
- 4.8.Check line with color chalk dust powder
- 4.9.Straightedge and line

Unit 5: Source of Power **[2 Hrs.]**

- 5.1.Definition
- 5.2.D.C. system
- 5.3.A.C. system
- 5.4.Phases (single and three phases lines)
- 5.5.Inverter system
- 5.6.Solar power system

Unit 6: Electric Symbols **[1 Hr.]**

- 6.1.Introduction
- 6.2.Types of symbols
- 6.3.Identification
- 6.4.Application

Unit 7: Earthing **[2 Hrs.]**

- 7.1.Definition of electric shock
- 7.2.Effects of electric shock on human body
- 7.3.Levels of electric shock
- 7.4.Introduction of earthing
- 7.5.Function and application
- 7.6.Earthing methods and testing
- 7.7.Safety and precaution in earthing

Unit 8: Electric Wiring Procedure **[2 Hrs.]**

- 8.1. Marking procedure and interpolation of wiring diagram
- 8.2. Setting out back ground on wall surface
- 8.3. Drilling holes for fixing wire and cables and switch boxes
- 8.4. Fixing accessories components or position
- 8.5. Installation of wires/cables to masonry wall by placing safety foundation
- 8.6. Fixing PVC insulated wires and cables branching boxes using clips and saddles
- 8.7. Fixing accessories on position

Practical

Project 1: Draw/interpret Drawings and Diagrams: **[5 Hrs.]**

- 1.1 Simple electrical drawings
- 1.2 Free hand plan/schematic diagram
- 1.3 Layout diagram
- 1.4 Wiring diagram.

Project 2: Connect the following Lighting Circuits on Board: **[32 Hrs.]**

- | | |
|---|----------|
| 2.1. One-way switch one light and one socket | [4 Hrs.] |
| 2.2. Two-way switch two lights and two sockets | [5hrs] |
| 2.3. Intermediate switches, two fluorescent lamps | [5 Hrs.] |
| 2.4. Multi-position switches and incandescent lamps | [7 Hrs.] |
| 2.5. Dimmer switches and incandescent lamps. | [7 Hrs.] |
| 2.6. Time switches and lamps | [4 Hrs.] |

Project 3: Connect the following Signal Circuits: **[8 Hrs.]**

- | | |
|-------------------------------------|----------|
| 3.1. Electrical bell | [2 Hrs.] |
| 3.2. Electric door opener | [3 Hrs.] |
| 3.3. Ceiling fan with fan regulator | [3 Hrs.] |

References:

1. Malla, N.B., (latest edition). Introduction of Electricity volume 1.
2. Malice, S. K., (latest edition). Electric Trade Theory and Practical.

Evaluation Scheme

S.N.	Description	Time (hours)	Marks
1	Draw/Interpret drawings and diagrams	5	5
2	Connect lighting circuits on boards	32	25
3	Connect the signal circuits	8	5
4	Viva from theory		5
	Total		40

Part II: Bench work

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

Course Description:

This part of the course focuses on familiarization of bench work and its application. It intends to impart knowledge and skills on bench works techniques and metal tools making procedures.

Course Objectives:

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

1. Introduce bench work;
2. Identify bench work tools and its types;
3. Classify the various techniques of metal joining processes by hand
4. Prepare general types of tools and equipment
5. Handle measuring instruments, hand tools, power tools with personal safety

Course Contents:

Unit 1: Bench work

[1 Hrs.]

- 1.1 Introduction
- 1.2 Importance and its Application in Engineering work
- 1.3 Safety measures used in workshop

Unit 2: Lying Tools

[2 Hrs.]

- 2.1 Introduction of layout tools: (scriber, punch, divider, surface plate, v-block, Vernier calliper and Vernier height gauge)
- 2.2 Types of layout tools
- 2.3 Handling procedure of layout tools
- 2.4 Repair and maintenance of the layout tools
- 2.5 Hammer/Hammering
 - 2.5.1 Introduction of the ball, cross, straight, claws and soft hammers.
 - 2.5.2 Selection of hammer for driving, chipping, punching, puling nails, riveting and fitting.
 - 2.5.3 Holding and replacing handle.
 - 2.5.4 Handling of hammering tools.
- 2.6 Wrenches
 - 2.6.1 Introduction to single, double, pipe and the adjustable wrenches
 - 2.6.2 Handling of wrenches
 - 2.6.3 Identification of bench, machine, pipe and chain vices.

Unit 3: Cutting tools

[4 Hrs.]

- 3.1 Chisels
 - Introduction to cross diamond and round chisels
 - Selecting the angle of the chisels and removing metal from the surface
 - Holding the hammer and chisel and chipping processes.
 - Uses of the chipping guard, care and maintenance of work place and tools.
- 3.2 Handsaw and sawing
 - Selection of hand saw, blade, cutting metal.
 - Method of the holding the work piece and rules of sawing.
- 3.3 Files and filing
 - Identification of the parts, shapes, sizes, cuts of the files.

- Selection of file for the shaping different types of the metal and surface finish with accuracy of $\pm 0.2\text{mm}$.
 - Method of the holding, balancing and the direction of the filing
- 3.4 Reamer and reamering
- Types of the reamers, hand, taper and adjustable reamers
 - Selection of holding device, reamer; drill speed.
 - Method of reamering on the metal
- 3.5 Thread and threading
- Introduction to taps, dies, handle kinds of the thread, size, angle, main part of the thread and uses.
 - Method of producing the thread by the taps and dies, lathe machine, rolling, pressing
- 3.6 Scraper and scraping
- Identification of flat, three side and curve scraper
 - Method of the scraping and the qualities of the surface

Unit 4: Measuring instrument **[1 Hr.]**

- 4.1 Identification of Vernier calliper, micrometre, try square, bevel protractor, wire, and filler radius and thread gauge.
- 4.2 Parts of measuring instrument
- 4.3 Rules of the measuring instrument.

Unit 5: Rivet and Riveting **[1Hr]**

- 5.1 Identification of rivets, size, head, metal, riveting sets punches.
- Calculation of length, diameter of rivet and head.
 - Procedure of the riveting and the joints mistakes.

Unit 6: Solder and Soldering **[1 Hr.]**

- 6.1 Introduction to soldering iron, types of solder, cleaning tools and the fluxes.
- Selection of source of heat and temperature
 - Process of cleaning and joining work metal

Unit 7: Shear and shearing **[1 Hr.]**

- Identification of hands, press, torch, snip, shear tools.
- Selection of method of the shearing sheet, rod, and square, flat angle metal

Unit 8: Bend and bending **[1 Hr.]**

- Introduction to bending devices, vice pliers, range, hand bar and fork
- Selection of folding, radius bending and rolling devices
- Method of bending the metal bar, flat and the plate
- Bending the metal into many shapes

Unit 9: Power tools **[2 Hrs.]**

- 9.1 Drill machines
- Identification of hand drill machine, bench, gang, colon and radial drill machine.
 - Selection of correct type of the machine
 - Correct method of using the drilling machine
 - Selection of correct speed and the fit for different size of the drill and the metal
- 9.2 Drill and drilling
- Identification of different kinds of drill size, purpose and angle
 - Selection of work and drill, holding tools and equipment

- Operation of all types of drill machine of the drill holes of acceptable standards.
- Operation of the drill machines and the functioning by coolant

Unit 10: The sheet metal work [1 Hr.]

10.1 Hand tool metal

- Identification of types of the sheet metal, mild steel, galvanized steel, copper, brass, aluminum familiar with sizes and thickness of the sheet metals.
- Measurement of the sheet with gauge and instruments.

10.2 Marking tools

- Identification and uses of sheet metal marking tools, scribe, rules, try square, punch, divider, trammel and depth gauge.
- Selection of 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

- Identification of bending, rollers, folders, and edge forming, sawing, crimping, spot welding and polishing parts

Practical:

1. Perform straight, curve and dot marking: [1 Hr.]
2. Measure with rules, Vernier caliper, gauge [1 Hr.]
3. Perform hammering by ball, cross and soft straight pin. [1 Hr.]
4. Perform sawing by power hand saw. [2 Hrs.]
5. Perform filing with single, double and rasp cut. [2 Hrs.]
6. Perform chiseling by the flat, cross, concave and power chisel. [2 Hrs.]
7. Perform hand and adjustable reamering. [2 Hrs.]
8. Perform threading with tap and dies. [2 Hrs.]
9. Perform flat and curve scrapping on the metal surface [1 Hr.]
10. Perform riveting with riveting sets pup riveter [2 Hrs.]
11. Operate power tools for drilling, folding, rolling, radius bending, spot welding, grinding, beading, crippling, edge forming, hacksaw machines. [5 Hrs.]
13. Make hammer by using the skill of measuring, marking, sawing, filing, drilling, thread cut using a Tool steel 1 pc of size 25x25x155mm [12 Hrs.]
14. Make store box by using the skill of measuring, marking, hemming, seaming, cutting, folding, riveting using a G.I. sheet 22 gauge of 400x500 mm [12 Hrs.]

References:

1. Rajput, R.K., (latest edition). Manufacturing process.
2. Chaudhary, S.K., Chaudhary, A.K., Roy, N., (2007). Workshop technology manufacturing processes (Vol -1), Media Promoters & Publishers Pvt. Ltd.

Evaluation Scheme

S.N	Description	Time (hours)	Marks
1	Perform marking and measurement	2	4
2	Perform hammering or sawing	3	4
3	Perform filing or chiseling	4	8
4	Perform reamering or threading	4	8
5	Perform scrapping or riveting	3	4
6	Operate power tools	5	8
7	Viva from theory		4
	Total		40

Engineering Drawing II
EG 1201 AR

Year: I
Semester: II

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

Course description:

This course is designed to impart knowledge and skills on drawing pictorial view (in isometric and oblique) of the solid, surface development and intersection between two elements.

Instructors are requested to manage and deliver the related theoretical contents at drawing room just before conducting the specific practical work. All the theoretical and practical classes should be conducted with in total time of 60 Hours as allotted.

Course objectives:

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

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

Course Contents:

Theory

Unit 1. Axonometric Projection: **[0.5 Hr.]**

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

Unit 2. Oblique Drawing: **[0.5 Hr.]**

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

Unit 3. Isometric Drawing: **[0.5 Hr.]**

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

Unit 4. Projection of True length and shape of oblique line and shape: **[0.5 Hr.]**

- 4.1. Introduction of oblique line
- 4.2. True length and angle to HP/VP of oblique line
- 4.3. True shape of oblique plane
- 4.4. Revolving method
- 4.5. Replacing Method

Unit 5. Projection of intersection of line and plane **[1 Hr.]**

- 5.1. Method of finding of intersection point
- 5.2. Method of finding the seen and hidden part of line

5.3. Method of finding the angle between plane and line

Unit 6. Projection of Intersection plane and plane: [0.5 Hr.]

- 6.1. Line of intersection
- 6.2. Seen and hidden part of plane
- 6.3. Finding the dihedral angle between two planes

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

- 7.1. Finding the points and lines by generating method
- 7.2. Finding the points and line by cutting plane method

Unit 8. Projection of intersection between line and geometrical solids: [0.5 Hr.]

- 8.1. Projection of piercing point by generating method
- 8.2. Projection of piercing point by cutting plane method

Unit 9. Section: [0.5 Hr.]

- 9.1. Introduction of section and its needed
- 9.2. Sectional plane and sectional views
- 9.3. Projection of sectional views
- 9.4. Type of section- Longitudinal and cross section- Full section, half section, offset section, detail section etc.

Unit 10. Projection of intersection between planes and simple geometrical solids and its Surface development with true shape of cut portion: [0.5 Hr.]

- 10.1. Introduction sectional plane and solid
- 10.2. Understanding the development of surfaces
- 10.3. Method of development
- 10.4. Method for development of cut surfaces

Unit 11. Projection of intersection between surfaces of solids: [1.5 Hrs.]

- 11.1. Introduction about surfaces of solids
- 11.2. Type of cutting plane (Vertical/Horizontal projecting plane)
- 11.3. Determination of line/curve of intersection
- 11.4. After the intersection of two solids that shape will be occurring of touched at touched portion

Practical (Class work sheet)

Sheet No 1: [10 Hrs.]

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

Sheet No 2: [10 Hrs.]

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

Sheet No 3: [3 Hrs.]

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

Sheet No 4: [3 Hrs.]

1. Perform projection drawing of intersection of line a triangular plane showing the point of intersection,

2. Draw true shape of plane and angle between plane and line on the edge of given plane (At least two exercises should be done).

Sheet No 5: **[3 Hrs.]**

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

Sheet No 6: **[1 Hr.]**

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

Sheet No 7: **[3 Hrs.]**

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

Sheet No 8: **[2 Hrs.]**

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

Sheet No 9: **[10 Hrs.]**

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

Sheet No 10: **[8 Hrs.]**

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

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

References:

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

Applied Mechanics EG 2102 CE

Year: I
Semester: II

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

Course Description:

This course focuses on analysis and effect of various types of forces on the particle and rigid body at rest. The course familiarizes with the frictional phenomenon on engineering problems. It includes the evaluation of properties of plane bodies as center of gravity and moment of inertia. The course focuses on the analysis of internal forces/stresses in beams and trusses.

Course Objectives:

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

1. Understand the basic laws of motion, vector and its laws, concept of particle and rigid body and application of equations of static equilibrium;
2. Describe the different types of forces that may act on the body, resolve the forces; determine resultant of a given force system;
3. Understand the laws of friction forces, be familiar with the frictional force on the body and analysis of typical problems;
4. Be familiar with the distributed forces (Centre of gravity, Centroid, Moment of Inertia) and be able to determine CG and MI for simple plane and solid figures;
5. Be familiar with structures (beam and truss), support systems, loading systems, be able to evaluate the reactions and forces in the truss members;

Course Contents:

Theory

Unit 1: Introduction: Forces Acting on Particle and Rigid Body [6 Hrs.]

- 1.1 Definition of Mechanics and scope of Applied Mechanics
- 1.2 Concept of Particle, Rigid Body, Deformable Body
- 1.3 Review of vectors and its laws;
- 1.4 Definition of a force, units, representation by a vector and by Bow's notation, Characteristics of a Force and its Effects,
- 1.5 Classification of Forces Based to Plane and Line of Action: Internal, External, Translational, Rotational, Coplanar, Non-Coplanar, Concurrent, Non-Concurrent, Like Parallel and Unlike Parallel Forces.
- 1.6 Resolution and Composition of Forces: Methods of resolution, Perpendicular Components and Non-Perpendicular Components,
- 1.7 Principle of Transmissibility of Forces
- 1.8 Resolution of a Force in to a Force and a Couple
- 1.9 Moment of a Force: Definition, Measurement of Moment of a Force, Units, Geometrical Interpretation of Moment, Classification of Moments According to Direction of Rotation, Sign Convention, Law of Moments, Varignon's Theorem of Moment and its Application,
- 1.10 Couple: Definition, Units, Measurement of a Couple, Properties of Couple, its use.

Unit 2: Equilibrium of Forces: **[8 Hrs.]**

- 2.1 Conditions of Equilibrium for a Particle and Rigid Body;
- 2.2 Analytical and Graphical Conditions of Equilibrium for Concurrent, Non-Concurrent and Parallel Force System;
- 2.3 Free Body Diagrams, Construction of Free Body Diagrams
- 2.4 Equations of Static Equilibrium: Two and Three Dimensional analysis of Particle, Two Dimensional analysis of Rigid Body
- 2.5 State and Prove: Triangle Law of Forces, Parallelogram law of Forces
- 2.6 Polygon Law of Forces and Lami's Theorem, Application of Lami's Theorem to Solve Various Problems.
- 2.7 Equivalent Forces: Definition of Equilibrant, Differentiate Resultant and Equilibrant, Equilibrant of Concurrent and Non-Concurrent force System.
- 2.8 Resultant and Equilibrium of Moments and Couples

Unit 3: Friction: **[5 Hrs.]**

- 3.1 Friction: Definition, Causes, Advantages, Disadvantages, Types, and Force of Friction.
- 3.2 Laws of Friction: Static and Dynamic Friction and Their Coefficients
- 3.3 Different status (No Friction, Certain Friction, Impending Motion and Motion)
- 3.4 Sliding and Tipping Condition of the Body
- 3.5 Angle of Friction and its Meaning, Angle of Repose, Relation between Angle of Friction Angle of Repose and Coefficient of Friction.
- 3.6 Equilibrium of Bodies on Level Plane; Equilibrium of Bodies on Inclined Plane:
- 3.7 External Forces Parallel to the Plane, External Forces in Inclined Plane.

Unit 4: Centre of Gravity (CG) and Centroid: **[5 Hrs.]**

- 4.1 Concept of Centre of Gravity, Center of Mass, Centroid (Plane Figures), Axis of Symmetry,
- 4.2 Centroid of Composite lines (straight line, arc, semicircle and quarter circle)
- 4.3 Centroid of Composite Figures (Rectangle, Triangle, Circle/Semi-circle/Quarter circle /Circular sector, Parabola/Semi-parabola and Ellipse)
- 4.4 Centroid of Area under curve by the method of Integration
- 4.5 Centroid of Built-up Plane Figures
- 4.6 Center of Gravity of Simple Solids: Cylinder, Sphere, Hemisphere, Cube, Cone and Rectangular Block (Ready to use formulae).

Unit 5: Moment of Inertia (MoI): **[7 Hrs.]**

- 5.1 Concept of Moment of Inertia, First Moment and Second Moment of Area
- 5.2 Axial and Polar Moment of Inertia
- 5.3 Moment of Inertia of Regular Areas (Rectangle, Triangle, Circle and Ellipse) about their Centroidal axes
- 5.4 Perpendicular and Parallel axis Theorems for Moment of Inertia
- 5.5 Moment of Inertia of Composite Area
- 5.6 Radius of Gyration
- 5.7 Application of Moment of Inertia in Engineering Problems
- 5.8 Concept of Principal Moment of Inertia and Application in Engineering Problems.
- 5.9 MoI of L, T, I- and channel sections. Section modulus

- Unit 6: Analysis of Statically Determinate Beams:** [3 Hrs.]
- 6.1 Definition of Structure and Mechanism
 - 6.2 Plane and Space Structures
 - 6.3 Determinacy and Stability (Static and Geometric) of the Structures. Degree of freedom.
 - 6.4 Different types of Load and Support in the Structures
 - 6.5 Definition and Types of Beam
 - 6.6 Calculation of Support Reactions: Examples on Beams, Trusses, Links and Beams with Internal Hinge

- Unit 7: Axial Force, Shear Force and Bending Moments** [6 Hrs.]
- 7.1 External and internal forces (Axial Force, Shear Force, and Bending Moment) in the Structural Members: Definition of Axial Force (AF), Shear Force (SF) and Bending Moment (BM), Sign Convention and Calculations and Plotting.
 - 7.2 Concept of Superposition of AF, SF and BM in Beams.
 - 7.3 Relationship between Load, Shear Force and Bending Moment
 - 7.4 Calculations of AF, SF and BM and Draw Corresponding Diagrams for Cantilever, Simply Supported and Overhanging Beams Subjected to Uniformly Distributed Load (UDL), Concentrated and Uniformly Varying Load (UVL).

- Unit 8: Analysis of Statically Determinate Plane Truss** [5 Hrs.]
- 8.1 Concept and definition of Trusses, Joints Formation and Load Transfer Mechanisms in the Truss. Classification: Perfect, imperfect, redundant and deficient, relation between members and joints, assumption in the analysis.
 - 8.2 Types of Truss Based on Their Uses
 - 8.3 Calculation of Member Force by the Method of Joints: Examples with Merits and Demerits.
 - 8.4 Calculation of Member Force by the Method of Sections: Examples with Merits and Demerits.

Tutorials: [30 Hrs]

Assist students for conceptual & critical problem solving

1. Problems on vectors addition, subtraction, multiplication, projection of vectors and components
2. Problems on characteristics of force and their effects on rigid bodies
3. Resolution of forces into different components
4. Simple problems on transmissibility of forces
5. Problems on parallel forces, couples and moments
6. Equilibrium of forces: Problems related to triangle law of forces, parallelogram law of forces polygon law of forces and Lami's theorem. Equilibrium of concurrent, non-concurrent and parallel force system. Resultant and equilibrant force. Moments, couples, resultant of parallel forces and moments.
7. Problems related to equilibrium of bodies on level plane; equilibrium of bodies on inclined planes considering frictional forces and external forces parallel to the plane, inclined to the plane.
8. Problems related to CG composite lines: straight line, arc, semicircle and quarter circle. CG of composite figures: Rectangle, triangle, circle/semi-circle/quarter circle/circular sector, parabola/semi-parabola and ellipse. CG of Area under curve by the method of integration.

9. Problems related to MoI of regular areas: Rectangle, triangle, circle/semi-circle/quarter/circle and ellipse. Perpendicular and parallel axis theorems. MoI of simple composite areas.
10. Problems on reactions of beams, trusses, links in beams, beams with internal hinge, portal frame.
11. Problems on calculations of AF, SF, BM and plotting for cantilever, simply supported, overhanging beams subjected to UDL, Concentrated and UVL.
12. Problems related to calculation of member force by the method of joints in simple trusses. Determination of member force by the method of sections for simple trusses.

Practical (Laboratory)

[15 Hrs]

1. Verify Triangle law of forces, Parallelogram law of forces and Lami's theorem
2. Verify Principle of Moments
3. Determine Centroid of Plane Figures (Rectangle, Triangles, Circle and Ellipse, L-Section, I-Section)
4. Determine Moment of Inertia by Flywheel
5. Determine Support Reactions of Simply Supported and Cantilever Beam with different types of Loading
6. Determine Support Reactions and Member Force of Simply supported Truss
7. Determine shear force at different sections on a simply supported beam under points loads
8. Determine bending moment at different sections on a simply supported beam under different types of loading.

Textbooks:

1. R. S. Khurmi, "*Applied Mechanics and Strength of Materials*", Nirja Construction and Development Pvt. Ltd., Ram Nagar, New Delhi
2. F. P. Beer & E. R Johnston Jr, "*Vector Mechanics for Engineers - Statics*", McGraw-Hill
3. I. H. Shames, "*Engineering Mechanics - Statics and Dynamics*", New Delhi, Prentice Hall of India
4. R. C. Hibbeler, "*Engineering Mechanics*", McMilan Publishing Company, New York

References:

1. M. R. Dhital, "*A Course Manual on Applied Mechanics I (Statics)*", IOE, Pulchowk Campus
2. R. Suwal, "*A Text Book of Applied Mechanics*", R & R Engineering Consultancy Pvt. Ltd

Evaluation Scheme

Unit	Chapters	Hours	Marks
1	Introduction: Forces Acting on Particle and Rigid Body	6	9
2	Equilibrium of Forces	8	12
3	Friction	5	6
4	Centre of Gravity (CG) and Centroid	5	6
5	Moment of Inertia (MoI)	7	9
6	Analysis of Statically Determinate Beams	3	3
7	Axial Force, Shear Force and Bending Moments	6	9
8	Analysis of Statically Determinate Plane Truss	5	6
Total		45	60

Experts Involved

- प्रा. डा. ज्ञान बहादुर थापा, विषय विज्ञ, Mathematics, IOE, Pulchok Campus, काठमाण्डौ ।
- श्री विनय देवकोटा, विषय विज्ञ, Physics, BSET, काठमाण्डौ ।
- श्री सुदन भक्त अधिकारी, विषय विज्ञ, Mathematics, काठमाण्डौ ।
- श्री भवानि प्रसाद अधिकारी, विषय विज्ञ, Physics, काठमाण्डौ ।
- श्री प्रकाश पौडेल, विषय विज्ञ, Chemistry, काठमाण्डौ ।
- श्री टिकाहरि बराल, विषय विज्ञ, नेपाली, नोभल कलेज, काठमाण्डौ ।
- श्री परशुराम घिमिरे, विषय विज्ञ, English, कामना कलेज, काठमाण्डौ ।
- श्री दिपक भट्ट, विषय विज्ञ, BSET, काठमाण्डौ ।
- श्री गोरकण बहादुर मोत्रा, विषय विज्ञ, IOE पुल्चोक, ललितपुर ।