CURRICULUM

DIPLOMA

Hydropower Engineering

(Three Year's Program - Semester System)

Council for Technical Education and Vocational Training

Curriculum Development Division

Sanothimi, Bhaktapur

2017

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Introduction:

Hydropower Engineering is one of the prominent disciplines in engineering sector. Many people in the developed countries, developing countries and under developed countries have emphasized for the broader application of Hydropower Engineering. This has been helping the world for the all-round physical infrastructure development and it has been creating wage and self-employment opportunities both in public and private sectors. This curriculum is based on the academic requirements to enter bachelor as well as designed with the purpose of producing middle level technical workforce equipped with knowledge and skills related to the field of civil engineering, especially in hydropower engineering so as to meet the demand of such workforce in the country to contribute in the national infrastructure development in the country. The knowledge and skills incorporated in this curriculum will be helpful to deliver the individual needs as well as national and international needs in the field of hydropower sector.

This course is based on the job required to perform by the hydropower Engineering Technicians (Hydropower Sub-Engineer) at different levels of public and private sectors for physical infrastructures development. There are six semesters in total in three year's course duration. The first year course focuses on foundational and core subjects of engineering; the second year course focuses on basic disciplinary subjects of civil engineering and hydropower Engineering. Similarly, the third year whole courses comprise of the disciplinary subjects including provision of elective subjects. Moreover, the third year insists on the application of learned skills and knowledge through the minor project and major project.

The foundational subjects like Physics, Chemistry, and Mathematics are offered in diffusion model of curricular programme. It also includes language subjects like Nepali and English applicable for the communication in the same area. The disciplinary subjects of hydropower Engineering are offered in this programme are included in all semesters. This curricular programme also makes provision of project works as well as elective subjects in the specific areas of hydropower Engineering. The curriculum structure and the subject wise content that reflect the details of this curriculum. In brief, this curriculum will guide to its implementers to produce competent and highly employable technical workforces in the field of hydropower engineering.

Curriculum title:

Diploma in Hydropower Engineering (DHE).

Aim:

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

Program objectives:

This program has following objectives to:

1. Prepare technicians capable of undertaking hydropower engineering works under Road, Irrigation, Water supply, Urban Development, Building Construction and hydropower infrastructures development;
2. Produce middle level competent technical workforce to provide supervisory works of civil engineering;

3. Prepare technical workforce who demonstrate positive attitude and respect towards the profession with greater initiative;
4. Fulfill the demand of required hydropower Engineering Technicians for the public and private infrastructure development sector of Nepal;
5. Reduce the dependency on foreign technicians.
6. Create self-employment opportunities.

Target Location:
The target location of this program will be all over Nepal.

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

Entry Criteria:
- SLC Pass or SLC/SEE with minimum C grade in Compulsory Mathematics & Science and D+ in Compulsory English.
- TSLC in Engineering with minimum 66.68%.
- Should pass entrance examination as administered by CTEVT.

Duration:
The total duration of this curricular program is three years. Each year consists of two semesters of six months each. Moreover, one semester consist of 19.5 academic weeks including evaluation period. Actual teaching learning hours will be not less than 15 weeks in each semester.

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.

Teacher and Student Ratio
The ratio between teachers and students must be:
- Overall ratio of teacher and student must be 1:10 (at the institution level)
- 1:48 for theory and tutorial classes
- 1:12 for practical classes

Qualification of Teachers and Instructors:
- The program coordinator should be a master's degree holder in the related area.
- The disciplinary subject related teachers should be a bachelor's degree holder in the related area with three years' experience in the related field.
- The demonstrators should be bachelor's degree holder in the related area with two years experiences in training activities.

- The foundational subjects' related teachers (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, Overhead transparencies, Slides etc.).
- *Audio-Visual Materials* (Audiotapes, Films, Slide-tape programs, Videodiscs, Videotapes etc.).
- *Computer-Based Instructional Materials* (Computer-based training, Interactive video etc.)

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

Theory: Lecture, discussion, assignment, interaction, seminar, group work.
Practical: Demonstration, observation, simulation, guided practice, self-practice, industrial practice and project work.

Mode of Education:
There will be inductive and deductive mode of education.

Examination and Marking Scheme:
a. Internal assessment
- There will be a transparent/fair evaluation system for each subject both in theory and practical exposure.
- Each subject will have internal assessment at regular intervals and students will get the feedback about it.
- Weightage of theory and practical marks are mentioned in course structure.
- Continuous assessment format will be developed and applied by the evaluators for evaluating student's performance in the subjects related to the practical experience.
b. Final examination
- Weightage of theory and practical marks are mentioned in 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 20 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 year within six years from the enrollment date; however there should be provision of chance exam for final year students as per CTEVT rules.

Disciplinary and Ethical Requirements:

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

Grading System:

The following grading system will be adopted:
- Distinction: 80% and above
- First division: 65% to below 80%
- Second division: 50 % to below 65%
- Pass division: Pass marks to Below 50%

Certification and Degree Awards:

- Students who have passed all the components of all subjects of all 3 years are considered to have successfully completed the course.
- Students who have successfully completed the course will be awarded with a degree of **"Diploma in Hydropower Engineering"**.

Career Opportunity:

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

Curriculum and credits:

In this curriculum each subject has its code; full marks; and credit hours divided into lecture hours, tutorial hours, and practical hours.

Subjects codes

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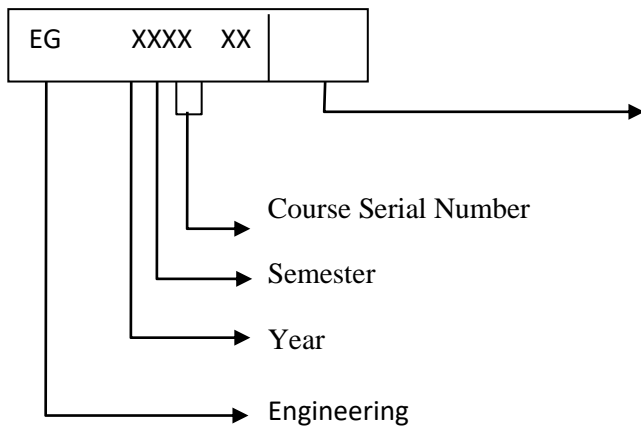
Offering Departments:

AR: Architecture

EE: Electrical Engineering

ME: Mechanical Engineering

EX: Electronics Engineering

CT: Computer Engineering

CE: Civil Engineering

HE: Hydropower Engineering

SH: Science and Humanities

MG: Management

| EG | XXXX | XX | |

- Course Serial Number
- Semester
- Year
- Engineering

Provision of elective subjects:

There will be provision of elective subjects in final semester of this curricular programme. Some subjects of hydropower engineering discipline are offered here with provision of the elective; viz Micro Hydro, Hydropower Structure and Energy Management.

Curriculum structure:

Diploma in Hydropower Engineering

S.N.	Code No.	Subjects	Mode				Total Hours	DISTRIBUTION OF MARKS						Total Marks	Remarks
								Theory			Practical				
			L	T	P	Lab		Assmt. Marks	Final Marks	Time Hours	Assmt. Marks*	Final Marks	Time Hours		
1	EG 1101 SH	Communication Nepali	2				2	10	40	1.5				50	*Continuous assessment
2	EG 1102 SH	Communication English	2				2	10	40	1.5				50	
3	EG 1103 SH	Engineering Mathematics I	4	1			5	20	80	3				100	
4	EG 1104 SH	Engineering Physics I	3	1		2	6	20	60	3	10	10	1.5	100	
5	EG 1105 SH	Engineering Chemistry I	3	1		2	6	20	60	3	10	10	1.5	100	
6	EG 1101 CE	Workshop Practice I	2		10		12				120	80	4	200	
7	EG 1101 AR	Engineering Drawing I	1		4		5				60	40	4	100	
TOTAL			17	3	14	4	38	80	280		200	140		700	

S.N.	Code No.	Subjects	Mode				Total Hours	DISTRIBUTION OF MARKS						Total Marks	Remarks
								Theory			Practical				
			L	T	P	Lab		Assmt. Marks	Final Marks	Time Hours	Assmt. Marks*	Final Marks	Time Hours		
1	EG 1201 SH	Engineering Mathematics II	3	1			4	20	80	3				100	*Continuous assessment
2	EG 1202 SH	Engineering Physics II	3	1		2	6	20	60	3	10	10	1.5	100	
3	EG 1203 SH	Engineering Chemistry II	3	1		2	6	20	60	3	10	10	1.5	100	
4	EG 1221 EE	Workshop Practice II	2		8		10	0	0		120	80	4	200	
5	EG 1202 CE	Engineering Materials	5			2/2	6	20	80	3	25	0		125	
6	EG 1201 AR	Engineering Drawing II			4		4	0	0		60	40	4	100	
7	EG 1211 CT	Computer Application	2		2		4	10	40	1.5	30	20	3	100	
		TOTAL	18	3	14	5	40	90	320		255	160		825	

Diploma in Hydropower Engineering

S.N.	Code No.	Subjects	Mode				Total Hours	DISTRIBUTION OF MARKS						Total Marks	Remarks
								Theory			Practical				
			L	T	P	Lab		Assmt. Marks	Final Marks	Time Hours	Assmt. Marks*	Final Marks	Time Hours		
1	EG 2104 SH	Engineering Mathematics III	3	1			4	20	80	3				100	*Continuous assessment
2	EG 2111 CE	Surveying I	3		5		8	20	80	3	60	40	4	200	
3	EG 2102 CE	Applied Mechanics	3	2		2/2	6	20	80	3	25			125	
4	EG 2103 CE	Basic Hydraulics	3	1		2/2	5	20	80	3	25			125	
5	EG 2104 CE	Building Construction	5	1	1	2/2	8	20	80	3	30	20	3	150	
6	EG 2105 CE	Construction Drawing			4		4				60	40	4	100	
7	EG 2106 CE	Computer Aided Drafting	2		3		5	10	40	1.5	30	20	3	100	
		TOTAL	**19**	**5**	**13**	**3**	**40**	**110**	**440**		**230**	**120**		**900**	

S. N.	Code No.	Subjects	Mode				Total Hours	DISTRIBUTION OF MARKS						Total Marks	Remarks
								Theory			Practical				
			L	T	P	Lab		Assmt. Marks	Final Marks	Time Hours	Assmt. Marks*	Final Marks	Time Hours		
1	EG 2211 CE	Engineering Geology	2		1		3	10	40	1.5				50	*Continuous assessment
2	EG 2103 MG	Principal of Management and Costing	4				4	20	80	3				100	
3	EG 2212 CE	Surveying II	3		4		7	10	40	3	60	40	4	150	
4	EG 2213 CE	Estimating and Costing I	3		4		7	10	40	3	60	40	4	150	
5	EG 2203 CE	Mechanics of Structure	4	2		2/2	7	20	80	3	25			125	
6	EG 2204 CE	Soil Mechanics	4	2		2/2	7	20	80	3	25			125	
7	EG 2212 CE	Hydrology and Irrigation	3		2		5	10	40	3	30	20	3	100	
		TOTAL	**23**	**4**	**11**	**2**	**40**	**130**	**520**		**200**	**100**		**800**	

Diploma in Hydropower Engineering

S.N	Code No.	Subjects	Mode				Total Hours	DISTRIBUTION OF MARKS						Total Marks	Remarks
								Theory			Practical				
			L	T	P	Lab		Assmt. Marks	Final Marks	Time Hours	Assmt. Marks*	Final Marks	Time Hours		
1	EG 3121 EE	Basic Electrical Engineering	3		3		6	20	80	3	30	20	3	150	
2	EG 3111 CE	Estimating and Costing II	3		3		6	20	80	3	60	40	4	200	
3	EG 3103 CE	Structural Design and Drawing	5	3	2		10	20	80	3	30	20	3	150	
4	EG 3112 CE	Road Engineering	3			1	4	20	80	3				100	*Continuous assessment
5	EG 3113 CE	Water Supply and Sanitary Engineering	3	1	1		5	20	80	3				100	
6	EG 3114 CE	Hydropower Engineering I	4	1			5	20	80	3				100	
7	EG 3107 CE	Minor Project (Survey Camp)			4		4				60	40	4	100	
		TOTAL	21	4	14	1	40	120	480		180	120		900	

S.N	Code No.	Subjects	Mode				Total Hours	DISTRIBUTION OF MARKS						Total Marks	Remarks
								Theory			Practical				
			L	T	P	Lab		Assmt. Marks	Final Marks	Time Hours	Assmt. Marks*	Final Marks	Time Hours		
1	EG 3201 MG	Entrepreneurship Development	3		2		5	20	60	3	10	10	1.5	100	
2	EG 3211 CE	Construction Management	4	1			5	20	80	3	0	0		100	
3	EG 3212 CE	Estimating and Costing III	3		3		6	20	80	3	30	20	3	150	
4	EG 3213 CE	Hydropower Engineering II	4	2	2		8	20	80	3	30	20	3	150	
5	EG 3214 CE	Major Project			10		10				120	80	4	200	*Continuous assessment
6		Elective (One of the followings)	3		3		6	20	80	3	30	20	3	150	
	EG 3215 CE	A: Micro Hydropower													
	EG 3215 CE	B: Hydropower Structure													
	EG 3215 ME	C: Energy Management													
		TOTAL	17	3	20		40	100	380		220	150		850	

First Year

(First and Second Semesters)

First Semester

Subjects:

1   EG 1101 SH Communication Nepali
2   EG 1102 SH Communication English
3   EG 1103 SH Engineering Mathematics I
4   EG 1104 SH Engineering Physics I
5   EG 1105 SH Engineering Chemistry I
6   EG 1101 CE Workshop Practice I
7   EG 1101 AR Engineering Drawing I

कम्युनिकेसन नेपाली

ई.जी. ११०१ एस.एच.

वर्ष : प्रथम

सेमेस्टर : प्रथम

जम्माः २ घण्टा ⁄ हप्ता

प्रवचनः २ घण्टा ⁄ हप्ता

पूर्णांकं : ५०

कोर्षको परिचय

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

कोर्षको उद्देश्य :

यस पाठ्यांशको अध्ययनबाट विद्यार्थीहरूले निम्नलिखित भाषिक क्षमता विकास गर्न सक्नेछन्ः-

१ आफ्नो व्यावसायिक कार्य क्षेत्रमा प्रभावकारी सञ्चार गर्न ।

२ आफ्नो व्यवसायसँग सम्बन्धित विविध लेखन सीप प्रदर्शन गर्न ।

३ कार्य सम्पादनमा आवश्यक परिस्थितिजन्य संवाद गर्न ।

पाठ्यांशको विषयवस्तु

एकाइ १ः संचारात्मक नेपाली भाषा   (७)

१.१ भाषिक भेदको परिचय

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

१.२ दैनिक कार्यमा प्रयोग हुने भाषाको ज्ञान र प्रयोग

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

एकाइ २ः लेखन सीप   (१८)

२.१ बोध, शब्दनिर्माण र शब्दभण्डारको ज्ञान र अभ्यास

क) शब्द भण्डार निर्माण र अभ्यास

- उपसर्ग
- प्रत्यय, (कृत् तथा तद्धित)
- समास
- प्राविधिक तथा पारिभाषिक शब्दहरूको ज्ञान र प्रयोग

ख) प्राविधिक ⁄ पारिभाषिक शब्दहरूको शब्दस्रोत,

- वर्णविन्यास (प्राविधिक शब्दका सन्दर्भमा आवश्यक मात्र)
- अर्थ र व्युत्पत्तिका लागि शब्दकोशको प्रयोगको अभ्यास

२.२ बुंदाटिपोट, सङ्क्षेपीकरण

- बुँदा लेखन
- सारांश लेखन

२.३ *अनुच्छेद लेखन ⁄प्रतिवेदन लेखन*

२.४ **निबन्ध लेखन**

२.५ **पत्र लेखन** (निमन्त्रणा पत्र, सूचना, सम्पादकलाई चिठ्ठी र निवेदन आदि)

२.६ **संवाद लेखन**

एकाइ ३: कृति परिचय : निम्न लिखित ढाँचामा तलका कृतिको परिचय लेख्ने अभ्यास (५)

३.१ **कृति परिचयको ढांचा :**
- कृतिको नाम :
- कृतिकारको नाम :
- कृतिका मूल विषयवस्तु : (एक अनुच्छेद)
- कृतिको महत्व : (एक अनुच्छेद)
- कृतिले आफूलाई पारेको प्रभाव : (छोटो एक अनुच्छेद)
- कृतिको भाषा शैली : (छोटो एक अनुच्छेद)
- कृतिको कमी, कमजोरी र सुझाव : (छोटो एक अनुच्छेद)
- निष्कर्ष

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

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

Communication English
EG 1102 SH

Total: 2 hour/week

Year: I   **Lecture: 2 hours/week**
Semester: I   **Tutorial: hours/week**
                                                   Practical: hours/week
                                                       Lab: hours/week

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

Course Objectives:
After the completion of this subject, students will be able to:
1. Familiarize with English sound and basic structures.
2. Communicate in English language at work/job environment
3. Define and use trade related technical terminologies
4. Demonstrate situational/structural conversation essential for job performance
5. Perform various writing skills.

Course Contents:
Unit 1.   **English sound and basic structures:**   **[2]**
           1.1.   Sounds and words
- The Vowels
- The Consonants
- Phonemes
- Morphemes

           1.2.   Dictionary skills   **[5]**
- Alphabetical order
- Dictionary entry
- Guide words,
- Head word
- British and American English spelling

Unit 2.   **Introduction to grammatical units with examples:**
           2.1   Grammatical units   **[2]**
- The word
- The phrase
- The clause
- The sentence

           2.2   Types of sentence   **[2]**
- Forms
- Function

2.3   Communicative functions   [4]
- Introducing
- Requests and offers
- Expressing gratuities
- Expressing likes/dislikes
- Asking for permission
- Agreeing/disagreeing
- Encouraging/discouraging
- Inviting/making invites
- Accepting/decline
- Suggesting/advising
- Making and receiving telephone calls
- Group discussing and presentation

Unit 3.   Reading: [2]
- Reading comprehension
- Trade related

Unit 4.   Writing skills in English: [12]
4.1.   Writing paragraphs
4.2.   Writing dialogues
4.3.   Writing precise/summaries
4.4.   Writing letters
- Job application with resumes
- Leave application
- Business letters
- Orders
- Complains
- Memo
4.5.   Writing essays
4.6.   Writing technical reports
4.7.   Writing meeting minutes
4.8.   Writing Minutes
4.9.   Writing instructions
4.10. Writing technical proposal

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

Engineering Mathematics I
EG 1103 SH

	Total: 5 hour /week
Year: I	**Lecture: 4 hours/week**
Semester: I	**Tutorial: 1 hours/week**
	Practical: hours/week
	Lab: hours/week

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

Course Objectives:
After the completion of this course, students will be able to explain the concepts of the followings and apply them in the field of related engineering area
1. Trigonometric ratios and equations, inverse circular functions and properties of triangles
2. Straight lines, angle between lines, circle and parabola
3. The progressions, permutations and combinations, binomial theorem, exponential and logarithmic series as well as the quadratic and polygonal equations
4. Sets, limit and continuity, derivatives, integration and integrals.

Course Contents:

Unit 1. Trigonometry: **[12]**
- 1.1. Review of trigonometric ratios:
  - ▪ Basic trigonometric formulae
  - ▪ Identities and conditional identities.
- 1.2. Trigonometric equations:
  - ▪ Periodicity of trigonometric functions
  - ▪ General solutions of the following equations:
    - • $\sin x = k$, $\cos x = k$ and $\tan x = k$ and using trigonometric equations.
- 1.3. Inverse circular functions:
  - ▪ Domain and their graphs
  - ▪ Formulae involving inverse circular functions
  - ▪ Simple identities and equations involving circular functions
- 1.4. Properties of triangles:
  - ▪ The sin law
  - ▪ The cosine law
  - ▪ The projection law
  - ▪ The half angle formulae
  - ▪ The area of a triangle
  - ▪ The encircles and ex-circles of a triangle

Unit 2.   Coordinate Geometry: **[12]**
    2.1   Straight lines:
        ▪ The three standard forms of equations of a line.
        ▪ The linear equation: $ax + by + c = 0$.
        ▪ Any line through the intersection of two lines.
        ▪ Concurrency of lines.
    2.2   Pair of straight lines:
        ▪ Angle between two lines
        ▪ Bisectors of angles between two lines
        ▪ Pair of lines
        ▪ Homogeneous equation of second degree
        ▪ General equation of second degree representing two lines
        ▪ Angle between a pair of lines
        ▪ Bisectors of the angles for a line pair
        ▪ Lines joining the origin to the points of intersection of a curve and a line
    2.3.   Circle:
        ▪ Standard equation
        ▪ General form
        ▪ Tangents and normal
    2.4.   Parabola:
        ▪ Standard equation
        ▪ Tangents and normal

Unit 3.   Algebra: **[12]**
    3.1.   Progressions:
        ▪ A.P., G.P. and H.P.
    3.2.   Permutations and combinations
    3.3.   The binomial theorem for any index
    3.4.   Series:
        ▪ Exponential & logarithmic
    3.4.   Equations:
        ▪ Quadratic & polynomial

Unit 4.   Set relation and function: **[8]**
    4.1   Idea of set, set notations, set operations,
    4.2.   Venn diagram,
    4.3.   The set of real members and its subsets.
    4.4.   The absolute value of a real number.
    4.5.   Functions- algebraic and transcendental.
    4.6.   Graphs of simple function.

Unit 5.   Calculus: **[16]**
       5.1.   Limit of community.
       5.2.   Derivatives from definition of simple functions like:
             ■   xn, (ax+b)n, sin (ax +b), e^{ax}, a^x, and log x.
       5.3.   Derivatives of sum, difference, product and quotient of functions, chain rule, parametric and   implicit functions
       5.4.   Integration, Rules for finding integrals.
       5.5.   Standard integrals and their uses.
       5.6.   Definite integrals- definition and evaluation.
       5.7.   Definite integral as limit of sum.

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

Engineering Physics I

EG 1104 SH

Total: 6 hour /week
Year: I   **Lecture: 3 hours/week**
Semester: I   **Tutorial: 1 hours/week**
Practical: hours/week
Lab: 2 hours/week

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

Course Objectives:
After the completion of this course, students will be able to explain the basic concepts related to the followings and apply them in the field of the related engineering area.
1. Mechanics.
2. Heat and thermodynamics.
3. Optics.
4. Magnetism.

Course Contents:

Unit 1.   Mechanics: **[15 Hours]**
    1.1   Basic units and measurements:
- Measurement of physical quantities
- Introductory ideas abut dimensions of physical quantities.
- Scalar and Vector: definitions and examples, dot and cross product of two vectors
- Composition and resolution of vectors (Triangle law and parallelogram law of vectors)

    1.2   Newton's laws of motion:
- Newton's laws of motion (First, second and third laws)
- Principle of conservation of linear momentum
- Solid friction: Dynamic and rolling friction, laws of solid friction and its verification

    1.3.   Uniform circular motion:
- Angular displacement and velocity.
- Centripetal force and acceleration.
- Motion of bicycle rider

    1.4.   Gravitation:
- Newton's law of universal gravitation.
- Gravitational attraction of earth:
- Acceleration due to gravity.
- Variation of acceleration due to gravity with height, depth, and latitude.

- Motion of satellites:
  - Orbital velocity,
  - Geostationary satellites.
- Weightlessness, motion of lift
1.5. Work, energy, and power:
- Definition and units of work, energy and power.
- Potential and kinetic energy.
- Conservation of energy.
- Conservative forces.
1.6. Simple harmonic motion (SHM):
- Simple harmonic motion and its characteristics.
- Energy of simple harmonic motion.
- Simple pendulum.
1.7. Equilibrium and rotation of rigid bodies:
- Forces in equilibrium, torque, couple, C.G. and center of mass.
- Moment of inertia.
- Angular momentum and
- Its conservation.
- Work done by torque.

Unit 2.   Heat and thermodynamics: **[12 Hours]**
2.1   Heat Phenomena and Quantity of Heat:
- Concept of temperature and thermal equilibrium.
- Temperature of scales.
- Quantity of heat gain or heat loss.
- Specific heat capacity.
- Determination of heat capacity by the method of mixtures.
- Newton's law of cooling.
2.2   Change of Phase:
- States of matter.
- Fusion and vaporization.
- Evaporation and boiling.
- Specific latent heats of fusion and vaporization.
- Melting and boiling points.
- Introduction of Saturated and unsaturated vapors.
- Variation of melting and boiling points with pressure.
- Triple point and critical point.
- Dew point and humidity.
2.3   Thermal Expansion:
- Coefficients of linear, superficial and cubical expansions of solid and relation between them.
- Cubical expansion of liquids.
- Real and apparent expansions.
- Variation of density due to expansion.
2.4   Heat Transfer:
- Thermal conduction and thermal conductivity

- Convection
- Radiation.
- Perfectly black body.
- Stefan-Boltzman's law of black body radiation.
2.5 Gas Laws:
- Boyle's law,
- Charles law and ideal gas equation.
- Universal gas constant,
- Avogadro number and Boltzman constant.
- Volume and pressure coefficients of ideal gas.
2.6 Kinetic Theory of Gases:
- Pressure in an ideal gas from molecular point of view.
- RMS speed, mean energy of a molecule of an ideal gas.
2.7 Thermodynamics:
- First law of thermodynamics.
- Different thermodynamic process:
  - Adiabatic (equation and work done)
  - isothermal (equation and work done)
  - Isobaric and Isochoric
- Specific and molar heat capacities for different thermodynamic processes, $C_p - C_v = R$.
- Second law of thermodynamics.
- Efficiency of heat engine

Unit 3.   Optics: [8 Hours]
3.1 Reflection by plane surfaces
- Nature of light, sources of light
- Review of reflection by plane surfaces
- Deviation due to reflection
  - Deviation of light due to plane mirror
  - Deviation of light due to rotating mirror
3.2 Refraction by plane Surfaces:
- Review of refraction by plane surfaces.
- Lateral shift
- Total internal reflection, critical angle
- Real and apparent depth.
3.3 Reflection by Spherical Surfaces:
- Review of reflection by spherical surfaces.
- Construction of image by ray diagrams and nature of images
- Real and virtual images.
- Nature of images formed by spherical mirrors.
- Mirror formula for concave and convex mirror
3.4 Refraction through Prisms and Lenses:
- Deviation due to prism and minimum deviation.
- Refraction through lenses.
- Lens maker equation.

- Lens formula for converging lens, diverging lens
- Formation of images by lenses.
- Combination of lenses.
- Magnification,
- Power of a lens.

Unit 4.   Magnetism: **[10 Hours]**
4.1   Magnets and Magnetic fields:
- Magnetic poles, magnetic moment, magnetic axis, and magnetic meridian.
- Magnetic field.
- Coulomb's law for magnetism.
- Magnetic field due to magnetic poles and bar magnets.
- Intensity and flux density of magnetic field.
- Neutral point.
- Tangent law.
4.2.   Earth's Magnetism:
- Horizontal and vertical components of earth's magnetic field.
- Declination and angle of dip.
4.3.   Magnetic properties of materials;
- Molecular and modern theory of magnetism.
- Para magnetism and diamagnetism:
  - Permeability and
  - Susceptibility.
- Intensity of magnetization.
- Domain theory of ferromagnetism.
- Hysteresis

Engineering Physics Practical I   **[30 Hours]**
1. Determine volume of hallow cylinder by using vernier calipers.
2. Determine density of a steel / glass ball by using screw gauge.
3. Determine thickness of glass plate using spherometer and calculate the area by using millimeter graph paper.
4. Determine the acceleration due to gravity by using simple pendulum.
5. Determine the magnetic movement of a bar magnet by using deflection magnetometer.
6. Determine the refractive index of the material of prism.
7. Determine specific heat capacity of solid by the method of mixtures.
8. Determine specific latent heat of ice by the method of mixtures.
9. Determine specific gravity of different solids by up thrust method.
10. Determine focal length of a converging lens by displacement method.

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

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

Engineering Chemistry I
EG 1105 SH

Year: I
Semester: I

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

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

Course Objectives:
After the completion of this subject, students will be able to explain the basic concepts related to the followings and apply them in the field of related engineering works:
1. General chemistry
2. Language of chemistry
3. System of classification

Course Content:

Unit: 1:   Language of chemistry: [4 Hours]
- 1.1   Symbol:
  - Definition
  - Significance (qualitative and quantitative)
- 1.2   Formula:
  - Definition
  - Significance (qualitative and quantitative)
  - Concept of valency in terms of combining capacity with H_2, O_2, and Cl_2
  - Variable valency (ref. Fe, Sn, Pb, Cu, Hg, S and N)
  - Radicals (electro- positive and electro - negative)
  - Writing a formula
- 1.3   Chemical equation:
  - Definition
  - Types requisites
  - Significance and limitation
  - Balancing of chemical equation by hit and trial method and Partial equation method

Unit: 2:   General chemistry: [8 Hours]
- 2.1   Atom and molecule:
  - Definition
  - Dalton's atomic theory and modern position of the theory
- 2.2   Atomic weight:
  - Definition
  - Determination of atomic weight by Dulong and Petit's method and

Related numerical problems
2.3   Molecular Weight:
- Definition
- Avogadro's hypothesis
- Application of Avogadro's hypotheses (Mol. $Wt = 2 \times V.D.$, in the deduction of atomicity of elementary gases H_2, Cl_2, O_2, and N_2)
- Molecular weight determination by Victor Meyer's method and Related numerical problems

2.4   Equivalent weight:
- Definition
- Equivalent weight of element, acid, base and salt
- Equivalent weight determination by hydrogen displacement method and oxide method.
- Numerical relation between equivalent weight, atomic weight and valency
- Some related problems of equivalent wt. (From Hydrogen displacement method and oxide method)

2.5   Simple mole concept:
- Mole of an atom
- Mole of a molecule
- Molar volume and
- Simple calculation on mole concept

Unit: 3:   System of classification: **[33 Hours]**

3.1   Acid, Base and Salt:
- Arrhenius concept of acid and base
- Lowry and Bronsted concept of acid and base
- Conjugate acid and base
- Amphoteric nature of water
- Lewis concept of acid and base
- Properties of acid and base.
- Definition of Salt
- Types of salt (normal, acidic and basic)
- Concept of hydrogen ion concentration, pH value and pH Scale
- Buffer solution.

3.2   Volumetric analysis:
- Definition of titration (acidimetry and alkalimetry),
- Indicator
- End-point (neutralization point)
- Standard solution (primary and secondary standard solution), Normal, Decinormal, Molar, Molal solution
- Requisites of primary standard substance
- Volumetric equation,
- Express the strength of solution Normality, Molarity, Molality, gram per litre and percentage and related numerical problems

3.3 Periodic table:
- Mendeleef's periodic law
- Mendeleef's periodic table
- Characteristics of groups and periods in the table
- Advantages and anomalies of the periodic table
- Modern periodic law

3.4 Electronic theory valency:
- Assumptions
- Types
- Electrovalency eg. NaCl, MgO, CaS
- Covalency eg. H_2, O_2, N_2, CH_4, H_2O, NH_3, C_2H_2
- Coordinate co-valency eg.H_2O_2, SO_2, O_3, SO_3)
- Electronic dot structure of some compounds eg.H_2SO_4, $CaCO_3$, K_2SO_3

3.5 Electrolysis:
- Definition of electrolyte, non-electrolyte and electrolysis
- Faraday laws of electrolysis,
- Application of electrolysis (electroplating and electro refining)
- Electrolysis of acidulated water

3.6 Oxidation and reduction:
- Classical definition
- Electronic interpretation
- Oxidizing agent: Definition and eg O_2, O_3, oxyacids, halogens, $K_2Cr_2O_7$, $KMnO_4$
- Reducing agent: Definition and eg. H_2, H_2S with some examples,
- auto-oxidation eg.H_2O_2, HNO_2, SO_2
- Idea of oxidation number
- Balancing chemical equation by oxidation number method

3.7 Atomic structure:
- Subatomic particles (electron, proton and neutron)
- Classical α - rays scattering experiment
- Rutherford's atomic model and its drawbacks
- Bohr's atomic model (postulates only)
- Composition of nucleus
- Mass number and atomic number
- Isotopes and isobar
- Arrangement of electron (Bohr - Bury Scheme)
- Concept of shell and sub shell,
- Electronic Configuration and atomic structure of Some elements (Atomic no. 1 to 30)
- Hund's rule
- General idea of quantum number and Pauli's exclusion principle

3.8 Corrosion:
- Definition
- Types
- Direct and indirect method and prevention against corrosion

3.9　　Activity and electrochemical series:
　　　　　　▪ Definition
　　　　　　▪ Action of water, acid and oxygen on metals.

Engineering Chemistry Practical I **[30 Hours]**
1.　　Simple Glass Working　　　　　　　　　　　　　　　　　　　　[6 Hours]
　　　a. to cut the glass tube into three equal parts and round up their shape edges
　　　b. to bore a hole through a cork
　　　c. to bend the glass tubing into acute, obtuse and right angle
　　　d. to draw a jet and capillary tube
　　　e. to fit up a wash bottle
2.　　To separate sand and copper sulphate crystals in pure and dry state from the mixture of
　　　sand and copper sulphate　　　　　　　　　　　　　　　　　　[2 Hours]
3.　　To separate sand and calcium carbonate in pure and dry state from the mixture of sand
　　　and calcium carbonate　　　　　　　　　　　　　　　　　　　[2 Hours]
4.　　To prepare pure water from supplied impure water by distillation and o test the purity
　　　of the sample prepared　　　　　　　　　　　　　　　　　　　[2 Hours]
5.　　To neutralize dilute sulphuric acid with sodium carbonate solution, and to recover crystals
　　　of sodium sulphate　　　　　　　　　　　　　　　　　　　　[2 Hours]
6.　　To obtain pure and dry precipitate of barium sulphate by treating excess of dilute
　　　sulphuric acid with barium chloride solution　　　　　　　　　　　[2 Hours]
7.　　To investigate the composition of water by electrolysis by using Hofmann's apparatus
　　　[2]
8.　　To determine the equivalent weight of reactive metal by hydrogen displacement method.[2 Hours]
9.　　To determine the pH of different unknown solution and using pH paper and universal
　　　indicator　　　　　　　　　　　　　　　　　　　　　　　　[2 Hours]
10.　　To prepare primary standard solution of sodium carbonate and to use it to standardize
　　　an approximate decinormal acid solution　　　　　　　　　　　　[2 Hours]
11.　　To standardize given unknown acid (Approx N/10) solution by preparing standard
　　　alkali solution. (Expression of strength in different ways)　　　　　[2 Hours]
12.　　To standardize given unknown alkali (approximately N/10) solution with the help of
　　　by preparing standard acid solution. (Expression of strength in different ways)　　[2 Hours]
13.　　To carry out conductivity experiments on solids and liquids ($CuSO4$, Zn, Mg, Al, Fe,
　　　CCl_4, C_6H_6, C_2H_5OH)　　　　　　　　　　　　　　　[2 Hours]

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

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

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

Workshop Practice I
EG 1101 CE

Year: I   **Total: 12 hours /week**
Semester: I   **Lecture: 2 hours/week**
                                                 Tutorial: hours/week
                                        Practical: 10 hours/week
                                                  Lab: hours/week

Course description:
This course intends to impart basic knowledge and skills on bricklaying and plumbing works.

Course objectives:
After the completion of this course students will be able to:
1. Understand the basic concept of brick laying;
2. Understand the basic concept of household plumbing:
3. Perform different bricklaying works and
4. Learn simple plumbing joining and installation works.

Part 1: Bricklaying

                                       Total: 6 hours /week
                                       Lecture: 1 hour/week
                                       Tutorial: hours/week
                                       Practical: 5 hours/week

Course description:
This part of the course focuses on familiarization of bricklaying and its standard requirements to be used on to-days construction. It also deals with pointing and curing works.

Course objectives:
After the completion of this course students will be able to:
1. Understand the concept of bricklaying;
2. Identify major operation related to civil engineering works;
3. Identify and select the tools and equipment required for bricklaying and
4. Perform differentbricklaying works on different bonding patterns.

Course Contents:
<div align="center">

Theory
</div>

Unit 1 Introduction of Bricklaying: **[1 Hour]**
    1.1.   History of Bricklaying
    1.2.   Importance of Bricklaying
    1.3.   Scope of Bricklaying
    1.4.   Types of Walling (Bricklaying)
    1.5.   Beauty of Bricklaying (Aesthetics of Bricklaying)

Unit 2 Observation of Safety Precaution: [1 Hour]
  2.1. Use of protective clothing and equipments
  2.2. Demonstration of safe working habits
  2.3. Maintaining tools and equipment
  2.4. Awareness of personal safety and safety of others in all aspects of works
  2.5. Observation of workshops safety rules and regulations
  2.6. Fire safety and electrical shocks protection

Unit 3 Identifying Bricklaying Materials: [2 Hours]
  3.1. Identifying Bricks in common use
  3.2. Identifying Bricks in Chinese bricks/Dachi Bricks
  3.3. Identifying Bricks in hand made bricks
  3.4. Identifying Bricks in 5% cement added sun dried soil bricks
  3.5. Identifying various types of tiles used in flooring and paving outside of buildings
  3.6. Identifying sand used in Bricklaying
  3.7. Identifying Lime/Cement used in Bricklaying
  3.8. Identifying Portland cement used in Masonry
  3.9. Identifying amount of water used in mixing Mortar/concrete
  3.10. Identifying admixture and their properties.

Unit 4 Proper use of Hand Tools: [1 Hour]
  4.1. Bricklaying Hand tools :- trowel, pointing trowel, plum bob, sprit level, line and pin/corner block, Mason's line, Straight edge/storey rod, Gang rod, Club Hammer, Bolster and closer or bat gauge etc.

Unit 5 Proper use of Bricklaying Equipment/Machines: [1 Hour]
  5.1. Shovel, spade, wheel barrow, buckets, jugs, sponge, Hesign Rags, Foam, Runner/Jointer, Mortar Boards, Mortar pan and Brooms for cleaning floor
  5.2. Protective equipment e.g. Hand gloves Goggles ear plugs and Mask etc
  5.3. Mortar mixer, electric drill and bits, rope and nails
  5.4. Bamboo and rope
  5.5. Tubular scaffolding pipe and fittings

Unit 6 Constructing Walls using Bricks in limemortar English Bond: [2 Hours]
  6.1. Building ½ Brick (4.5" thick wall) to stretcher Bond
  6.2. Building 1 Brick (9" thick wall) to English Bond
  6.3. Building 1.5 Brick (14" thick wall) to English Bond
  6.4. Building 2 Brick (18" thick wall) to English Bond

Unit 7 Constructing Walls in Various types of Bond: [2 Hours]
  7.1. Flemish Bond-1 Brick thick, 1.5 Brick and 2 brick thick double Flemish bond wall.
  7.2. Making of one end stopped and other end racked back.
  7.3. Constructing cavity wall, 12" thick making cavity of 3" wide.
  7.4. Constructing rat trap bond 1 brick thick (9" thick wall)

Unit 8 Demonstrating various Types of Bond: **[2 Hours]**
    8.1.   Function of Bond
    8.2.   Bond types
    8.3.   Design of Bond patterns
    8.4.   Designs of wall faces showing various wall textures
    8.5.   Design of wall faces using various types of bricks

Unit 9 Demonstrating various Types of Pointing: **[1 Hour]**
    9.1.   Mortar for pointing/Ratio and proportion
    9.2.   Pointing procedure
    9.3.   Pointing as the work proceeds
    9.4.   Pointing after the Brick work is completed
    9.5.   Types of pointing:
        (a) flush pointing
        (b) Struck joint or pointing
        (c) Weather struck and cut pointing
        (d) Rounded or tooled pointing
        (e) Recessed pointing
        (f) Tuck pointing
        (g) V-joint pointing
        (h) Purpose of pointing
        (i) Advantage of pointing.

Unit 10 Curing Walls: **[1 Hour]**
    10.1. Curing wall both side by water pouring from top
    10.2. Curing wall both side by sprinkling water at face
    10.3. Temporary covering wall by heavy rain, frost and dirty materials nearby building operation
    10.4. Liquid curing in hot climate
    10.5. Cleaning wall by chemicals and acids

Unit 11 Building Foundation Footing Courses Wall (Square footing):   **[1 Hour]**
    11.1. 2.5 Bricks*2.5 Bricks square footing
    11.2. 3.5 Bricks*3.5 Bricks square footing
    11.3. 3.0 Bricks*3.0 Bricks square footing
    11.4. Purpose and advantage of foundation footing

Practical

Project-1 Identify/enumerate/ handle tools/equipment/materials related to bricklaying.

[3 Hours]

Project-2   **[6 Hours]**
2.1.Prepare workshop floor areas
2.2.Set out work area
2.3.Position materials/tools
2.4.Prepare mortar

Project -3   **[8 Hours]**
3.1.Handle motor, pick up motor, handling brick trowel properly positioning yourself, layout line spread motor, furrow mortar, pick up bricks and lay bricks to line. Watch bond.

Project -4   **[6 Hours]**
4.1.Lay stretcher bond wall making 4 bricks long and 6 courses high using gangue rod properly.

Project -5   **[6 Hours]**
6.1.Build English bond wall 1 brick thick (9") up to 7 courses high to gauge and pointing to appropriate dimensions.

Project -6   **[6 Hours]**
6.1.Build Flemish bond wall up to 6 courses high to gauge and pointing to appropriate dimensions.

Project -7   **[10 Hours]**
7.1.Build 1.5 brick thick (14") wall to English bond return corner of English bond. One end ranked back and other end completely stopped as per given dimensions, up to five courses high.

Project -8   **[6 Hours]**
8.1.Build a T-junction wall of English Bondpattern as per given dimensions up to 6 courses high.

Project -9   **[12 Hours]**
9.1.Construct cavity wall showing 3" thick cavity using butterfly wall ties providing cavity clean using cavity clean batten or board, dry bond only.

Project -10   **[12 Hours]**
10.1. Construct a rattrap bond wall making 9" thick (1 brick thick wall) up to 6 courses high showing internal trap clear, dry bond only.

References:
1. Brick work vol 1 -W.G. Hash, A.L.O.B.   M.R.S.H, Senior lecturer in building Collage of Technology Southampton, England, Hutchinson Technical Education Press.
2. गारो लगाउने प्रविधि- मोहनमान व्यन्जनकार

Total: 6 hours /week
Lecture: 1 hour/week
Tutorial: hours/week
Practical: 5 hours/week

Courses description:
This part of the course focuses on familiarization of plumbing works related to civil constructions. It also includes basic knowledge and skills on welding and bar bending.

Course objectives:
After the completion of this course students will be able to:
1. Apply operating systems of plumbing works;
2. Identify the tools and equipment required to plumbing works;
3. Perform simple pipe fittings works and
4.   Prepare the PVC fittings.

Course Contents:

Theory

Unit 1 Introduction of Plumbing: **[1 Hour]**
1.1. History of plumbing.
1.2. Importance of plumbing
1.3. Plumbing and sanitary
1.4. Scope of plumbing

Unit 2 Plumber's Hand Tools: **[2 Hours]**
2.1.   Pipe wrench of size 12", 9", and up to 18" long.
2.2.   Pair of footprints.
2.3.   Stocks and dies, up to 2" diameter, replacement of cutters
2.4.   Wrench chain
2.5.   Hack's saw frame and blade
2.6.   Measuring tape
2.7.   Soldering iron
2.8.   Tin snips
2.9.   Rasp
2.10. Caulking iron
2.11. Adjustable wrench up to 12 long.
2.12. Claw hammers /Ball pin hammer/Claw hammer
2.13. Pipe cutter-use and care adjustment of cutting wheels.
2.14. Drilling machine and its bits.
2.15. Pipe vise
2.16. Bench vice
2.17. Spanners of various size
2.18. Folding rules metallic/steel

2.19. Try square, Vernier caliper   joining elements:- Nuts, bolts, washer, pins, screws and rivets and jute/pipe tape and lead.

Unit 3 Galvanized Pipe Fittings/PVC fittings: [2 Hours]
3.1. G.I pipe nipples
3.2. G.I. elbows
3.3. G.I tee
3.4. G.I cross
3.5. G.I reducing elbow
3.6. G.I reducing tee and reducing cross
3.7. G.I sockets
3.8. G.I reducing sockets
3.9. G.I lock nut
3.10. G.I plugs or caps
3.11. Flange unions (Gasket)
3.12. G.I gate valve (heavy and light)
3.13. Foot valve/Glove valve
3.14. Pipe tape
3.15. Float valve or ball valve.

Unit 4 Pipe Threading to Dimension: [2 Hours]
4.1. Fixing pipe to pipe vice
4.2. Measuring pipe to millimeter
4.3. Measuring methods
4.4. Die holding/threading methods
4.5. Die checking/cleaning/oiling
4.6. Die tightening and loosing/fixing cutter
4.7. Checking accurate threading and its sharpness
4.8. Doing loosen the die fixing the pipe to die and repeat the threading twice for sharpness. (Repeat)

Unit 5 Assembling the Threaded Pipe to Fittings with Pipe Tape as per Drawing:
[2 Hours]
5.1. Visualization of drawing in detail
5.2. Collecting the fittings
5.3. Collecting the threaded pipes in position
5.4. Fixing the fittings with pipe tape to pipe in position
5.5. checking the tightness/testing pipe joints
5.6. Adjusting measurement
5.7. Marking, laying, using chalk line to wall/floor/ceiling
5.8. Accurate pipe cutting with margin of necessary threads to pipe
5.9. Fixing pipe to pipe vice
5.10. Positioning techniques.

Unit 6 Making up H.D.P fittings: **[2 Hours]**
    6.1.   Definition of HDP pipe and fittings
    6.2.   Collecting hot plate with power
    6.3.   Collecting HDP pipe with necessary diameters
    6.4.   using miter box cutting pipe to 90^0
    6.5.   Clean, trim and weld the two halves of pipe to form 90^0 elbow (L)
    6.6.   Making Tee
    6.7.   Making Wyes (Y)

Unit 7 Introduction of Welding: **[2 Hours]**
    7.1.   Electric power needed for welding
    7.2.   Welding rods
    7.3.   Welding safety rules
    7.4.   Arc welding equipments, accessories and protective gear
    7.5.   Welding Techniques
    7.6.   Types of welding
    7.7.   Principles of gas opening and its use
    7.8.   Gas welding techniques
    7.9.   Forging techniques

Unit 8 Bar Bending Works: **[1 Hour]**
    8.1.   Straight making bars methods
    8.2.   Bar tying methods.
    8.3.   Categories of bars, e.g. Mild steel bar T.O.R steel bar and TORKARI bars.
    8.4.   Making L(Hook) procedure to Hook making die and bench
    8.5.   Making 45 degrees crank procedure
    8.6.   Making chair to fix reinforcement methods
    8.7.   Making overlaps to steel bars.

Unit 9 Fixing or Fastening Rods to Wire: **[1 Hour]**
    9.1.   Single knot tying to slab methods
    9.2.   Double knot tying to slab methods
    9.3.   Tying to beam methods
    9.4.   Tying to column methods
    9.5.   Checking tightness of stirrups to main bar loops
    9.6.   Making stirrups or rings

Practical

1. Identify/enumerate/use hand tools and equipments [3 Hours]
2. Demonstrate pipes, plates to shape and size. [3 Hours]
3. File to clean pipe end (mouth). [3 Hours]
4. Cut/thread G.I pipe to given dimensions. [4 Hours]
5. Make nipples to appropriate standard. [2 Hours]
6. Make and assemble using various pipes as Elbow, Union and tee in a Rectangular Loop. [4 Hours]
7. Cut /join H.D.P. pipe and PVC pipe. [4 Hours]
8. Make L, cross and T bends project of PVC pipe [4 Hours]
9. Join PVC fittings with PVC pipe. [4 Hours]
10. Install PPR pipe with fittings. [4 Hours]
11. Install CPVC pipe with fittings. [4 Hours]
12. Perform internal (below ground level) pipe layout and assembling fittings using pipe tape for water supply or sanitation works. [12 Hours]
13. Perform external (wall) pipe layout and joining fittings for water supply. [12 Hours]
14. Tie reinforcement of 12 mm ø rods of tor steel @ 6"c/c spacing for a basement RCC footing slab of 1 mx1m size showing 15cm (L) at its ends,and tie the rods in a double knot method. [6 Hours]
15. Weld two plates of 10mm thick together making butt joint, do filing on it. [6 Hours]

References:

1. Birdie G.S., Birdie J.S. *Water Supply and Sanitary Engineering*,
2. Deolakar S.G., *Plumbing Design and Practice*, Tata Mc Graw-Hill Publishing Company Limited, 1994.
3. McConnell, Charles, *Plumbers and pipe Fitters Library, volume I, II, and III*, Macmillan Publishing Company, 1986.
4. Plumbing practice – book (vol. 1) by James D. Tailor, I.L.O. expert 1975.

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 Hours]
 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: [1 Hour]
 2.1 Lettering
       2.1.1   Introduction of single stroke letter and their ratio between height and breadth.
       2.1.2   Introduction of upper and lower case letter.
       2.1.3   Introduction of Vertical and inclined (*italic*) letter (with inclined angle).
       2.1.4   Practical exercise of letter writing using the guide lines of vertical and italic letter, (Sheet No 2).

2.2 Scale [1.5 Hours]
    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 Hour]
    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 Hours]
   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 Hour]
   Introduction of following curves:
   4.1 Involutes
   4.2 Spiral
   4.3 Cycloid
   4.4 Helices

Unit 5: Conic- Section: [1 Hour]
   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 Hours]
      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 Hour]

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 Hour]

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 Hours]

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

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

Practical (Class work sheet)

Sheet No: 1 [6 Hours]

1. Draw horizontal, vertical, inclined (45°, 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 Hours]

1. Practice free hand lettering exercise on upper and lower case vertical letter using horizontal and vertical guide line (at least one set).

2. Practice free hand lettering exercise on upper and lower case inclined letter with numerical using the horizontal and vertical guide line (at least one set).

3. Practice free hand lettering exercise on upper case letter using horizontal guide line of different height letter of 10 to 3mm height.

4. Draw symbols of general civil /electrical/ plumbing work.

5. Perform paper size scheduling work (A0 to A4 size).

Sheet No: 3 [3 Hours]

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

2. Performscale construction

Sheet No: 4   **[9 Hours]**
1. Perform Line- bisection, trisection, line division any number of parts, with proportional division, circle division in three, four five, six, seven and eight parts, area of triangle and trapezoid division any number of equal parts.
2. Construct triangle by given sides, making equilateral triangle/square and regular Polygons (pentagon, hexagon, heptagon etc.)
3. Find the centre of Arc, making the circle touching the three points. Describing the circle on triangle, inscribe the circle in right angle triangle, Equilateral triangle, and scalene triangle and inscribing the circle in a sector.
4. Draw tangent from any point on circle, open and crossed line (belt) tangent. Arc Tangent-Internal, External and combined.

Sheet No: 5   Draw: **[6 Hours]**
1. Involutes- Line, triangle and circular involutes with tangent.
2. Spiral construction (mentioning the pole, vector radius, vector angle and Convolution)
3. Cycloid – Cyclodical curve with tangent
4. Helices- Cylindrical helix with pitch angle, conical helix.

Sheet No: 6 Draw: **[6 Hours]**
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 Perform/draw: **[6 Hours]**
1. Point projection- Point projection by given location by first and third angle projection (At least two exercise)
2. Line projection-perpendicular to one plane and parallel to other plane, parallel to both planes, parallel to both plane inclined to one or both planes.

Sheet No: 8 Perform/draw**:**   **[3 Hours]**
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 Perform/draw: **[3 Hours]**
1. Solid projection-Orthographic projection of simple geometrical solid in first and third angle projection.

Sheet No: 10   **[12 Hours]**
1. Analyze the view and draw orthographic projection of flat, inclined and circular surfaced model (At least15 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.

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 1221 EE	Workshop Practice II
5	EG 1202 CE	Engineering Materials
6	EG 1201 AR	Engineering Drawing II
7	EG 1211 CT	Computer Application

Engineering Mathematics II
EG 1201 SH

Total: 4 hour /week

Year: I **Lecture: 3 hours/week**

Semester: II **Tutorial: 1 hours/week**

Practical: hours/week

Lab: hours/week

Course Description:

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

Course Objectives:

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

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

Course Contents:

Unit 1. Vectors: **[9]**
   1.1. Vectors in plane, addition and subtraction.
   1.2. Composition and decomposition of vectors.
   1.3. Vectors in space.
   1.4. The unit vectors i, j, k
   1.5. Product of two vectors-
     • dot product,
     • cross product,
   1.6. Simple applications.

Unit 2. Algebra: **[15]**
   2.1. Complex number in the from A+ ib.
     • Algebra of complex numbers.
     • Polar representation of complex numbers.
   2.2. De Moivre's theorem and its applications

2.3. Linear inequalities and their graphs.
- System of linear inequalities in two variables,
- System of linear inequalities in two variables,
- Linear programming: Problems involving two variables under given linear constraints

2.4. Determinants and matrices,
- Algebra of matrices,
- Properties of determinants,
- Ad joint and inverse of matrices.
- Solution of linear equations using cramers' rule
- Row equivalent matrices
- Idea of polynomial equations

Unit 3. **Calculus:** [9]

3.1. Applications of derivatives-
- Tangents and normal to a curve taking slope as derivative
- Maxima and minima of a function
- Derivative as rate of change

3.2 Areas under curves:
- Use of definite integral as limit of a sum to find areas under curves
- Areas of closed curves and
- Areas between curves.

3.3 Antiderivatives:
- Curve tracing, maxima and minima
- Rieman sums & integral
- Application of fundamental theorem

Unit 4. **Geometry:** [6]

4.1. Coordinates in space,
4.2. Coordinates in planes.

Unit 5. **Statistics:** [6]

5.1. Statistics:
- Introduction to statistics
- Measures of Central Tendency
- Measures of Dispersion
- Moments, Skew ness and Kurtosis
- Correlation and Regression

5.2. Probability:
- Concept of Probability
- Concept of conditioned probability
- Concept of independent and dependent events
- Concept of mutually exclusive events

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

Engineering Physics II
EG 1202 SH

Year: I
Semester: II

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

Course Description:

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

Course Objectives:

After the completion of this course, students will be able to:
1. Explain the basic concepts related to the electricity and apply it in the field of the related engineering area
2. Explain the basic concepts related to the waves and apply it in the field of the related engineering area
3. Explain the basic concepts related to the properties of matter and apply it in the field of the related engineering area
4. Explain the basic concepts related to the modern physics and apply it in the field of the related engineering area.

Content Contents:

Unit 1.   **Electricity:**   **[16]**
       1.1.   Electrostatics:
- Elementary charge, charging and induction.
- Faraday's ice-pail experiment.
- Idea of electric field
- Lines of forces.
- Coulomb's law.
- Intensity of electric field.
- Electrostatic potential, equipotential.
- Surfaces.
- Potential and field strength.
- Potential gradient.
- Action of point.
- Van de Graaf generator.
- Capacitors.
- Different types of arrangement of capacitors.
- Energy storage.
- Action of dielectrics

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

1.3. Magnetic effect of current and electromagnetism:
- Magnetic forces and magnetic field of current:
- Force experienced by charge moving in magnetic field.
- Maxwell's crockscrew rule.
- Force applied by magnetic field on current carrying conductor.
- Torque on current carrying coil in magnetic field.
- Theory of moving coil galvanometer.
- Biot-Savart's Law
  - Field due to a long straight conductor and due to circular coil.
  - Force between two parallel conductors carrying current.
- Ampere's law
  - Magic field due to the solenoid and long straight conductor.
- Electromagnetic induction:
- Faraday's law of electromagnetic induction and Lenz's law.
- Phenomenon of self-induction.
- A.C. generator.
- D.C. generator.
- Transformer.

1.4 Alternating current:
- Instantaneous and effective values of current and voltage.
- Phase between current and voltage across different elements of circuit.
- Capacitive and inductive reactance.

- Impedance.
- Resonance.
- Power in a.c. circuit

Unit 2. Waves: [9]
2.1. Wave motion:
- Wave motion.
- Types of wave motion
- Characteristics of wave motion
- Wavelength, frequency and speed of waves
- Speed of waves in different media.
- Velocity of sound in air.

2.2. Wave phenomena:
- Sound waves.
- Beats and their formation.
- Progressive waves.
- Stationary waves.
- Waves in strings and pipes: fundamental vibrations and overtones.
- Intensity of sound.
- Intensity level.
- Inverse square law.

2.3. Physical optics:
- Interference of light waves and coherent sources.
- Phase difference and path difference. Young's double slit experiment.
- Introduction of Diffraction of light waves.
- Introduction of of Huygen's principle.
- Polarization and un polarized lights, polarization by reflection(Brewster's law)

Unit 3. Properties of matter: [10]
3.1 Elasticity:
- Elasticity, Hook's law, Young's modules, Bulk modulus
- Elasticity of shear.

3.2 Surface tension:
- Intermolecular attraction in liquid, surface tension.
- Cohesion and adhesion, angle of contact, capillary action
- Coefficient of surface tension and surface energy (Only introduction).

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

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

      4.1   Atomic physics:
- Photons, Photoelectric effect, Einstein's photoelectric equation and stopping potential for photoelectrons.
- Motion of charged particles in simultaneously applied electric and magnetic fields, e/m for electron, Milliken's oil drop experiment. Bohr model for hydrogen atom. Energy level diagrams and spectral series.
- X-rays:Production, nature and uses.
- Laser (introduction only)

      4.2   Semiconductors:
- Energy states of valent electrons in solids, energy bands.
- Semiconductors, intrinsic and doped, p-type and n-type semiconductors.
- Majority and minority carries.
- Acceptors and donors, p-n junction, diode and depletion layer, forward and reverse bias.
- Rectifying property of diode
- Transistor and it's uses

      4.3   Nuclear physics:
- Laws of radioactive disintegration: half life, mean life, and decay constant.
- Stable and radioactive nuclei.
- Binding energy and mass defect
- Fission and fusion.

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

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

Learning materials:

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

Text book for laboratory work:
1. Physics Practical Guide by U.P. Shrestha, RPB

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

Engineering Chemistry II
EG 1203 SH

Total: 6 hour /week
Year: **I**   **Lecture: 3 hours/week**
Semester: II   **Tutorial: 1 hours/week**
Practical: hours/week
Lab: 2 hours/week

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

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

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

Course Content:

Unit: 1:   **Non-metals and their compounds:**   **[20]**
        1.1   Water:
- Source of water
- Hard and soft water
- Removal of temporary and permanent hardness of water
- Water treatment of domestic and industrial purpose

        1.2   Ammonia:
- Lab preparation
- Manufacture by Haber's process
- Properties and uses

        1.3   Nitric acid:
- Manufacture by Ostwald's process
- Properties and uses.
- Nitrogen cycle
- Fixation of Nitrogen
- Chemical fertilizers
- Oxides of nitrogen as pollutant (general concept)
- Acid rain (due to oxides of nitrogen and oxide of Sulphur "Sulpher dioxide")

        1.4   Halogens (Chlorine):
- Lab preparation
- Properties and uses

        1.5   Hydrochloric acid:
- Lab preparation

- Properties and uses
- 1.6 Hydrogen Sulphide:
  - Lab preparation
  - Properties and uses
- 1.7 Sulphuric acid:
  - Manufacture by contact process)
  - Properties and uses
- 1.8 Carbon and its compounds:
  - Allotropes of carbon (reference of diamond & graphite & their structure).
  - Oxides of carbon (Ref. carbon dioxide & carbon mono oxide as pollutants)- general idea only

Unit: 2: Metals and their compounds: **[15]**
- 2.1 General study of metals and their components:
  - Difference between metal and non-metal
  - Combined & free state of metals
  - Chemistry of Metallic Carbonates, Sulphates, Chlorides and Nitrates
- 2.2 Alkali metals:
  - General characteristics of Alkali metals
  - Properties & uses of sodium
- 2.3 Alkaline earth metals:
  - General characteristics of the Alkaline earth metals
  - Properties & uses of calcium
- 2.4 Aluminum:
  - Properties and uses
- 2.5 Coinage metals:
  - General properties of coinage metals
  - Properties and uses of cupper
- 2.6 Zinc:
  - Properties & uses
- 2.7 Iron:
  - Properties & uses
- 2.8 Lead:
  - Properties & uses
- 2.9 Alloys:
  - Definition
  - Purpose of making alloys
  - Types of alloys

Unit: 3: Organic compounds and synthetic materials: **[10]**
- 3.1. Organic compounds
  - Organic compounds:
    - Historical background, classification, and nomenclature
    - Functional groups and homologous series
  - Saturated hydrocarbon: Properties of Methane

- Unsaturated hydrocarbon: Properties of Ethylene and Acetylene
- Aromatic compounds:
  - Definition
  - Comparison of aliphatic and aromatic compounds
  - Properties of Benzene

3.2. **Synthetic materials:**
- Polymer and polymerization
  - Definition
  - Types of polymer
- Rubber:
  - Types (Natural and Synthetic)
  - Preparation and uses.
- Polyvinyl chloride (PVC):
  - Preparation and uses
- Polythene:
  - Preparation and uses

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

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

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

Workshop Practice II
EG 1221 EE

Year: I   **Total: 10 hours /week**
Semester: II   **Lecture: 2 hours/week**
                                                                Tutorial: hours/week
                                                                Practical: 8 hours/week
                                                                Lab: hours/week

Course description:
This course intends to impart basic knowledge and skills on electricity and manufacture works.

Course objectives:
After the completion of this course students will be able to:
1. Understand the basic concept of electricity;
2. Understand the basic concept of manufacturing;
3. Perform house wiring works and
4. Understand the use of measuring instruments
5. Perform machine tool operations.

Part I: Electricity

                                                                Total: 5 hours /week
                                                                Lecture: 1 hour/week
                                                                Tutorial: hours/week
                                                                Practical: 4 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. Understand the concept of 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: Introduction of electricity   **[1 Hour]**
    1.1.History of electricity
    1.2.Generation of electricity
    1.3.Scope of electricity
    1.4.Types of current

Unit 2: Fundamentals of electric circuits [4 Hours]

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 Hours]

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 Hour]

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. Miniature 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 Hours]

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 Hour]

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

Unit 7: Earthing   [2 Hours]
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 Hours]
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: [6 Hours]
1.1 Simple electrical drawings
1.2 Free hand plan/schematic diagram
1.3 Layout diagram
1.4 Wiring diagram.

Project 2: Connect Lighting Circuits on Board:
2.1. With one-way switch one light and one socket   [6 Hours]
2.2. With two-way switch two lights and two sockets   [6 Hours]
2.3. With intermediate switches, two fluorescent lamps   [6 Hours]
2.4. With multi-position switches and incandescent lamps   [9 Hours]
2.5. With Dimmer switches and incandescent lamps.   [9 Hours]
2.6. With time switches and lamps   [6 Hours]

Project 3: Connect the Following Signal Circuits:
3.1. With electrical bell   [4 Hours]
3.2. With electric door opener   [4 Hours]
3.3. Ceiling fan with fan regulator   [4 Hours]

References:
1. Introduction of Electricity Vol. I, by N.B.Malla
2. S.K.Malice, *Electric Trade Theory and Practical*

Part II: Manufacturing

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

Course description:
This part of the course focuses on familiarization of use basic hand tools and operations of machine tools. It intends to provide knowledge and skills on field of basic workshop technology. It deals with different hand and machine tools required for manufacturing simple metal components and articles.

Course objectives:
After the completion of this course, students will be able to:
1. Apply the safety rules in the workshop;
2. Identify the tools measuring instrument;
3. Acquire knowledge and use simple measuring and gauging instruments
4. Hold and use the basic hand tools for marking, measuring and cutting the metal in shape
5. Operate simple drilling machines for producing small holes
6. Operate various machine tools and produce metal components

Course Contents:

Theory
Unit 1: Safety in workshop: [1 Hour]
    1.1. Rules in the mechanical workshop
    1.2. Cause of accident and prevention
    1.3. Types of safety (Personal safety, tools, equipment and machine safety)

Unit 2: Basic hand tools operation and metal removing tools: [3 Hour]
    2.1. Hand and Sawing
    2.2. Filing
    2.3. Chiseling
    2.4. Threading
    2.5. Scribing
    2.6. Riveting
    2.7. Shearing

Unit 3: Measuring and gauging instrument: [1 Hour]
    3.1. Introduction
    3.2. Linear and angular measuring tools with their uses (scale, tape, vernier caliper, least count, micrometer, try square, dial indicator, surface plate and bevel protractor)

Unit 4: Sheet metal working: **[2 Hour]**
   4.1. Types and thickness of different metal sheet (mild steel, galvanized steel, copper, brass, aluminum)
   4.2. Marking tools: types and uses (scriber, rules, try square, punch, divider, trammel and depth gauge)
   4.3. Development of sheet
      i. Types of development (rectangular, conical, triangular)
      ii. Marking and cutting to produce patterns templates (sheet boxes, book stand, scoop, tool box, funnel pipe and machine gaurds)

Unit 5: Drill and drilling process: **[4 Hour]**
   5.1 Drill machines: Use and types (Hand bench, gang, column and radial)
   5.2 Drill bits: Types, bit size, purpose and angle
   5.3 Drill and work holding devices
   5.4 Speed and bit selection for different working material
   5.5 Operation on drill machine using coolants
   5.6 Safety rules and care of tools

Unit 6: Machine tools: **[4 Hour]**
   6.1 General safety considerations
   6.2 Introduction to machine tools
   6.3 Physical construction and types of lathe
   6.4 Lathe operations - Turning, Facing, Shaping
   6.5 Introduction on cutting tools
   6.6 Speed and bit selection for different working material
   6.7 Operation on drill machine using coolants

Practical

Project 1: Prepare metal/aluminum pieces with concept of marking, cutting and filing.
                                                                            [12 Hours]
Project 2: Make a household dustbin collector from the given raw material tin plate:
                                                                            [12 Hours]
Project 3: Drill a hole on a required rectangular shaped mild steel   [12 Hours]
Project 4: Make a cylindrical piece of metal piece to required dimension by turning and facing on lathe machine tool   [12 Hours]
Project 5: Cut internal and external screw thread on a machined cylindrical mild steel piece using die: [12 Hours]

References:
   1. Workshop technology (Vol 1), *S.K. Hajra Chaudhary*
   2. Manufacturing process, *S.K. Hajra Chaudhary*
   3. "Shop Theory", J. Anderson and E. E. Tatro, McGraw – Hill, 5th Edition, 1942

Engineering Materials
EG 1202 CE

Year: I   **Total: 6 hours /week**
Semester: II   **Lecture: 5 hours/week**
                                                                  Tutorial: hours/week
                                                                  Practical: hours/week
                                                                  Lab: 2/2 hours/week

Course description:
This course is designed to help students on using various construction materials in construction works.

Course objectives:
After the completion of this course, students will be able to:
1. Recognize various construction materials that are essential in construction;
2. Select the quality materials for the use in construction;
3. Test materials for quality, strength and durability and
4. Use available materials in their proper position and state.

Course Contents:
Theory

Unit 1 Stones: **[10 Hours]**
1.1 Introduction to stones as building units
1.2 Stones as various forms of engineering materials
1.3 Formation of rocks and its classification
1.4 Geological classification of stones
1.5 Availability of stones in Nepal
1.6 Physical and Chemical properties of stones
1.7 Quarrying of stones – Excavation, wedging and blasting,
1.8 Blasting of stones – Precautions
1.9 Preparing building units from stones- Dressing, Sawing, Polishing, and seasoning.
1.10 Method of laying stones as building units-natural bed of stones and construction technique with various stones
1.11 Testing of stones for-
    1.11.1 Weathering
    1.11.2 Durability,
    1.11.3 water absorption and porosity,
    1.11.4 specific gravity,
    1.11.5 Compressive strength
1.12 Characteristics of good building stones.

Unit 2: Bricks [10 Hours]
2.1 Introduction
2.2 Classification
2.3 Brick earth: Composition of brick earth, functions of various constituent of brick earth, harmful constituents.
2.4 Preparation of brick earth for making bricks: digging, weathering, blending and temping.
2.5 Moulding of bricks and various methods of moulding
2.6 Drying of moulded bricks,
2.7 Burning of bricks: Intermittent and continuous kilns
2.8 Quality of good bricks
2.9 Tests of bricks: Compressive strength, Water absorption and Efflorescence.

Unit 3: Clay and Clay Products [6 Hours]
3.1 Various clay products: Roofing Tiles, wall tiles, clay pipes etc
3.2 Tiles: different types and uses in construction
3.2 Types of tiles: Roofing and Paving tiles.
3.4 Manufacturing of tiles
3.5 Properties of tiles
3.6 Characteristics of machine made tiles

Unit 4: Lime [8 Hours]
4.1 Introduction
4.2 Properties of limes
4.3 Classification of limes: Fat Lime (white lime), Lean lime, and Hydrated lime.
4.4 Setting action of lime
4.5 Manufacturing of lime
4.6 Raw materials, burning, slaking and setting.
4.7 local and other methods of manufacture
4.8 Testing of Limes: Visual examination test, acid test, ball test, impurity test and working test

Unit 5: Cement [10 Hours]
5.1 Introduction
5.2 Uses of Cement in Construction
5.3 Raw materials (Ingredients) of Cement
5.4 Manufacturing process
5.5 Wet process of manufacturing
5.6 Flow diagram of wet process manufacturing
5.7 Various types of cement and their properties
5.8 Storage and transportation
5.9 Various admixtures
5.10 Standards test on Cement

Unit 6: Timber and Timber products [10 Hours]
    6.1 Introduction
    6.2 Definition and sources of timber
    6.3 Classification of trees
    6.4 Growth of trees
    6.5 Structure of tree, hard wood and soft wood and their characteristics,
    6.6 Defects in timber, Felling of timber, Conversion of Timber,
    6.7 Various method of Sawing,
    6.8 Seasoning of Timber, Objectives of Seasoning, Various methods of seasoning, Prevention of drying of logs, Preservation of Timbers,
    6.9 Plywood, Lamina Boards, Block boards, Hard boards, Fiber boards

Unit 7: Metals and Alloys [10 Hours]
    7.1 Ferrous and Non-ferrous metals
    7.2 Uses of different metals in construction
    7.3 Occurrence of Iron: Pig iron
    7.4 Properties and uses of:
        - Cast iron
        - Wrought iron
    7.5 Comparison with wrought iron with cast iron in similar headings
    7.6 Steel: Composition, properties and uses, different types of steels
    7.7 Corrosion in ferrous metals
    7.8 Protection of ferrous metals
    7.9 Alloys: composition, properties and uses.

Unit 8: Paints and Varnishes: [6 Hours]
    8.1 Introduction – Paints and Varnishes
    8.2 Uses of Paints and Varnishes
    8.3 Types of Paints
    8.4 Composition of various types of Paints: Oil paint, Water Paint, Cement paints and Acrylic paints
    8.5 Preparation techniques of various paints
    8.6 Methods of application on various construction locations

Unit 9: Miscellaneous Materials: [5 Hours]
    9.1 Asbestos (source, properties, types and hazards)
    9.2 Glass (Constituents, types, properties, applications and limitation in use)
    9.3 Plaster of Paris
    9.4 Insulation Boards
    9.5 Terrazzo tiles
    9.6 Vinyl tiles

Practical (Laboratory)   **(15 Hours)**

1. Test fineness of cement
2. Test consistency of cement
3. Determine initial and Final setting time of cement
4. Perform compressive test of cement
5. Perform tensile test of cement

References:
1. Chong, C.V.Y., (1977). Properties of Materials, MacDonald and Evans Ltd. Estover, Plymouth, UK
2. Gupta, R. B. , (1974). Material Science and Processes, Satya Prakashan, Inc. Tech India Publication, New Delhi.

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

Unit 2. Oblique Drawing: [0.5 Hour]
   2.1. Oblique drawing
   2.2. Measurement in receding axis
   2.3. Rules for placing object in oblique (box method)
   2.4. Cavalier and Cabinet projection
   2.5. Making of Angle, Circular arc in oblique drawing

Unit 3. Isometric Drawing: [0.5 Hour]
   3.1 Isometric scale
   3.2 Angle of receding axis
   3.3 Isometric drawing and isometric projection
   3.4 Isometric and Non isometric line
   3.5 Making of angle, circular arc in isometric view

Unit 4. Projection of True length and shape of oblique line and shape: [0.5 Hour]
   4.1. Introduction of oblique line
   4.2. True length and angle to HP/VP of oblique line

4.3.   True shape of oblique plane
4.4.   Revolving method
4.5.   Replacing Method

Unit 5. Projection of intersection of line and plane: **[1 Hour]**
    5.1.   Method of finding of intersection point
    5.2.   Method of finding the seen and hidden part of line
    5.3.   Method of finding the angle between plane and line

Unit 6. Projection of Intersection plane and plane: **[0.5 Hour]**
    6.1.   Line of intersection
    6.2.   Seen and hidden part of plane
    6.3.   Finding the dihedral angle between two planes

Unit 7. Projection of points and line on the surface of geometrical solids: **[0.5 Hour]**
    7.1.   Finding the points and lines by generating method
    7.2.   Finding the points and line   by cutting plane method

Unit 8. Projection of intersection between line and geometrical solids:
    8.1.   Projection of piercing point by generating method
    8.2.   Projection of piercing point by cutting plane method

Unit 9. Section   :   **[1 Hour]**
    9.1.   Introduction of section and its needed
    9.2.   Sectional plane and sectional views
    9.3.   Projection of sectional views
    9.4.   Type of section- Longitudinal and cross section- Full section, half section, offset section, detail section etc.

Unit 10.   Projection of intersection between planes and simple geometrical solids and its Surface development with true shape of cut portion: **[0.5 Hour]**
    10.1.   Introduction sectional plane and solid
    10.2.   Understanding the development of surfaces
    10.3.   Method of development
    10.4.   Method for development of cut surfaces

Unit 11.   Projection of intersection between surfaces of solids: **[1.5 Hour]**
    11.1.   Introduction about surfaces of solids
    11.2.   Type of cutting plane (Vertical/Horizontal projecting plane)
    11.3.   Determination of line/curve of intersection
    11.4.   After the intersection of two solids that shape will be occurring of touched at touched portion

Practical (Class work sheet)

Sheet No. 1 [10 Hours]
1. Make the oblique view using by models or work pieces.
2. Make oblique view by six models on flat or inclined surfaces.
3. Make oblique view by six models on round and inclined/ flat surfaces.

Sheet No 2 [10 Hours]
1. Make the isometric view by models or work pieces.
2. Make oblique view by six models on flat or inclined surfaces.
3. Make oblique view by six models on round and inclined/ flat surfaces.

Sheet No 3 [3 Hour]
1. Find the true length of oblique line by revolving method. (At least three exercise on true length by revolving method)
2. Find the true shape of oblique plane (Triangle) by replacing (Auxiliary view) method

Sheet No 4 [3 Hours]
1. Perform projection drawing of intersection of line a triangular plane showing the point of intersection,
2. Draw true shape of plane and angle between plane and line on the edge of given plane (At least two exercises should be done).

Sheet No 5 [3 Hours]

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

Sheet No 6 [1 Hour]
1. Perform projection drawing of pyramid and cone with line(s) and point(s) of the surface finding in HP or VP as missing in one plane.

Sheet No 7. [3 Hours]
1. Perform projection drawing of full section and half sectional view of model which has through hole (At least two exercises shouldbe done of this topic).

Sheet No 8 [2 Hours]
1. Draw intersection between line and cylinder, pyramid cone, and sphere, showing the piercing points.

Sheet No 9. [10 Hours]
1. Perform/draw square prism, pentagonal prism, hexagonal prism, cylinder and cone cut by a vertical projecting plane (Inclined to HP and perpendicular to VP) with true shape.

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

Sheet No 10   **[8 Hours]**

Perform/draw projection drawing of intersection of two surfaces of two solids (intersection of two solids) on:
1. Vertical (right) prism and horizontal prism of different size.

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

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

Computer Application
EG 1211 CT

Total: 4 hours/week

Year: I   **Lecture: 2 hours/week**
Semester: II   **Tutorial: hours/week**

Practical: 2 hours/week

Lab: hours/week

Course description:

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

Course objectives:

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

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

Course Contents:

Theory

Unit 1	**Introduction to Computers:**	**[2 Hours]**
	1.1 History of computers	
	1.2 Generation and type of computers	
	1.3 Computer hardware and software	

Unit 2	**Hardware Components:**	**[6 Hours]**
	2.1 Major blocks of a digital computer	
	2.2 Input devices like keyboard, mouse, joystick, scanner, light pen etc.	
	2.3 Output devices like monitor, printer, plotter, sound card, speaker etc.	
	2.4 Central Processing Unit	
	2.5 Memory Unit: RAM, ROM, PROM, EPROM	
	2.6 Auxiliary storage devices:	

- Magnetic storage like floppy disk, hard disk, magnetic tape etc.
- Optical storage like CD-ROM, DVD
- Pen drive, flash memory card etc.

Unit 3	**Introduction to Operating System Software:**	**[6 Hours]**
	3.1 Importance and use of operating systems (OS)	
	3.2 Type of OS: MS-DOS, Windows, Unix, Linux	
	3.3 File management, device management and memory management by OS	
	3.4 MS-DOS system files: io.sys, msdos.sys, command.com, config.sys, autoexec.bat	
	3.5 MS-DOS internal and external commands	

	3.6	Windows Operating System: Graphical User Interface and windows environment, file/folder management
	3.7	Linux: GNU open source operating system

Unit 4   Application Packages: **[7 Hours]**
4.1   Text Editors (edit in DOS, notepad in Windows, vi editor in Linux
4.2   Word Processing Package: Microsoft Word
4.3   Spreadsheet Package: Microsoft Excel
  - Entering data
  - Using formula
  - Basic calculations
  - Financial calculations
  - Charts
4.4   Concept of Database management system
4.5   Database management package: Microsoft Access
4.6   Presentation Package: Microsoft PowerPoint

Unit 5   Utility Programs: **[2 Hours]**
5.1   Computer virus and its removal (antivirus programs)
5.2   Multimedia: Audio, Video and Graphics

Unit 6   Networks and Internet: **[7 Hours]**
6.1   Brief Introduction of LAN, MAN, WAN
6.2   Topologies: Bus, Ring and Star
6.3   Hub, Switch, Modem
6.4   Network Cabling
6.5   NIC
6.6   Network OS
6.7   Client and server concept
6.8   File and print sharing
6.9   Email/Internet
  - World Wide Web (WWW)
  - ISP
  - Search Engines
  - Internet Client: Web browsers like Internet Explorer, Netscape Navigator, Mozilla Firefox etc.,
  - Email clients like Outlook Express, Netscape Mail etc.

Practical

1. Identification of major components of computer and familiarization with keyboard and mouse.
   (1 session)
2. Internal and External DOS commands (1 session)
3. Windows Graphical User Interface and file/folder management (1 session)
4. Microsoft Word (2 sessions)
   a. Editing text
   b. Formatting document
   c. Creating tables
   d. Creating graphics and word art
5. Microsoft Excel (3 sessions)
   a. Editing worksheet
   b. Data formatting and manipulation
   c. Analysis of data(use of functions for calculation)
   d. Charts/Data presentation
   e. Import/Export data
6. Microsoft Access (2 sessions)
   a. Creating and manipulating data tables
   b. Query
   c. Forms/Reports
7. Using Multimedia and Internet/Email (1 session)
8. Creating effective presentation using Microsoft PowerPoint (1 session)
9. Project Work (3 sessions)
   The students will be assigned (individually or in group) a project work based on Microsoft Excel or Access. The students are required to prepare a short report in MS Word and prepare a short presentation in PowerPoint.

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 Year
(Third and Fourth Semesters)

Third Semester

Subjects:

1	EG 2104 SH	Engineering Mathematics III
2	EG 2111 CE	Surveying I
3	EG 2102 CE	Applied Mechanics
4	EG 2103 CE	Basic Hydraulics
5	EG 2104 CE	Building Construction
6	EG 2105 CE	Construction Drawing
7	EG 2106 CE	Computer Aided Drafting

Engineering Mathematics III
EG 2104 SH

Total: 4 hours /week

Year: II
Semester: I

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

Course description:
This course consists of Partial derivative, Differential equations, Infinite series, Fourier series, and Elementary group theory necessary to develop mathematical background.

Course objectives:
After completing this course students will able to:
1. Provide the basic mathematical idea for the analysis of electronic circuits and
2. Help in the development of program for the technical applications

Course Contents:

Unit 1. Partial Derivative: [8 Hours]
      1.1   Functions of more than one variables
      1.2   Partial derivative, partial differential coefficient.
      1.3   Partial derivative of first and higher order.
      1.4   Homogeneous function and Euler's Theorem on homogeneous functions.
      1.5   Composite function, Derivative of composite functions.(Total differential coefficient)

Unit 2. Differential Equations: [10 Hours]
      2.1**Ordinary Differential Equations**
            2.1.1   Differential Equation and its order and degree.
            2.1.2   Differential Equations of first order and first degree,
            2.1.3   Differential Equations with separate variables,
            2.1.4   Homogeneous and exacted differential Equations
      2.2   **Partial Differential Equations (PDF)**
            2.2.1   Basic concepts, definition and formation
            2.2.2   General solution of linear PDF of first order ($Pp + Qq = R$ form)

Unit 3. Infinite Series: [11 Hours]
      3.1   Definitions of sequence and infinite series,
      3.2   Condition for convergence of an infinite series,
      3.3   Geometric series.
      3.4   Test of convergence. (p-test, D' alembert's ratio test, Cauchy radical test or root test)
      3.5   Power series and its interval of convergence,
      3.6   Expansion of functions using Taylor's and Maclaurin's theorems.

Unit4. Fourier series: **[8   Hours]**
    4.1   Periodic function,
    4.2   Even and odd function
    4.3   Trigonometric series
    4.4   Fourier series of the functions of period 2π,
    4.5   Euler's formula,

Unit 5. Elementary Group Theory: **[8 Hours]**
    5.1.   Binary operation, Binary operation on sets and their properties.
    5.2.   Definition of group
    5.3.   Group whose elements are not number
    5.4.   Finite, Infinite group and Abelian group
    5.5.   Elementary properties of group.

References:
1. Thomas and Finney, *Calculus and Analytical Geometry*, Narosa Publishing House, New Delhi, 1990.
2. E. Kreyszig,*Advanced Engineering Mathematics*, Wiley-Easter Publication, New Delhi, 1990.
3. Chandrika Prasad, *Mathematics for Engineer*, Prasad Mudranalaya, Allahabad, 1996.
4. E. Kreyszig,*Advanced Engineering Mathematics*, Wiley-Easter Publication, New Delhi, 1990.
5. A.V. Oppenheim, *Discrete-Time Signal Processing*, Prentice Hall, India Limited, 1990.
6. K. Ogata, *Discrete-Time Control System*, Prentice Hall, India Limited, 1993.

Surveying I
EG 2111 CE

Year: II
Semester: I

Total: 8 hours /week
Lecture: 3 hours/week
Tutorial: hours/week
Practical: 5 hours/week
Lab: hours/week

Course description:
This course focuses on familiarization on different surveying techniques and handling of surveying equipment. The different surveying techniques include linear, angular, vertical measurements, and plotting skills.

Course objectives:
After the completion of this course, students will be able to:
1. Apply distance measurement techniques and
2. Use basic surveying techniques and plotting of plan and map.

Course Contents:
Theory

Unit 1 Introduction: **[4 Hours]**
    1.1 History and definition of surveying
    1.2 Primary division of survey
    1.3 Classifications according to discipline, nature and instruments used
    1.4 Principles of surveying
    1.5Definition of accuracy, precision and error
    1.6 Types and sources of error

Unit 2 Linear Distance Measurement: **[6 Hours]**
    3.2 Different methods of direct and indirect distance measurement
    3.3 Equipment for direct chaining and taping
    3.4 Ranging and its methods
    3.5 Chaining on horizontal and sloping ground by direct and indirect methods
    3.6 Errors in chaining and precision ratio
    3.7 Various correction for linear distance measurement
    3.8 Field procedures and problems

Unit 3 Chain Surveying: **[4 Hours]**
    4.1 Introduction
    4.2 Principles of chain surveying
    4.3 Procedures of chain surveying
        4.3.1 Reconnaissance
        4.3.2 Selection and marking of survey stations and survey lines
        4.3.4 Detailing

4.4 Obstacles in chaining and taping
4.5 Plotting and field problems

Unit 5 Compass Traversing: [8 Hours]
5.1 Introduction
5.2 Technical terms
5.3 System of bearings, fore and back bearing
5.4 Prismatic and Surveyor's compass
5.5 Calculation of angles from bearing and bearing from angles, angular precision
5.6 Magnetic declination, local attraction, detection and correction of local attraction
5.7 Error in compass survey and their adjustment
5.9 Field problems and procedures

Unit 6 Leveling: [12 Hours]
6.1 Definition and objectives
6.2 Classification of leveling according to principles
6.3 Technical terms used in leveling
6.4 Instruments used in leveling
6.5 Temporary and permanent adjustment of level
6.7 Methods for booking and reducing of level
6.8 Classification of direct leveling
      6.8.1 Simple leveling
      6.8.2 Continuous or differential leveling
      6.8.3 Fly leveling
      6.8.4 Reciprocal leveling
      6.8.6 Profile leveling and cross sectioning
6.9 Errors in leveling and its adjustment
6.11 Field procedures, problems and plotting of graphs

Unit 7: Contouring: [6 Hours]
7.1 Definition - Contour interval, Horizontal equivalent, general contours, Index
    contour
7.2 Criteria for selection of contour interval
7.3 Characteristics of contours
7.4 Methods of control for contour survey
      7.4.1 Direct method
      7.4.2 Indirect method i.e. grid method, cross section method and radial method
7.5 Methods of interpolation of contours
7.6 Uses of contour maps
7.7 Field procedures and problems

Unit 8: Plane Tabling: [5 Hours]
8.1 Definition and principles
8.2 Accessories used in plane tabling
8.3 Working operations - temporary adjustment and orientation

8.4 Methods of plane tabling - Radiation, Intersection, Traversing and Resection
   (introduction only   for resection)
8.5 Errors in plane table surveying
8.6 Merits and demerits of plane table surveying

Practical (Field work)

1. Care and handle instruments.   [5 Hours]
2. Measure linear distance on plane and sloping ground.   [5 Hours]
3. Perform Chain triangulation and detailing.   [10 Hours]
4. Perform Compass traversing and detailing.   [15 Hours]
5. Perform Leveling   [20 Hours]
         5.1 Two peg test
         5.2 Differential/fly leveling
         5.3 Profile leveling and cross sectioning
6. Contouring – indirect method   [5 Hours]
7. Perform plane table traverse, resection, intersection and detailing   [15 Hours]

Evaluation of Practical: Continuous evaluation (Viva + Instrumentation + Objective test)

Textbooks:
   1. Dr. BC Punmia, " Surveying " Vol I and II, Laxmi Publication New Delhi

References:
   1. R. Agor ,"Surveying and Leveling", Khanna Publication New Delhi
   2. SK Duggal, "Surveying" Vol I and II, Tata MC Graw Hill Publishing
   3. N Basnet and M Basnet, "Basic Surveying – I", Benchmark Education Support Pvt.
      Ltd. Tinkune Kathmandu
   4. N Basnet and M Basnet, "Basic Surveying –II", Published by D. Shrestha & R.
      Shrestha , Rajmati Press, Lalitpur

Applied Mechanics
EG 2102 CE

Year: II   **Total: 6 hours /week**
Semester: I   **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 body at rest.

Course objectives:
After the completion of this course, students will be able to:
1. Understand the 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 and analysis of typical problems;
3. 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, and Moment of Inertia) and calculation and
5. Know about the structure (beam and truss), their supports, loads and analysis of them.

Course Contents:

Theory

Unit 1   **Introduction:**   **[4 Hours]**
        1.1   Definition and scope of Applied Mechanics
        1.2   Concept of Particle, Rigid Body, Deformed Body, Free Body Diagram and Equilibrium of particle and Rigid Body
        1.3   Equations of Static Equilibrium: Two and Three Dimensional analysis of Particle, Two Dimensional analysis of Rigid Body

Unit 2   **Forces acting on Particle and Rigid Body:**   **[9 Hours]**
        2.1   Different types Forces: Internal, External, Translational, Rotational, Coplanar, Non-Coplanar, Concurrent, Non-Concurrent, Like Parallel and
Unlike Parallel
        2.2   Resolution and Composition of Forces
        2.3   Principle of Transmissibility and Equivalent Forces
        2.4   Moments and Couples
        2.5   Varignon's Theorem
        2.6   Resolution of a Force in to a Force and a Couple
        2.7   State and Prove: Triangle Law of Forces, Parallelogram law of Forces Polygon Law of Forces and Lami's Theorem

Unit 3   **Friction:**   **[5 Hours]**

            3.1   Friction: Definition, Causes, Advantages, Disadvantages and Types

            3.2   Laws of Dry Friction

            3.3   Static and Dynamic Friction and Their Coefficients

            3.4   Angle of Friction

            3.5   Different status (No Friction, Certain Friction, Impending Motion and Motion)

            3.6   Sliding and Tipping Condition of the Body

Unit 4   **Centre of Gravity and Centroid:**   **[6 Hours]**

            4.1   Concept of Centre of Gravity, Centroid, Axis of Symmetry

            4.2   Centroid of Composite lines (straight line, arc, semicircle and quarter circle)

            4.3   Centroid of Composite Area (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

Unit 5   **Moment of Inertia:**   **[6 Hours]**

            5.1   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 Theorem for Moment of Inertia

            5.5   Moment of Inertia of Composite Area

            5.6   Radius of Gyration

Unit 6   **Structures:**   **[5 Hours]**

            6.1   Structure and Mechanism

            6.2   Plane and Space Structures

            6.3   Different types of Load and Support in the Structures

            6.4   External and Internal forces (Axial Force, Shear Force, and Bending Moment) in the Structural Members

            6.5   Relationship between Load, Shear Force and Bending Moment

            6.6   Determinacy and Stability (Statically and Geometrically) of the Structures

Unit 7   **Analysis of Statically Determinate Beam:**   **[5 Hours]**

            7.1   Definition and Types of Beam

            7.2   Calculation of Support Reactions and Internal Forces (i.e. Axial Force, Shear Force and Bending Moment) of the Beam

            7.3   Draw Axial Force, Shear Force and Bending Moment Diagrams of the Beam

Unit 8   **Analysis of Statically Determinate Plane Truss**   :   **[5 Hours]**

            8.1   Definition, uses and Types of Truss

            8.2   Calculation of Member Force by the Method of Joints

            8.3   Calculation of Member Force by the Method of Sections

Practical (Laboratory)   **[15 Hours]**
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)
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

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

Basic Hydraulics
EG2103 CE

Year: II

Semester: I

Total: 5 hours /week
Lecture: 3 hours/week
Tutorial: 1 hour/week
Practical: hours/week
Lab: 2/2 hours/week

Course description:

This course focuses on the fundamental concepts and principles of Hydraulics, measurement of flow, introduction to open channel flow and pipe flow.

Course objectives:

After the completion of this course, students will be able to:
1. Understand the properties of fluid;
2. Analyze the behavior of fluid at rest;
3. Analyze the behavior of fluid in motion;
4. Apply the measurement techniques for pressure and discharge;
5. Understand the concept of head loss in pipe flow and
6. Understand the basic concept of open channel flow.

Course Contents:

Theory

Unit 1 Introduction: **[5 Hours]**
    1.1   Introduction to Fluid
    1.2   Introduction to Fluid Mechanics and Hydraulics
    1.3   Properties of fluid (Definition, formula, unit and dimension): mass density, specific weight, specific volume, specific gravity, viscosity (Newton's law, Dynamic and kinematic viscosity), compressibility and Bulk Modulus
    1.4   Difference between real and ideal fluid
    1.5   Difference between Newtonian and Non-Newtonian fluid

Unit 2 Hydrostatics: **[10 Hours]**
    2.1   Introduction to fluid pressure
    2.2   Pascal's law
    2.3   Derivation for pressure-depth relationship (Hydrostatic law)
    2.4   Definition of atmospheric pressure, gauge pressure and absolute pressure
    2.5   Measurement of pressure by piezometer and U-tube manometer
    2.6   Definition of total pressure and center of pressure
    2.7   Derivation for total pressure and center of pressure on vertical and inclined plane submerged surface
    2.8   Definition of Buoyancy and Archimedes' principle
    2.9   Principle of floatation

Unit 3   **Hydrokinematics:**   **[5 Hours]**

    3.1   Types of flow: Steady and unsteady, uniform and non-uniform, laminar and turbulent, compressible and incompressible, rotational and irrotational, one, two and three dimensional

    3.2   Reynold's number: Definition, equation and criteria for laminar and turbulent flow

    3.3   Streamline: Definition, equation, characteristics

    3.4   Conservation principles and continuity equation for one dimensional incompressible flow

Unit 4   **Hydrodynamics:**   **[3 Hours]**

    4.1   Energy of flowing fluid: potential or datum energy, kinetic energy, pressure energy

    4.2   Concept of energy head

    4.3   Bernoulli's theorem: Statements, assumptions, equation and applicability

    4.4   Concept of Hydraulic gradient line (HGL) and energy gradient line (EGL)

Unit 5   **Pipe Flow:**   **[5 Hours]**

    5.1   Introduction to pipe flow

    5.2   Velocity profile for laminar and turbulent flow through pipes

    5.3   Loss of head in pipes: introduction to major and minor loss

    5.4   Derivation of Darcy-Weisbach equation for loss of head due to friction

    5.5   Derivation of equation for expansion and contraction loss

Unit 6   **Open Channel Flow:**   **[7 Hours]**

    6.1   Difference between pipe flow and open channel flow

    6.2   Types of open channel flow: steady and unsteady, uniform and non-uniform (gradually varied, rapidly varied and spatially varied flow), laminar and turbulent, subcritical, critical and supercritical flow

    6.3   Geometric elements of open channel (flow depth, flow area, top width, wetted perimeter, hydraulic radius, hydraulic depth, section factor)

    6.4   Velocity distribution in open channel flow

    6.5   Chezy's equation and Manning's equation for the computation of velocity in uniform flow

    6.6   Energy equation and momentum equation in open channel flow

    6.7   Specific energy: Definition, equation and diagram

Unit 7   **Flow Measurement:**   **[10 Hours]**

    7.1   Orifice: Definition and types, definition of vena-contracta

    7.2   Derivation of equation for discharge through small orifice

    7.3   Hydraulic coefficients of orifice: coefficient of discharge, velocity and contraction (definition, formula and experimental method of determination)

7.4   Concept of venturimeter, derivation of equation for discharge through venturimeter
7.5   Introduction to weir or notch and their classifications
7.6   Derivation of equation for discharge through rectangular, triangular and trapezoidal weir or notch
7.7   Area-velocity method for the discharge measurement in open channel (float and current meter): description of measurement technique, mid-section method for discharge computation

Tutorials: [15 Hours]

1.   Numericals of fluid properties
2.   Pressure computation, Pressure measurement by piezometer and U-tube manometer, Total pressure and center of pressure for vertical and inclined submerged surface, principle of floatation
3.   Computation of discharge by using continuity equation, computation of Reynold's number and identifying type of flow
4.   Application of Bernoulli's equation with and without head loss
5.   Head loss computation in pipe flow
6.   Cross-sectional properties, velocity, discharge and flow depth computation for uniform flow through open channel
7.   Computation of discharge through orifice, venturimeter, rectangular, triangular and trapezoidal   weir, mid-section method for discharge computation

Practical (Laboratory)   [15 Hours]

1.   Measure pressure by piezometer and manometer
2.   Verify Bernoulli's theorem using venturimeter
3.   Measure flow through orifice
4.   Measure river discharge by float method

Textbooks:
1. R. K. Bansal, *"Fluid Mechanics and Hydraulic Machines"*, Laxmi Publications (P) Ltd.

References:
1. R. K. Rajput, *"Fluid Mechanics and Hydraulic Machines"*, S. Chand & Company Ltd.
2. A. K. Upadhyay, *"Hydraulics and Pneumatics"*, S. K. Kataria and Sons.

Building Construction
EG 2104 CE

Year: II　　　　　　　　　　　　　　　　　　**Total: 8 hours /week**
Semester: I　　　　　　　　　　　　　　　**Lecture: 5 hours/week**
　　　　　　　　　　　　　　　　　　　　　　Tutorial: 1 hour/week
　　　　　　　　　　　　　　　　　　　　　Practical: 1 hour/week
　　　　　　　　　　　　　　　　　　　　　　　　Lab: 2/2 hour/week

Course description:
This course is designed to provide knowledge and skills in building construction techniques and technology including earthquake resisting construction technology. It intends to provide skills and knowledge on preparing drawings and sketches of building components.

Course objectives:
After the completion of this course students will be able to:
1. Identify the different components of buildings;
2. Follow the steps of construction systematically;
3. Supervise and test on the workmanship and quality of materials to be used in construction and
4. Acquire knowledge and skills on earthquake resistant building construction techniques.

Course Contents:
Theory
Unit 1: Introduction to Building Construction:　　　　　　　　　**[4 Hours]**
1.1　Definition of building and its uses
1.2　Building types
1.3　General components of a building
1.4　Technical terms used in buildings
1.5　General requirements of parts of building
1.6　General rules of Vaastu

Unit 2: Foundation and its types:　　　　　　　　　　　　　　**[10 Hours]**
2.1　Foundation and its purposes
2.2　Site exploration and its purposes
2.3　Preliminary soil investigation
2.4　Methods of site investigation
2.5　Depth and spacing of trial pits or bore holes
2.6　Bearing capacity of soil and methods of determination
2.7　Plate load test method
2.8　Penetration test method in brief
2.9　Safe bearing capacity values based on N.S, and I.S. code.
2.10　Methods of improving bearing capacity of soil
2.11　Types of shallow foundation and their uses
2.12　Causes of failure of foundation and remedy

2.13 Setting out of foundation
2.14 Timbering of trenches
2.15 Construction of foundation under water lodged trenches.
2.16 Deep foundation and its types (introduction only)
2.17 Design example on masonry wall foundation
2.18 Design example on brick pillar foundation

Unit 3: Masonry Wall: [6 Hours]
3.1   General introduction to
   3.1.1   Types of bricks
   3.1.2   Types of bonds
   3.1.3   Types of junctions
3.2   bonds in Piers
3.3   Piers attached to main walls
3.4   Retaining wall
3.5   Stability of retaining walls
3.6   Thumb rules of retaining wall construction
3.7   Strength of brick masonry
3.8   Permissible compressive stress in brick masonry
3.9   Defects in brick masonry
3.10   Reinforced brickwork

Unit 4: Stone Masonry: [6 Hours]
10.1.   General definition
10.2.   Technical Terms used in masonry
10.3.   Dressing and selection of surface finish
10.4.   Setting of stone work
10.5.   Joints in stone masonry
10.6.   General principles to be observed in stone masonry construction
10.7.   Classification of stone masonry
10.8.   Selection of stone for masonry
10.9.   Stone masonry block construction
10.10. Safe permissible loads on stone masonry.
10.11. Composite masonry in stone and brick
10.12. Cement concrete block masonry

Unit 5: Partition and Cavity wall: [4 Hours]
5.1.   Objectives of partition wall
5.2.   Types of partition walls
5.3.   Advantage of cavity wall
5.4.   Position of cavity
5.5.   Wall ties and construction details
5.6.   Precautions on cavity construction

Unit 6: Damp and Water Proofing: [4 Hours]
6.1. Dampness and its effects on construction works
6.2. Causes and sources of dampness
6.3. Methods of damp proofing
6.4. Materials used for damp proofing
6.5. Damp proofing treatment in
    6.5.1. Foundation
    6.5.2. Walls
    6.5.3. Floors
    6.5.4. Roofs
    6.5.5. Parapet walls

Unit 7: Concrete and Concrete Construction: [10 Hours]
7.1. Concrete and grades of concrete
7.2. Properties of concrete
7.3. Methods of proportioning concrete mixes
7.4. Mix design
    7.4.1. Design mix
    7.4.2. Nominal mix
7.5. Concreting processes
    7.5.1. Batching of materials
    7.5.2. Concrete mixing
    7.5.3. Transportation of concrete
    7.5.4. Placing of concrete
    7.5.5. Compaction of concrete
    7.5.6. Curing of concrete
7.6. Concreting under water
7.7. Placing under cold weather
7.8. Placing concrete in hot weather
7.9. Water proofing of concrete
7.10. Steel reinforcement
7.11. Permissible stresses in reinforcement
7.12. Reinforced cement concrete and its characteristics
7.13. Advantages of reinforced cement concrete
7.14. Concreting equipment and accessories
7.15. Causes of failure of reinforced concrete structure

Unit 8: Formworks and Scaffolding: [5 Hours]
8.1. Characteristics of good formwork
8.2. Materials for formwork
    8.2.1. Timber formwork
    8.2.2. Plywood formwork
    8.2.3. Steel formwork
8.3. Construction of formwork
8.4. Order and method of removing formwork
8.5. Types of shoring and their uses
8.6. Types of scaffolding and their uses.

Unit 9: Lintels and Arches: [4 Hours]
    9.1. Lintels and its uses
    9.2. Types of lintels in terms of material used
    9.3. Arch and its uses
    9.4. Types of arches and materials of construction

Unit 10: Floors and Floor finishes: [10 Hours]
    10.1. Ground floor and its types
        10.1.1 Mud floor
        10.1.2 Brick floor
        10.1.3 Timber floor
        10.1.4 Flagstone floor
        10.1.5 Tile floor
        10.1.6 Marble floor
        10.1.7 Concrete floor
    10.2. Upper floor and its types
        10.2.1 Timber floor
        10.2.2 Reinforced cement concrete floor
        10.2.3 Reinforced brickwork floor
        10.2.4 Precast concrete floor
    10.3. Floor finishes and construction methods
        10.3.1 Plaster punning
        10.3.2 Mosaic tile
        10.3.3 Porcelain ceramic tile
        10.3.4 Marble
        10.3.5 Parqueting

Unit 11: Stairs and Roofs: [8 Hours]
    11.1. Location of stair types of stair
    11.2. Technical terms used
    11.3. Requirements of good stair
    11.4. Fixing of going and rise
    11.5. Types of roofs
        11.5.1 Slope or pitched roof
            11.5.1.1 Lean to roof
            11.5.1.2 Coupled roof
            11.5.1.3 Scissors roof
            11.5.1.4 King and Queen post roof truss
        11.5.2 Flat roof
            11.5.1.2 Mud terraced roof
            11.5.1.3 Brick, glazed tiled roof
    11.6. Roof covering
        11.6.1 Thatch covering
        11.6.2 Shingle
        11.6.3 Tile
        11.6.4 A.C. and C.G.I. sheet

      11.6.5 Slate
      11.6.6 Laying and fixing of roof coverings

Unit 12: Doors and Windows: [10 Hours]

12.1. Location of doors and door sizes
12.2. Door frame
12.3. Types of doors
      12.3.1 Battened, ledged braced and framed door
      12.3.2 Framed and Paneled door
      12.3.3 Flush door
      12.3.4 Sliding door
      12.3.5 Revolving door
      12.3.6 Collapsible steel door
      12.3.7 Rolling steel shutter door
12.4. Types of windows
      12.4.1 Fixed window
      12.4.2 Sliding window
      12.4.3 Double hung window
      12.4.4 Casement window
      12.4.5 Sash or glazed window
      12.4.6 Corner window
      12.4.7 Bay window
      12.4.8 Ventilators
12.5. Erecting and fixing of door and window frames
12.6. Fixtures and fastenings of door and windows

Unit 13: Finishing Works: [5 Hours]

13.1. Plasterworks
      13.1.1 Material used (mud, lime, cement ,surkhi)
      13.1.2 Plaster applying procedures
      13.1.3 Pointing works on brick and stone masonry
13.2. Paints and painting procedure
      13.2.1 Cement paint
      13.2.2 Enamel paint
      13.2.3 Distemper
      13.2.4 Emulsion paint
13.3. Heritage plaster

Unit 14: Miscellaneous Construction Works: [5 Hours]

14.1. Purpose and materials used for false ceiling
14.2. Plaster of Paris works
14.3. Causes and prevention of cracks in buildings
14.4. Methods to prevent termite action

Unit 15: Earthquake: **[14 Hours]**

15.1   Concept of earthquake   (2 Hours)

    15.1.1 Introduction

    15.1.2 Terminologies

    15.1.3 Causes of earthquake

    15.1.4 Earthquake locations

    15.1.5 Measurement of Earthquake

        15.1.5.1   Earthquake Magnitude

        15.1.5.2   Earthquake Intensity

    15.1.6 Seismicity of Nepal

    15.1.7 Seismic hazard of Nepal

15.2   Earthquake effect   (1 Hour)

    15.2.1. Ground effects

    15.2.2 Effects of earthquake on buildings

    15.2.3. Causes of failure

15.3   Building forms for earthquake resistance   (2 Hours)

    15.3.1. Building configuration

    15.3.2. Height and number of storey

    15.3.3 Distribution of load bearing elements

    15.3.4. Location and size of door and window openings

15.4   Masonry building with rectangular building units in cement mortar   (3 Hours)

    15.4.1. Improving buildings for seismic safety

    15.4.2. Foundation

        15.4.2.1.RC Strip

        15.4.2.2. PCC Strip / lime Strip

        15.4.2.3. Plum concrete

        15.4.2.4. Brick / stone masonry

   15.4.3. Walls

        15.4.3.1. Openings

        15.4.3.2. Reinforcement of opening

        15.4.3.3. Wall Reinforcement

            15.4.3.3.1. Strengthening the junctions

            15.4.3.3.2. Bands

            15.4.3.3.3. Vertical Reinforcement

15.5.   Concrete block walls

15.6.   Separation and crumple sections

15.7   Low strength Masonry in rectangular block and stone   (3 Hours)

   15.7.1. Definition

   15.7.2. Limitations

   15.7.3. Strengthening measures

   15.7.4. Materials

   15.7.5. Walls

        15.7.5.1. Thickness

        15.7.5.2. Buttresses

        15.7.5.3. Door and window openings

            15.7.5.3.1. Rectangular block masonry

15.7.5.3.2. Stone masonry
    15.7.5.4. Construction
        15.7.5.4.1. Block masonry
        15.7.5.4.2. Stone masonry
    15.7.5.5. Stitches
    15.7.5.6. Bands
    15.7.5.7. Vertical Reinforcing

15.8   Detailing of RC Frames   (3 Hours)
    15.8.1. Foundation
    15.8.2.   Beam
        15.8.2.1. Dimensions
        15.8.2.2. Longitudinal Reinforcement
        15.8.2.3. Web Reinforcement
    15.8.3.   Column
        15.8.3.1. Dimension
        15.8.3.2. Longitudinal Reinforcement
        15.8.3.3. Web Reinforcement
    15.8.4. Beam Column Joint
        15.8.4.1. Transverse Reinforcements

Laboratory/Practical

Unit 1: Laboratory: **[15 Hours]**
1. Test bulking of sand
2. Perform slump test
3. Perform compressive strength test of local and machine made bricks
4. Perform compressive strength of concrete/Hollow blocks
5. Observe effects of water cement ratio on concrete

Unit 2: Designs and Drawings Study and Field visit: **[15 Hours]**
Interpret designs/drawings and administer hand on practice on Earthquake resistant construction of following buildings:
1. Stone masonry houses
2. Timber houses
3. Brick and block masonry houses
4. Reinforced Concrete buildings
5. Repair and strengthening existing buildings

Textbooks:
1. Punmia B.C. Dr., *Building Construction* (Latest Edition).
2. Kumar Sushil *Building Construction* (Latest Edition).
3. Sharma S. K. & Kaul B. K., *Building Construction* (Latest Edition).
4. Singh Gurucharan, *Building Planning & Design* (Latest Edition)

References:
1. Department of Urban Development, *Nepal Building Code*
2. Arya A. S., *Masonry and Timber Structure including Earth* (Latest Edition)
3. Jain, *Plain Cement Concrete, Vol. I & II* (Latest Edition)
4. Kumar Sushil, *Reinforced Concrete Structure*(Latest Edition)
5. Punmia B.C. Dr., *Reinforced Concrete Structure, Vol. I & II* (Latest Edition)
1. IS 4326-1993; Earthquake Resistant Design and Construction of Buildings-Code of Practice, Bureau of Indian Standards, New Delhi, India
2. NBC 108-1994; Site Consideration, Government of Nepal, Ministry of Housing and Physical Planning, Department of Buildings, Nepal, 1995.
3. NBC 109-1994; Masonry: Unreinforced, Government of Nepal, Ministry of Housing and Physical Planning, Department of Buildings, Nepal, 1995.
4. NBC 201-1994; Mandatory Rules of Thumb: Reinforced Concrete Buildings with Masonry Infill, Government of Nepal, Ministry of Housing and Physical Planning, Department of Buildings, Nepal, 1995.
5. NBC 202-1994; Mandatory Rules of Thumb Reinforced Concrete Buildings without Masonry Infill, Government of Nepal, Ministry of Housing and Physical Planning, Department of Buildings, Nepal, 1995.
6. NBC 202-1994; Mandatory Rules of Thumb: Load Bearing Masonry, Government of Nepal, Ministry of Housing and Physical Planning, Department of Buildings, Nepal, 1995.
7. *NSET-Nepal: Earthquakes, A manual for designers and builders,*

Construction Drawing
EG 2105 CE

Year: II
Semester: I

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

Course description:
This course is designed to provide skills in preparing engineering construction drawings. It also intends to impart skills on preparing drawings and sketches of construction details for earthquake resistant building construction and construction other structures.

Course objectives:
After the completion of this course students will be able to:
1. Prepare setting out drawings for construction activities;
2. Draw working drawings of different components of buildings;
3. Prepare working drawing of engineering constructions;
4. Prepare drawings for different components of hydropower
5. Prepare drawings for different conveyance structures

Course Contents:

Unit 1: Drawing and Field Work: **[48 Hours]**
1. Prepare drawing plate/plates of a building with three or more rooms per floor and two and half or more storied timber sloped roof meeting the requirements of local municipality/ VDC building rules and regulations.
2. Prepare setting out plans for earth cutting and construction lines of building drawn in task 1 above.
3. Practice staking out in the field of the plan prepared on task 2 above.
4. Draw detail drawings of:
    4.1. Dog legged stair case (Timber and RCC)
    4.2. Door and Window frames including joints and fixing details
    4.3. Flush and panel door including joints and fixing details.
    4.4. Casement window including joints and fixing details.
5. Prepare a roof plan with valleys for CGI, Tile, Thatch and RCC roofing materials including their construction details.
6. Draw septic tank and soak pit including sanitary fittings details.
7. Draw Racking, Flying and Dead shores with fixing details.
8. Prepare working drawing of: [6 hours]
    8.1. Canal Gate and Aqueduct
    8.2. Slab and pipe Culvert
    8.3. Drawing of section of canal in both cutting and filling

9. Drawing of Hydropower components   [12 hours]
    9.1 Drawing of weir structure (Sloping glacis concrete weir, Vertical drop masonry weir, earthen weir)
    9.2 Drawing of a typical intake (side intake, frontal, drop)
    9.3 Drawing of settling basin or desander demonstrating inlet transition, settling zone, outlet transition and flushing arrangements.

Textbooks:
1. Civil Engineering Drawing; Gurcharan Singh
2. NSET – NEPAL; Earthquakes, A manual for designers and builders.

References:
1. Sushil Kumar; Building Construction
2. Dr.B.C. Punmia, A.K.Jain, Arun Kr. Jain, Building Construction.
3. W.B. McKay, Building construction, Vols. I – IV, ELBS, LONGMAN

Computer Aided Drafting
EG 2106 CE

Year: II   **Total: 5 hours /week**
Semester: I   **Lecture: 2 hours/week**
                                                Tutorial: hours/week
                                                Practical: 3 hours/week
                                                Lab: hours/week

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

Course objectives:
After the completion of this course student will be able to:
1. Learn to use popular CAD software programs (Autodesk AutoCAD) to model construction projects and
2. Create basic Civil and Architectural drawings

Course contents:

Theory

Unit 1: Introduction to the course and Hardware: **[2 Hours]**
    1.1. Overview about Fundamental of computer. (Hard ware, software etc.)
    1.2. Introduction application software (specially CADD, Land Development software)
    1.3. Overview of a PC, peripherals e.g. printers and plotters, system settings and the Windows environment.

Unit 2: Starting a New Drawing/Opening an Existing Drawing: **[2 Hours]**
    2.1. Setting up a drawing, starting from scratch, using a Wizard, using and creating a template file.
    2.2. Opening an existing drawing
    2.3. Screen layout, pull-down menus, screen icons, command line and dialogue boxes, status bar toggles,
    2.4. Setting preferences (Setting Units and Scale, managing drawing area by using MVsetup and Limits, setting and use of drafting aids.

Unit 3: Computer Graphics: **[2 Hours]**
    3.1. Computer graphics fundamentals (raster object and vector application) data storage and retrieval , hierarchical storage system ,introduction to basic graphical application, drawing exchange .

Unit 4: Drawing Commands: [4 Hours]
    4.1. Co-ordinate input methods (directive, absolute, relative and polar)
    4.2. Point, Lines, Polyline, Multiline,Construction Lines
    4.3. Circle, Arc, Ellipse, Donut
    4.4. Polygon, Rectangle, Spline, , solids etc
    4.5. Hatching
    4.6. Text (multi-line & single line / true type fonts
    4.7. Dimensions

Unit 5: Modify Commands: [6 Hours]
    5.1. Object selection
    5.2. Erase, Trim, Break
    5.3. Copy, Mirror, Offset, Array,
    5.4. Move, Rotate, Scale, Stretch,
    5.5. Lengthen, Extend,
    5.6. Chamfer, Fillet, etc.

Unit 6: Features: [6 Hours]
    6.1. View tools,
    6.2. Layers concept, match and change properties.
    6.3. measure and divide
    6.4. inquiry commands (Id, Distance, Area, List, Mass property etc
    6.5. Working with Block, W-block and External References.
    6.6. Drawing Exchange (convert to other format from drawing format and into
        drawing format)
    6.7. Using drawing attributes, uses of pre-defined objects etc.
    6.8. Uses of script files.

Unit 7: Use of CADD in Civil Engineering Field: [6 Hours]
    7.1. Land development and surveying,
    7.2. CADD and Highway Engineering
    7.3. CADD and Building Drawing
    7.4. CADD with water supply and sanitary drawings

Unit 8: Plotters and Plotting the Drawing: [2 Hours]

Practical
Unit 1: Starting a New Drawing/Opening an existing drawing [5 Hours]
    1.1. Setting up a drawing starting from scratch, using a Wizard, using and creating a
        template file, drafting aids.
    1.2. Opening an existing drawing
    1.3. Screen layout, pull-down menus, screen icons, command line and dialogue boxes,
        toggles keys, Screen organization.
    1.4. Setting preferences (Setting Units and Scale, managing drawing area by using
        MVsetup and Limits.)

Unit 2: Drawing Commands [5 Hours]

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

Unit 3: Modify Commands [5 Hours]

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

Unit 4: Features [5 Hours]

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

Unit 5: Use of CADD in Civil Engineering Field [20 Hours]

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

Unit 6: Plotters and Plotting the drawing in different scale [5 Hours]

References:

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

Fourth Semester

Subjects:

1. EG 2211 CE   Engineering Geology
2. EG 2103 MG Principles of Management and Costing
3. EG 2212 CE   Surveying II
4. EG 2213 CE   Estimating and Costing   I
5. EG 2203 CE   Mechanics of Structure
6. EG 2204 CE   Soil Mechanics
7. EG 2214 CE   Hydrology and Irrigation

Engineering Geology
EG 2211 CE

Year: II   **Total: 3 hours /week**
Semester: IV   **Lecture: 2 hours/week**
                                                Tutorial: hours/week
                                                Practical: 1 hours/week
                                                Lab: hours/week

Course description:
.....
Course Objectives:
At the end of this course the student will be able to
   - Apply geological knowledge this knowledge in various engineering projects.
   - Perform geological Investigation.
   - Measure attitude of Geological Strata
   - Identify rocks in the field.
   - Study rock Structures (In Block diagram and In the Field)
   - Identify Topographic Maps and Prepare Profile.

Course contents:

Theory
Unit 1: Introduction   [2 Hours]
   1.1   Geology and Branches of geology
   1.2   Engineering geology and its importance in civil engineering

Unit 2: Physical Geology   [6 Hours]
   2.1   Structure of Earth and its Composition
   2.2   Plate tectonics and mountain building processes and Formation of Himalayas.
   2.3   Landform and processes associated with river and groundwater
   2.3   Geological Hazard (Earthquake, Flood and Landslide)

Unit 3: Petrology   [6 Hours]
   3.1   Petrology, Crystal, Minerals
   3.2   Rock forming Minerals
   3.3   Classification of rocks with structure
   3.4   Differentiate between three rocks types (Igneous, Sedimentary and
         Metamorphic Rocks) and its engineering significance
   3.5   Engineering properties of common rock types found in Nepal (Granite,
         Pegmatite, Shale, Sandstone, Limestone, Dolomite, Slate, Phyllite, Schist,
         Amphibolite Gneiss, Quartzite and Marble)

Unit 4: Structural Geology   [6 Hours]
   4.1   Attitude of Geological Strata (Strike and Dip (Dip Amount and Dip Direction)
   4.2   Geological Structures
      - Primary Structures- Lamination, Bedding Plane, Graded Bedding, Ripple
        Marks and Mud Cracks

- Secondary Structures- Foliation, Folds, Faults and Joints
    4.3   Clues for identification of fold and Fault in the field
    4.4   Importance of Geological Structures in Civil Engineering

Unit 5: Geological Investigation   [6 Hours]
    5.1   Types of Mass Movement and their classification (Landslide, Slope Failure and Debris Flow) Causes and Preventive Measures.
    5.2   Modes of Rock Failure (Plane, Wedge and toppling failure)
    5.3   Geological condition necessary for design and construction of Dams, Reservoirs, Tunnels, Bridge and road cuttings.

Unit 6: Geology of Nepal   [4 Hours]
    6.1   Geological Division of Nepal
    6.2   Major geological Structures and their engineering significance

Practical
Laboratories: Field excursion, One day each, for identification of rock in the field and field observation of landslide.   **(15 Hours]**
    1)   Measurement of attitude of Geological Strata
    2)   Identification of rocks in the field.
    3)   Study of rock Structures (In Block diagram and In the Field)
    4)   Study of Topographic Maps and Preparation of Profile.
    5)   Plotting of stereo net diagram.

References:
    1.   Principles of Physical Geology: A. holmes, ELBS English Language Society
    2.   Principles of Structural Geology: M.P Billings, Prentice Hall of India, New Delhi
    3.   Geology of Nepal: Dr. C. K. Sharma, Educational Enterprises
    4.   Geology for Engineers: Blyth, F. G. H., Freitas, M. H., ELBS

Principles of Management and Costing
EG 2103 MG (Electrical)

	Total: 4 hour /week
Year: II	**Lecture: 4 hours/week**
Semester: I	**Tutorial: hours/week**
	Practical: hours/week
	Lab: hours/week

Course description:

This course is designed to develop understanding about principles and functions of management.

It also deals with basic concepts of accounting, benefit and cost analysis and project risk.

Course Objectives:

After completing this course, the students will be able to

1. Familiarize with organization and management.
2. Explain human resource management, motivation and leadership.
3. Apply skills for cash flow transaction, depreciation and rate calculation.

Course Contents:

Theory

First Part: Management

Unit 1: Organization and Management   [6 Hours]

    1.1 Definition of Organization and Management

    1.2 Need of Management

    1.3 Principles of Management (Henri Foyal)

    1.4 Functions of Management (Planning, Organizing, Controlling, Supervision, Directing, Leading, Motivation etc.)

    1.5 Types of Ownership and hierarchy level (in brief)

Unit 2: Human Resource Management   [8 Hours]

    2.1 Introduction

    2.2 Job Analysis

    2.3 Recruiting Sources

    2.4 Manpower Selection Process

    2.5 Selection Devices

    2.6 Socializing the new employees

    2.7 Labor Welfare Schemes

    2.8 Accidents and Safety measures

Unit 3: Motivation and Leadership   [8 Hours]

    3.1 Definition

    3.2 Need and Functions of Leader

    3.3 Managers as a Leader

    3.4 Motivation Theory: Maslow's Need theory, Herzberg's two factor theory and MC Gregor theory x and theory Y

    3.5 Method of improving motivation

3.6 Job satisfaction and job enrichment

3.7 Disciplinary problems faced by managers

Unit 4: Strategy and Environmental Scanning [6 Hours]

4.1 Strategy with strategic plan

4.2 Environmental Scanning (External plus Internal Analysis)

4.3 Project analysis and project appraisal

4.4 Environmental and Technology (Today Perspective, with case study)

4.5 Technology and Society

Unit 5: Marketing [8 Hours]

5.1 Definition of market and marketing

5.2 Marketing Mix

5.3 Definition of FMCG and One Time Purchase goods

5.4 Understanding consumer Behavior and consumer satisfaction

5.5 Concept of channel of distribution (For heavy equipment, one time purchase items)

5.6 Sales Promotion

5.7 Direct Advertising (Target Group)

5.8 Role of technical manpower in marketing process.

Second Part: Estimating and Costing

Unit 6: Introduction and basic account concept. (in brief) [12 Hours]

6.1 Role of engineering /technical manpower of the organization

6.2 Types of engineering economics decision

6.3 Finance and Capital Management

- Sources of finance for investment
- Concept of assets and liabilities
- Concept of fixed capital and selection of machine tools
- Concept of working capital and calculation
- Accounting - Basic Concept (definition, objectives and importance of accounting, concept of debit and credit, concept of journal and ledger, profit and loss account, balance sheet)
- Simple and compound interest rates, effective interest and continuous compound interest
- Depreciation methods, straight line, declining balance method.
- Cash flow, Net Present Value and Payback Period.
- Related numerical problems on interest and depreciation and NPV.

Unit 7: Benefit and Cost Analysis [6 Hours]

7.1 Calculation of benefits and costs

7.2 Definition on Benefits/Cost (B/V) ratio

7.3 Relation between B/C ratio and NPV

7.4 Related numerical problems on 7.1

Unit 8: Project Risk   **[6 Hours]**
    8.1 Definition of project risk
    8.2 Sensitivity analysis
    8.3 Breakeven analysis
    8.4 Scenario analysis
    8.5 Related numerical problems on 8.2, 8.3 and 8.4

Suggestions for Instruction:
1. Lectures
2. Guest speakers from industries
3. Student's presentations
4. Case studies from industries
5. Industrial visits
6. Use calculate or/and interest factor table during calculation demonstration.
7. Give examples of locally operating engineering activities and projects as much as possible

References:
1. Principles of Management, Philip Kotler, TEE Publication
2. Industrial Engineering and Management, TR Banga
3. Industrial Management, VK Sharma, OP Harkut
4. Agrawal, G.R (2003) Principles of Management in Nepal. M.K. Publishers and distributors, Kathmandu, Nepal
5. Mahajan, M. (2002), Industrial Engineering and production management (2nd ed.), DhanpatRai and Co. (P) Ltd., Delhi
6. Chan S. Park, 2002, Comtemporary Engineering Economics, Third Edition, Prentice- Hall India Pvt. Ltd., New Delhi, India, ISBN-81-203-2143-X.
7. R Panneerselvam, 2001, "Engineering Economics", First Edition, Prentice-Hall of India Pvt. Ltd., New Delhi, ISBN-81-203-1743-2
8. Decenzo, David A. and Robbins, Stephen P. (1997). Personal/ Human Resource Management (3rd ed.), Prentice Hall of India, New Delhi.
9. Dessler, Gary (2002). A Framework of Human Resource Management (2nd ed.) Pearson Education Asia, India.

Surveying II
EG 2212 CE

Year: II   **Total: 7 hours /week**
Semester: II   **Lecture: 3 hours/week**
Tutorial: hours/week
Practical: 4 hours/week
Lab: hours/week

Course description:
This course focuses on familiarization of different surveying techniques and equipment. The different surveying techniques include area, volume, coordinate system, and graphical and analytical method of mapping.

Course objectives:
After the completion of this course, students will be able to:
1. Familiarize with different surveying techniques of civil engineering field;
2. Apply modern survey techniques and
3. Use modern survey instruments for surveying, constructions and map making procedures.

Course Contents:
Theory
Unit 1: Theodolite: **[4 Hours]**
    1.1 Introduction and uses of theodolites
    1.3 Technical terms, fundamental lines and planes of theodolites
    1.4 Working principle of theodolites
    1.5 Temporary adjustment of theodolites
    1.6 Measurement of angles
    1.7 Errors in theodolites survey

Unit 2: Theodolite Traversing: **[7 Hours]**
    2.1 Traverse definition, purpose, types
    2.2 Traverse field works
    2.3 Traverse adjustment and computation of total coordinates
    2.4 Traverse plotting
    2.5 Omitted measurements in traverse

Unit 3: Area and Volume Measurements: **[7 Hours]**
    3.1 Basic definition
    3.2 Area by division into simple figures
    3.3 Area by different methods
        3.3.1 Area by coordinates
        3.3.2 Area by trapezoidal rule
        3.3.3 Area by Simpson's 1/3 rule
    3.4 Volume by cross section
    3.5 Volume by Trapezoidal and prismoidal formula

Unit 4: Trigonometric Leveling: **[4 Hours]**
    4.1 Introduction
    4.2 Different cases of trigonometric leveling
    4.3 Refraction and curvature correction by linear method
    4.4 Field procedures and problems

Unit 5: Stadia Tacheometry: **[5 Hours]**
    5.1 Introduction
    5.2 Instrument used for tacheometry
    5.3 Different system of tacheometric measurements
        5.3.1 Stadia method
        5.3.2 Movable hair method
        5.3.3 Tangential method
    5.6 Horizontal base subtense method
    5.7 Field procedure of tacheometric surveying
    5.8 Errors and their adjustment in tacheometric survey

Unit 6: Engineering Curves: **[9 Hours]**
    6.1 General definition and purposes
    6.2 Classification of engineering curves
        6.2.1 Horizontal curve (simple circular, compound, reverse, transition, combined
            and broken back)
        6.2.2 Vertical curve (summit and sag)
    6.3 Designation of curves
    6.4 Elements of simple circular curve
    6.5 Design and setting out of simple circular curves by ordinate from long chord,
       offsets ordinate from long chord, offsets from tangent and deflection angle
       method.
    6.6 Purpose of horizontal and vertical curves
    6.7 Length of vertical curves
    6.8 Computation and setting out of vertical curves by tangent correction and parabolic
       equation method
    6.9 Introduction and purpose of transition curves

Unit 8: Total Station   **[4 Hours]**
    8.1 Introduction
    8.2 Features of Total Station
    8.3 Electronic Data Recording
    8.4 Summary of total station characteristics
    8.5 Field procedure for total station in topographical survey

Unit 9: Geographic Positioning System (GPS)   **[3 Hours]**
    9.1 Introduction, Definition of terms
    9.2 Geographical Coordinate system
    9.3 Component of GPS
    9.4 Working Principles and uses of GPS

9.5 GPS positioning technique – static point positioning
9.6 GPS data processing

Unit10: Geographic Information System (GIS)   **[2 Hours]**
    10.1 Introduction
    10.2 Application of GIS to Civil engineering projects

Practical (Field works):

1. Care and instrument handling   [5 Hours]
2. Perform theodolite traverse, traverse computation and adjustment   [15 Hours]
4. Perform tacheometric surveying and prepare topographic map   [15 Hours]
5. Perform topographic survey using total station   [10 Hours]
6. Set out simple circular curve, transition curve and composite curves by linear and
   angular method   [10 Hours]
7. Perform GPS survey to prepare a thematic map of a given area.   [5 Hours]

Evaluation of Practical: Continuous evaluation (Viva + Instrumentation + Objective test

Textbooks:
    1. Dr. BC Punmia, "Surveying"- Vol. I & II, Laxmi Publication New Delhi

References:
    1. R. Agor, " Surveying and Leveling" , Khanna Publication New Delhi
    2. SK Duggal, "Surveying" Vol. I & II,T ata MC Graw Hill Publishing
    3. N Basnet & M Basnet , "Basic Surveying I", Benchmark Education Support Pvt,
        Ltd, Tinkune Katmmandu
    4. N Basnet & M Basnet, " Basic Surveying II", Published by D. Shrestha & R.
        Shrestha, Rajmati Press, Lalitpur

Estimating and Costing I
EG 2213 CE

Year: II
Semester: II

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

Course description:
This course focuses on familiarization of estimating and costing of building works.

Course objectives:
After the completion of this course, students will be able to:
1. Prepare the estimated cost and actual cost.
2. Identify the procedures methods of measuring and quantifying the building works.
3. Prepare the estimating the cost of building works.

Course Contents:

Theory
Unit 1: Introduction: [5 Hours]
    1.1.Definition of estimate
    1.2.Purpose of estimating
    1.3.Estimate and the actual cost
    1.4.Definition of terms
        1.4.1.   Administrative approval
        1.4.2.   Technical sanction
        1.4.3.   Capital cost
        1.4.4.   Schedule of rates
        1.4.5.   Abstract of cost
        1.4.6.   Bill of quantities
        1.4.7.   Contingency
        1.4.8.   Plinth area
        1.4.9.   Carpet area
        1.4.10. Work charged establishment

Unit 2: Types of Estimates: [8 Hours]
    2.1 Approximate estimate
    2.2 Detailed estimate
    2.3 Revised estimate
    2.4 Supplementary estimate
    2.5 Annual repair and maintenance estimate
    2.6 Extension and improvement estimate
    2.7 Complete estimate of work/project
    2.8 Split up of the cost of building work

Unit 3: Estimation of Building [16 Hours]
3.1. Data required for preparation of detailed estimate
3.2. Principle of units of measurement
3.3. Units of measurement and payment for various items of work
3.4. Limits of measurement and degree of accuracy
3.5. Methods of taking out quantities of building work
3.6. Methods of measurement of building and other civil engineering works
3.7. Various types of forms used in estimating
3.8. Preparation of detailed estimate

Unit 4:Analysis of Rates: [16 Hours]
4.1. Introduction
4.2. Purpose of analysis of rates
4.3. Requirements of rate
4.4. Factor affecting rate analysis
4.5. Importance of rate analysis
4.6. Terms used in analysis of rates
    4.6.1. Overhead cost
    4.6.2. Task or out turn work
    4.6.3. Labour rate
    4.6.4. Material rate
    4.6.5. Through rate
4.7. Government procedure of preparing analysis of rates for building works
4.8. Estimating quantities of materials

Practical [60 Hours]
Taking out detailed quantities and preparing estimate for the following:
1. Estimate a wall
2. Estimate one room building with RCC flat roof
3. Estimate one room building (having verandah) with RCC flat roof
4. Estimate two roomed RCC framed structure building
5. Estimate steel reinforcement of footing, RCC beam, column and slab
6. Estimate stone and brick masonry retaining walls
7. Estimate steel tubular truss and purlins
8. Estimate dog legged staircase
9. Estimate septic tank and soak pit
10. Perform approximate estimation of building works, road works water supply and sanitary works, irrigation work and bridge works
11. Determine approximate quantities of materials and labour for building based on CBRI, Rookee
12. Perform computerized estimation of quantities of building work

References:
1. Amarjit Aggarwal "Civil estimating quantity surveying and valuation" Katson Publishing House, Ludhiyana, 1985
2. P.K. Guha "Quantity Surveying" (Principles and application Khanna Publishers

Mechanics of Structure
EG 2203 CE

Year: II   **Total: 7 hours /week**
Semester: II   **Lecture: 4 hours/week**
                                                  Tutorial: 2 hours/week
                                                  Practical: hours/week
                                                  Lab: 2/2 hours/week

Course description:
This course is about structural analysis of statically determinate structures and properties of some materials used in structure. It is requisite for design of simple structures.

Course objectives:
After the completion of this course, students will be able to:
1. Understand constitutive relation of some materials to be used in structures;
2. Identify stable and unstable and statically determinate and indeterminate structures;
3. Determine degree of static indeterminacy of statically indeterminate structures and
4. Analyze the simple determinate structures like truss, beam and frame.

Course Contents:

Theory

Unit 1. Introduction: **[4 Hours]**
1.1   Definition of mechanics of structure.
1.2   Review on types of loads, types of supports. Their symbolic representation. Reactions on them and degrees of freedom.
1.3   Stability of structure(beam, frame and truss)
1.4   Introduction to statically determinate and indeterminate structures
1.5   Determination of degrees of static indeterminacies.

Unit 2. Simple Stress and Strain: **[12 Hours]**
2.1   Concepts of stress and strain
2.2   Linear stress and strain and their relation, Hooke's law and Young's modulus of elasticity.
2.3   Deformation of uniform bar due to axial load
2.4   Stress strain curves for different materials.
2.5   Ultimate strength and working stress of materials and factor of safety.
2.6   Factors affecting factor of safety.
2.7   Thermal stress.
2.8   Stress and strains in plain and composite bars.
2.9   Poisson's ratio.
2.10   Shear stress shear strain and modulus of rigidity.
2.11   Volumetric strain and Bulk modulus.
2.12   Relation between Young's modulus, Bulk modulus and modulus of rigidity.

Unit 3. Analysis of Plane Truss: [8 Hours]
3.1   Definition and types of truss.
3.2   Assumptions.
3.3   External and internal forces in truss.
3.4   Determination of internal forces in truss by method of joints and method of sections.

Unit 4. Axial force, Shearing force and bending moment: [12 Hours]
4.1   Force actions in statically determinate beams.
4.2   Definition of axial force, shear force and bending moment.
4.3   Relation between shear force bending moment and applied load.
4.4   Axial force, shear force and bending moment diagrams for statically determinate beam and frame under various types of loading.
4.5   Point of contraflexure.

Unit 5. Theory of Simple Bending: [12 Hours]
5.1   Concept of bending and pure bending.
5.2   Assumptions in theory of simple bending.
5.3   Radius of curvature, neutral layer and neutral axis.
5.4   Stress due to bending.
5.5   Moment of resistance.
5.6   Derivation of flexural formula (Relation between bending stress, radius of curvature and moment of resistance)
5.7   Section modulus.
5.8   Shearing stress in beams.
5.9   Distribution of shear stress in rectangular cross section of beam.
5.10   Definition of elastic curve, slope and deflection in a beam.
5.11   Differential equation of elastic curve.
5.12   Deflection of simply supported and cantilever beams by double integration method.

Unit 6. Torsion: [6 Hours]
6.1   Introduction.
6.2   Definition of torque and angle of twist.
6.3   Stress due to torsion.
6.4   Derivation of torsional equation.
6.5   Strength of solid and hollow circular shaft.
6.6   Power transmitted by shaft.

Unit 7. Simple Strut Theory: [6 Hours]
7.1   Definition of column and strut.
7.2   Stability of columns
7.3   End conditions and their effects.
7.4   Derivation of Euler's formula for columns
7.5   Effective height.
7.6   Slenderness ratio.
7.7   Introduction to eccentrically loaded column.

Practical (Laboratory)   **[15 Hours]**

1 Determine Young's modulus yield stress and ultimate strength of mild steel specimen
   (Stress-strain curve)
2 Measure strains and determination of forces in members of a model truss
3 Measure deflection of simple beams
4 Determine stability/buckling of columns

Textbooks:
   1. G B Motra, "A text book of strength of materials" 2nd edition

References:
   1. Surendra singh "Strength of materials" S. K. Kkataria and sons.
   2. Ferdinand P. Beer E Russell Johnston "Mechanics of Materials "Mcgrow hill Book
       Company.

Soil Mechanics
EG 2204 CE

Year: II
Semester: II

Total: 7 hours /week
Lecture: 4 hours/week
Tutorial: 2 hours/week
Practical: hours/week

Lab: 2/2 hours/week

Course description:
This course is intended to give student a brief introduction to the field of soil mechanics and use of the basic data for analyzing various soil problems common to the civil engineering.

Course objectives:
After the completion of this course, students will be able to:
1. Understand the fundamental and relevant principles of soil mechanics;
2. Have an overall picture of the behavior of soil;
3. Describe the nature of some of the soil problems encountered in civil engineering and
4. Formulate the basic technique and to develop the methodologies to solve the soil problem.

Course Contents:
Theory
Unit 1:   **Introduction:**   **[2 Hours]**
- 1.1   Definition of soil
- 1.2   Soil mechanics
- 1.3   Objective of soil mechanics
- 1.4   Formation of soil and their types

Unit 2:   **Basic Terminology and Interrelations:**   **[4 Hours]**
- 2.1   Introduction
- 2.2   Phase diagrams
- 2.3   Void ratio, porosity, degree of saturation, unit weight, density, air content and percentage air voids
- 2.4   Interrelations

Unit 3:   **Index properties of Soil:**   **[6 Hours]**
- 3.1   Introduction
- 3.2   Specific gravity
- 3.3   Water content
- 3.4   Particle size distribution
- 3.5   Consistency of soils
- 3.6   Determination of field density

Unit 4:   **Soil Classification:**   **[6 Hours]**
- 4.1   Purpose of soil classification
- 4.2   M.I.T classification system

4.2	Textural soil classification of soil	
4.3	Unified soil classification of soil	
4.4	Field identification of soil	

Unit 5:   **Soil Water and Effective Stress**   **[9 Hours]**

5.1	Types of soil water	
5.2	Water table	
5.3	Permeability	
5.4	Seepage through soils	
5.5	Darcy's Law	
5.6	Determination of coefficient of permeability: laboratory methods	
5.7	Principle of effective stress	
5.8	Quick sand condition	
5.9	Approximate stress distribution method for loaded areas	

Unit 6:   **Compaction:**   **[4 Hours]**

6.1	Introduction	
6.2	Standard proctor test	
6.3	Field compaction methods	
6.4	Factors affecting compaction	
6.5	Compaction control	

Unit 7:   **Consolidation:**   **[9 Hours]**

7.1	Introduction	
7.2	Primary and secondary consolidation	
7.3	Settlement	
7.4	The spring analogy	
7.5	The standard one-dimensional consolidation test	
7.6	Pressure-void ratio curves	
7.7	Co-efficient of compressibility	
7.8	Co-efficient of volume change	
7.9	Computation of consolidation settlement	

Unit 8:   **Shear Strength of Soils:**   **[6 Hours]**

8.1	Introduction	
8.2	Principle plane and principle stress	
8.3	Mohr's circle for two dimensional stress system	
8.4	Mohr-Coulomb failure theory	
8.5	Determination of shear strength parameter	
8.6	Direct shear test	
8.7	Unconfined compression test	

Unit 9:   **Earth Pressure Theory:**   **[5 Hours]**

9.1	Introduction	
9.2	Different types of lateral earth pressures	
9.3	Rankine's earth pressure theory	

9.4 Types of retaining walls
9.5 Principles of the design of retaining walls

Unit 10:   **Bearing Capacity:**   **[9 Hours]**
10.1 Introduction
10.2 Types of foundation
10.3 Basic definition
10.4 Gross and net foundation pressure
10.5 Terzaghi's bearing capacity theory
10.6 Bearing capacity of footing with finite dimensions
10.7 Effect of water table on bearing capacity
10.8 Settlement of foundation

Practical (Laboratory)   **[15 Hours]**
1. Perform sieve analysis of Coarse grained soil(1 session)
2. Determine specific gravity by Pycnometer method(1 session)
3. Determine liquid limit and plastic limit(1 session)
4. Determine field density by Sand replacement method and Core cutter method(1 session)
5. Perform compaction test: Standard proctor test(1 session)
6. Perform direct shear test(1 session)
7. Perform unconfined compression test(1 session)

Textbooks:
1. K.R Arora,"*Soil Mechanics and Foundation Engineering*" ,Standard Publishers Distributors, Nai-sarak, New Delhi, 2005

References:
1. V.N.S Murthy "*A Text Book ofSoil Mechanics and Foundation Engineering in SI Units* "UBS Distributors Ltd.Fourth Edition,1993
2. Prof.T.N Ramamurthy,Prof.T.G Sitaram "*Geotechnical Engineering,Soil Mechanics*"S.Chand Publishing, New Delhi, Revised Edition,2000
3. Dr.Sehgal "A text book of soil mechanics" S.B CBS Publishers and Distributors, New Delhi,1988

Hydrology and Irrigation
(EG 2214 CE)

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

Course Description:
This course is aimed at teaching students the concept of hydrology and Irrigation and for the design and management of water resources projects. It gives a practical approach to the various facts of the subject and emphasizes the application of hydrological knowledge to solve engineering problems and to understand irrigation system.

Course Objectives:
This course is aimed to meet following objectives.
1. Understand hydrology and different hydrological processes.
2. Measure rainfall and interpret rainfall data.
3. Measure stream runoff by different methods.
4. Relate stream runoff with rainfall.
5. Understand flood and estimate flood at a point in a basin.
6. Understand basics of irrigation and calculate water requirements of irrigation.
7. Understand irrigation system and different components of irrigation system.

Course Contents:

Unit 1: Introduction   **[2 hours]**
   1.1. Definition of Engineering hydrology
   1.2. Scope and Application of Hydrology in Civil Engineering
   1.3. Hydrologic cycle and water balance equation

Unit 2: Precipitation   **[7 hours]**
   2.1 Causes, forms and types of precipitation
   2.2 Types of raingauge and measurement of rainfall.
   2.3 Existing raingauge stations in Nepal
   2.4 Snow fall and its measurement
   2.5 Estimation of missing rainfall data
   2.6 Test for inconsistencies of rainfall data (Double Mass Curve)
   2.7 Presentation of rainfall data (Mass curve, Hyetograph, Average curve of annual rainfall)
   2.8 Estimation of mean rainfall over an area
   2.9 Introduction of Intensity - Duration - Frequency (IDF) curve and equation

Unit 3: Hydrological Losses   **[7 hours]**
   3.1 Initial losses (Interception and depression storage)
   3.2 Evaporation process

       3.2.1   Meteorological parameters (Radiation, Temperature, Vapor pressure, Humidity, Wind)

       3.2.2   Evaporimeters (types and purpose)

   3.3 Evapotranspiration

       3.3.1   Actual evapotranspiration and Lysimeters

       3.3.2   Potential Evapotranspiration (Penman's equation)

   3.4 Infiltration

       3.4.1   Horton's equation

       3.4.2   Infiltration indices (Φ and W)

       3.4.3   Infiltrometers

Unit 4: Surface Runoff [7 hours]

4.1 Drainage basins/catchment area

4.2

4.3 Factors affecting runoff from a catchment

4.4 Rainfall - Runoff relationship

4.5 Stream gauging (selection of sites, types of gauges and measurement)

4.6 Stream flow measurement by i) velocity area method (current meters, floating method) ii) salt dilution method iii) slope-area method iv) bucket method v) rectangular weir and v-notch

4.7 Development of Rating curve and its uses

4.8 Estimation of monthly flows by empirical methods (MIP, HYDEST, CAR)

Unit 5: Flood Hydrology [4 hours]

5.1 Design flood and its frequency, introduction to return period and risk

5.2 Flood prediction by Rational and Empirical methods

Unit 6: Introduction to Irrigation [4 Hours]

6.1 Purpose of irrigation

6.2 Types of irrigation and significance (gravity, lift, drip and sprinkler)

6.3 Status of irrigation development in Nepal

6.4 Some terminologies used in Irrigation system(duty, delta, base period, GCA, CCA, NCA, cropping intensity, design discharge)

6.5 Methods of rain water harvesting for irrigation.

Unit 7: Soil Water Relationship and water requirement [6 Hours]

7.1 General classification of soil for agricultural purposes

7.2 Effective rainfall

7.3 Soil-Moisture / Crop-water requirement

7.4 Factors affecting Crop-Water Requirements

7.5 Principal crops, Their seasons and water requirements (operational water requirement and irrigation water requirement

7.6 Crop-Water requirement calculation by Penman-Monteith method.

Unit 8: Canals [4 Hours]

8.1 Classification of canals according to function, discharge, alignment

8.2 Components of the canal system, head works, major Canal, Branch Canal, distributaries and water Courses
8.3 Canal alignment
8.4 Canal losses due to seepage and evaporation
8.5 Assessment of water requirement in canals and command area
8.6 Necessity of canal lining and it's types.

Unit 9: Introduction to hydraulic structures for canals   **[2 Hours]**
9.1 Canal regulators (head regulator and cross regulator)
9.2   Cross-drainage structures(aqueduct, superpassage, level crossing)
9.3 Canal Falls
9.4 Canal escapes
9.5   Canal outlets

Unit 10: Operation and maintenance of irrigation system   **[2 Hours]**
10.1 Operation and maintenance of gates and trash rack
10.2 Maintenance of Canals

Practical (Field Visit)   [30 Hours]

1. Use of Current meter and salt dilution techniques for discharge measurements.
2. Measurement of stream discharge using float method.

Recommended Books and References:
1 Engineering Hydrology by K. Subramanya, Tata-McGraw Hill Publishing Co., New Delhi
2 Applied Hydrology by V.T. Chow, D.R. Midment and L.W. Mays, McGraw Hill International
3 Engineering Hydrology by R. S. Varshney, Nem Chand & Bros., Roorkee
4 Hydrology for Engineers by Linsley, Kohler and Paulhus, McGraw Hill International Co.
5 Engineering Hydrology by B. L. Gupta, Standard Publishers and Distributors, New Delhi
6 Irrigation Engineering and drainage management by S. K. Garg, Khanna publishers.
7 FAO irrigation and Drainage paper No. 56, crop Evapotranspiration (http://www.kimberly.uidaho.edu/water/fa)

Third Year
(Fifth and Sixth Semesters)

Fifth Semester

Subjects:

1. EG 3121 EE   Basic Electrical Engineering
2. EG 3111 CE   Estimating and Costing II
3. EG 3103 CE   Structural Design and Drawing
4. EG 3112 CE   Road Engineering
5. EG 3113 CE   Water Supply and Sanitary Engineering
6. EG 3114 CE   Hydropower Engineering I
7. EG 3107 CE   Minor Project (Survey Camp)

Basic Electrical Engineering
EG 3121 EE

Year: III **Total: 6 hours /week**
Semester: I **Lecture: 3 hours/week**
Tutorial: hour/week
Practical: 3 hours/week
Lab: hours/week

Course Description:
The course deals with basic concept of electricity. This deals features and classification of Basic Electricity.

Course Objectives:
1. Known the basic concept parameters of electricity.
2. Familiarize with electrical quantities.
3. Understand the basic circuit theory.
4. Gain the knowledge of measuring instrument used in hydropower station.
5. Understand the basic concept of protection system.
6. Understand the basic concept of electronic devices.
7. Understand the basic concept of Electrical Machines.

Unit 1: Introduction [8 Hours]
1.1. Conductor, Insulator, semiconductor
1.2. Voltage, current and resistance
1.3. AC, DC, Frequency, Torque, Power, Energy
1.4. Battery and Cell (Lead Acid Battery)

Unit 2: Electrical Circuit Fundamental [12 Hours]
2.1. Circuits: series and Parallel and Mix circuits
2.2. Ohm's law, Kirchhoff's laws, Electrical Power and energy
2.3. Single phase ac circuit, three phase A.C. Circuit (power calculation)
2.4. Concept of power factor

Unit 3: Measuring Instrument [10 Hours]
3.1. Ammeter, voltmeter, Basic operation and circuit
3.2. Frequency meter basic concept and operation
3.3. Multimeter operation
3.4. Energy meter (1-phase, and 3-phase)
3.5. Power factor meter connection and general concept

Unit 4: Protection System [15 Hours]
4.1. Fuse, MCB, ELCB Connection in circuit and basic knowledge
4.2. Uses of circuit breaker in Hydro Power
   i. Basic concept of OCB, MOCB
   ii. Basic Concept of SF 6, ACB
   iii. Earthing(equipment, system earthing)

4.3. Repair and maintenance in Hydro power.
   i. Basic Process of Desmintal of Circuit Breaker.
   ii. Basic testing of Circuit breaker.
   iii. Assebling of Circuit Breaker
   iv. Fault analysis (Basic Concept)

Unit 5: Electronic Devices [8 Hours]
   i. Basic Concept of Diode, transistor
   ii. Basic Concept of Capacitor, Inductor
   iii. SCR (silicon controller rectifier) operate circuit

Unit 6: electromechanical machines [7 Hours]
   i. Faraday's law of electromagnetic induction
   ii. Operating principle and components of Generator (1-phase and 3-phase)
   iii. Operating principle and components of motor (1-phase and 3-phase)
   iv. Listing the electromechanical machines use in Hydro power plants.

Practical: (3*15=45 Hours)
1. Verification of Ohm's law
2. Verification of Kirchoff's laws
3. Handling and connection idea of Energy meter, Power factor meter, frequency meter, ammeter and voltmeter.
4. Perform Board wiring: One bulb controlled by one way switch.
                            Two bulb Controlled by two way switch.

References:
1. A text book of Electrical Technology Vol. 1, 2, 3, 4 by B. L. Therja.
2. Fundamental Electrical Engineering by V. K. Metha
3. Basic Electricity by Dogal Vol. 1, 2, 3.

Estimating and Costing II
EG 3111 CE

Year: III **Total: 6 hours /week**
Semester: I **Lecture: 3 hours/week**
Tutorial: hour/week
Practical: 3 hours/week
Lab: hours/week

Course description:
This course focuses on familiarization of estimating and costing and specifications of road works and water supply and sanitary works and valuation of existing property.

Course objectives:
On completion of this course the student will be able to:
1. Understand the procedures, methods of measuring and quantifying the road and restoration work;
2. Calculate the quantities of earthwork of road in plan and hilly area;
3. Analyze rate of road and water supply and sanitations works;
4. Provide basic knowledge of the value of existing properly and role of computes in valuation;
5. Provide basic knowledge of specifications building and road works and
6. Prepare estimate of road and restoration works.

Course Contents:

Theory

Unit 1: Introduction: **[3 Hours]**
    1.1. Terms use in Earthwork in road construction
    1.2. Method of estimating of road and restoration works

Unit 2: Earthwork in road construction: **[10 Hours]**
    2.1 Various methods of earthwork calculation in road work
    2.2 Earthwork calculation of road work in plain area
    2.3 Earthwork calculation of road work having vertical drop
    2.4 Earthwork calculation of road work in highly area

Unit 3: Analysis of rules (for road and sanitary and water supply): **[10 Hours]**
    3.1. Task or outturn work
    3.2. Factors affecting the cost of road and sanitary and water supply works
    3.3. Govt. procedure of preparing rate analysis of road and sanitary and water supply works

Unit 4: Valuation: **[10 Hours]**
    4.1. Definition
    4.2. Purpose of valuation
    4.3. Principle of valuation

4.4.Factors affecting the value of propose

4.5.Definition of terms used in valuation

4.6.Method of valuation

4.7.Method of writing valuation report

Unit 5: Specifications [12 Hours]

5.1.Definition

5.2.Purpose of specification

5.3.Types of specification

5.4.Necessity of specification

5.5.Technique of specification

5.6.Paragraph of specification

5.7.Detailed specification for:
  a) Building work :
  - earthwork in excavation
  - plain content concrete work
  - steel reinforcement
  - form work
  - brick masonry work
  - stone masonry work
  - wood work for doors and windows frame and shutters
  - cement sand plaster work
  - CGI sheet roofing

  b) Road works:
  - embankment construction
  - sub-grade
  - base course
  - WBM road
  - surface dressing using hot bitumen
  - premix capet

Practical: [45 Hours]

Taking out detailed quantities and preparing estimate for the following:
1. Estimate two storey RCC framed structure building having a flat roof
2. Calculate earthwork in road construction by three methods
3. Calculate earthwork of road in plain area
4. Calculate earthwork of road having vertical drop
5. Calculate earthwork of road in highly area
6. Estimate metalled road of one KM
7. Evaluate report of existing properly
8. Estimate restoration work of road

References:

1. Amarjit Aggrawal "civil estimating quantity surveying and valuation, "Katson publishing house, Ludhiana, 1985.
2. M. Charkraborti "estimating, costing, specifications and valuation in civil engineering"
3. G. S. Berdie "text book of estimating and costing".

Structural Design and Drawing
EG 3103 CE

Year: III　　　　　　　　　　　　　　　　　　**Total: 10 hours /week**
Semester: I　　　　　　　　　　　　　　　　**Lecture: 5 hours/week**
　　　　　　　　　　　　　　　　　　　　　　Tutorial: 3 hours/week
　　　　　　　　　　　　　　　　　　　　　　Practical: 2 hours/week
　　　　　　　　　　　　　　　　　　　　　　Lab: hours/week

Course description:
This course focused on giving the general ideas and design of steel, timber and reinforced concrete structures.

Course objectives:
After the completion of this course, the students will be able to:
1. Identify material and structural elements of steel, timber and RCC structures;
2. Understand concept of design and codal provisions and
3. Design simple structural elements.

Course Contents:
Theory
Unit 1:　　Introduction　　　　　　　　　　　　　　　　**[4 Hours]**
　　1.1　　Introduction to steel structures
　　1.2　　Types & properties of steel
　　1.3　　Allowable stresses in structural steel
　　1.4　　Use of steel as a structural member in construction
　　1.5　　Codes of practice for design of steel structures
　　1.6　　Advantage and disadvantage of steel structures
　　1.7　　Different types of load on roof truss

Unit 2: Joints in the Steel Structures　　　　　　　　　**[4 Hours]**
　　2.1.　　Types of rived and bolted joints
　　2.2.　　Types of failure of riveted and bolted joints
　　2.3.　　Rivets value and efficiency of joints
　　2.4.　　Welded joints

Unit 3: Design & Details of Joints　　　　　　　　　　**[8 Hours]**
　　3.1.　　Design of riveted bolted joints under axial force
　　3.2.　　Details of riveted and bolted joints under axial forces
　　3.3.　　Design of welded joints under axial forces

Unit 4: Design of Tension of Members　　　　　　　　**[6 Hours]**
　　4.1.　　Types of tension members
　　4.2.　　Net sectional area
　　4.3.　　Design of members subjected to axial load

Unit 5: Axially loaded Compression Members (Tubular)and angle section)

[8 Hours]

5.1. End condition & Effective lengths
5.2. Radius of gyration and slenderness ratio
5.3. Strength of compression members
5.4. Design of compressive members

Unit 6: Design of Roof Trusses [4 Hours]

6.1. Different types of loads on roof truss
6.2. Introduction to the design of roof trusses:
6.3. Tubular sections

Unit 7: Timber Structures [3 Hours]

7.1. Introduction of timber
7.2. Properties of timber
7.3. Use of timber as a structural member in construction
7.4. Code of practice of design of timber structures
7.5. Advantage & disadvantage of timber structure

Unit 8: Design of Timber Structure [6 Hours]

8.1. Design of compression member
8.2. Design of solid rectangular beam
8.3. Check of deflections
8.4. Types of joints and their connection

Unit 9: Design Concept of Reinforced Concrete [6 Hours]

9.1. Properties of concrete and steel reinforcement
9.2. Behavior of reinforced concrete in bending
9.3. Methods of design of a reinforced concrete section
9.4. Concept of modular ratio, permissible and ultimate stress
9.5. Description of ultimate load and limit state method

Unit 10: R.C Section in Bending [6 Hours]

10.1. Basic assumption (working stress method)
10.2. Stress – strain diagram
10.3. Position of neutral axis
10.4. Moment of resistance
10.5. Under reinforcement, over reinforcement, and balanced sections
10.6. Analysis of singly and doubly reinforcement rectangular sections
10.7. Analysis of singly reinforced flanged sections
10.8. Flexure design of rectangular and flanged section
10.9. Design of one way and two way slabs using IS Code

Unit 11: Shear and Bonds for R.C. Sections [6 Hours]

11.1. Behavior of a R.C. section in shear
11.2. Shear resistance of reinforced section

11.3. Types of shear reinforcement
11.4. Strength of vertical links (stirrups)
11.5. Design of vertical stirrups
11.6. Local and anchorage bond
11.7. Anchorage lengths
11.8. Bar curtailment

Unit 12: Axial Loaded R.C. Columns   **[8 Hours]**
12.1. Short and long columns
12.2. Types of compression members
12.3. Design of a RCC column
12.4. Reinforcement detailing
12.5. Code requirements

Unit 13: Introduction to the Limit State Method   **[6 Hours]**
13.1. General introduction
13.2. Use of IS-456 and Tables of SP 16 for the design of :
    13.2.1. Singly reinforcement beam
    13.2.2. Doubly reinforcement beam
    13.2.3. Axially and uni-axially loaded columns

Practical: [30 Hours]
Design and draw followings:
1. Singly reinforcement rectangular beams
2. Doubly reinforcement rectangular beams
3. Singly reinforcement T – beams
4. One way slabs (simply supported, cantilever and overhang)
5. Two way slab
6. Short and long columns (axially loaded)
7. Simple pad footings for columns
8. Preparation of bar bending schedule for all RC drawings
9. Details riveted and welded joints.
10. Steel beam column connection and column bases
11. Steel roof truss joint details
12. Timber roof truss joint details
13. Timber beam and column

References:
1. Dr. Rajan Suwal, "Design of Steel and Timber Structures", R & R Group, Kathmandu
2. P. Dayaratnam, "Design of Reinforced Concrete Structures", Oxford & IBH Publishing Company.
3. S. Negi, "Design of Steel & Timber Structures", Tata McGraw Hill Publishing Co., New Delhi.
4. Dr. Rajan Suwal, "Design of Reinforced Concrete Structures", A. K. Book Publication, Kathmandu

Road Engineering
EG 3112 CE

Year: III
Semester: I

Total: 4 hours /week
Lecture: 3 hours/week
Tutorial: hour/week
Practical: hours/week
Lab: 2/2 hours/week

Course description:

This course is aimed to provide general background knowledge road engineering putting emphasis on alignment survey, geometric design, drainage, highway materials, road pavement, road machineries, road construction technology, road maintenance and bridges.

Course objectives:

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

1. Describe highway alignments and conduct its engineering survey;
2. Understand the principles of geometric design, both vertical and horizontal together with drainage components of highway;
3. Differentiate between the various types of materials used in road construction
4. Perform different test of road construction materials.
5. Differentiate between road pavement structures;
6. Know the different types of equipment used in road construction along with the road construction methodology depending upon the type of road surface.
7. Be familiar with different types of failures that may occur in road pavement after its operation and probable causes of failure.

Course Contents:

Unit 1: Introduction to road engineering: **[3 Hours]**
    1.1. Introduction to road engineering
    1.2. Road transport and its advantages/disadvantages
    1.3. History of road development
        1.3.1   Roman roads construction technique
        1.3.2   Tresaguet road construction technique
        1.3.3   Telford road construction technique
        1.3.4   Macadam road construction technique
        1.3.5   Modern roads
    1.4. Road construction in Nepal

Unit 2: Road Alignment and Engineering Survey: **[3 Hours]**
    2.1. Introduction
    2.2. Requirements of ideal road alignment
    2.3. Factors controlling road alignment
    2.4. Engineering survey for road alignment
        2.4.1.   Map study

      2.4.2. Reconnaissance,
      2.4.3. Preliminary survey
      2.4.4. Final location and detailed survey

Unit 3: Road Geometric: [9 Hours]
   3.1. Introduction
   3.2. Road cross sectional elements
      3.3.1. Typical drawings of road cross sections: rural roads
      3.3.2. Camber
      3.3.3. Width of pavement or carriageway
   3.3. Sight distance
      3.3.1. Introduction
      3.3.2. Types
      3.3.3. Analysis
   3.4. Design of Horizontal alignment
      3.4.1. Horizontal curves
      3.4.2. Super elevation
      3.4.3. Extra widening on horizontal curves
      3.4.4. Horizontal Transition curve
   3.5. Design of Vertical alignment
      3.5.1. Gradient
      3.5.2. Vertical curves

Unit 4: Road Drainage: [3 Hours]
   4.1. Introduction and important of road drainage
   4.2. Causes of moisture variation in subgrade soil
   4.3. Requirements of good drainage system
   4.4. Classification of road drainage system
      4.4.1. Surface drainage
      4.4.2. Subsurface drainage
      4.4.3. Cross drainage
      4.4.4. Energy dissipating structures
   4.5. Surface drainage system (longitudinal drainage types like lined/unlined, rural/hill road drainage system)
   4.6. Subsurface drainage system
   4.7. Cross drainage structures

Unit 5: Highway Materials: [9 Hours]
   5.1. Classification of highway materials
   5.2. Subgrade soil
      5.2.1. Uses
      5.2.2. Requirements of soil as a highway material
      5.2.3. California Bearing Ratio test of soil
   5.3. Stone aggregates
      5.3.1. Definition
      5.3.2. Types

5.3.3. Desirable properties of road aggregates
5.3.4. Tests on road aggregates (Los Angeles Abrasion test, Aggregate Impact test, Water absorption test, Specific Gravity test, Shape test)
5.4. Binding materials (bituminous material):
5.4.1. Introduction
5.4.2. Types of binding materials (bitumen, tar), natural bitumen, petroleum bitumen, cutback bitumen, bituminous emulsion
5.5. Tests on bitumen: penetration test, ductility test, viscosity test, softening point test

Unit 6:   **Road Pavement:**   **[2 Hours]**
   6.1.   Definition, types, difference between flexible and rigid pavement
   6.2.   Different layers in pavement structure and their functions

Unit 7:   Road Machineries: **[2 Hours]**
   7.1. Methods of road construction (labor based, machine based)
   7.2. Different types of tools, equipment and plants
   - Earth moving equipment
   - Grading equipment
   - Transporting equipment
   - Compacting equipment
   - Paving equipment and plants

Unit 8:   Road Construction Technology: **[8 Hours]**
   8.1. Introduction
   8.2. Activities involved in road construction
   8.3. Earthwork
   8.4. Construction of earthen road: Introduction, materials required, equipment required, construction procedure
   8.5. Construction of gravel roads: Introduction, materials required, equipment required, construction procedure
   8.6. Construction of soil stabilized roads: Introduction to soil stabilization, types of soil stabilization, mechanical stabilization of soil (materials, equipment, construction procedure)
   8.7. Constructions of Water Bound Macadam (WBM) roads: Introduction, materials required, equipment required, construction procedure
   8.8. Construction of bituminous roads: Introduction, types of bituminous surfacing, interface treatment (prime coat, tack coat), seal coat, functions of each coat
   8.9. Surface dressing: types (single, double), materials required, equipment required, construction procedure

Unit 9:   Road Maintenance and Repair: **[3 Hours]**
      9.1 Introduction
      9.2 Types of maintenance activities
      9.3 Maintenance of earth roads, gravel roads, WBM roads
      9.4 Maintenance of bituminous roads (pot hole, patch repair works, resurfacing)
      9.5 Maintenance of drainage structures

Unit 10: Bridge: **[3 Hours]**
      10.1 Introduction
          10.1.1 Definition
          10.1.2 Classification based on span, length, loading, materials and structures
      10.2 T Beam bridge
          10.2.1 Essential elements
          10.2.2 Detail of superstructure and substructure
      10.3 Suspension bridge
          10.3.1 Introduction
          10.3.2 Components and their function

Practical (Laboratory)   **[15 Hours]**
      1. Perform California bearing test of soil.
      2. Perform Los Angles Abrasion test of aggregate
      3. Perform penetration test of bitumen
      4. Perform softening point test of bitumen
      5. Perform ductility test of bitumen

References:

1. Dinesh Kumar Shrestha, Anil Marsani, Transportation Engineering volume 1, Jasni Publications, Mid Baneshwor, Kathmandu, Nepal, 2013.
2. Partha Mani Parajuli, Course Manual on Transportation Engineering I.IoE, Pulchowk, Lalitpur, Nepal.
3. C E G Justo, S K Khanna, Highway Engineering, Khanna Publications, New Delhi, India
4. Ajay K Duggal, Vijaya P. Puri, Laboratory manual on Highway Engineering, 1991, New Age International (P) Limited, New Delhi, India.
5. S. K. Sharma, Principles, Practice and Design of Highway Engineering, S Chand and Company Ltd. New Delhi, 1985.

Water Supply and Sanitary Engineering
(EG 3113 CE)

Year: III　　　　　　　　　　　　　　　　　　**Total: 5 hours /week**
Semester: V　　　　　　　　　　　　　　　　　**Lecture: 3 hours/week**
　　　　　　　　　　　　　　　　　　　　　　　Tutorial: 1 hour/week
　　　　　　　　　　　　　　　　　　　　　　　Practical: 0 hour/week
　　　　　　　　　　　　　　　　　　　　　　　　　Lab: 1 hour/week

Course description:
The course aims at developing fundamental knowledge of sanitary engineering such as sewerage system, preliminary sewage treatment system, on site sanitation systems and solid waste management. This course focuses on familiarization of fundamental of water supply engineering terminology, principle, system management, different component of w/s design and construction.

Course objectives: water supply
After the completion of this course, students will be able to:
1. Assess the various water consumption categories;
2. Describe the sources and methods of water collection;
3. Explain and illustrate water transmission and distribution systems;
4. Describe and illustrate pipe fittings, valves accessories and layout;
5. Carry out qualitative and quantitative analysis of water;
6. Understand an overview of the water treatment process and
7. Outline and sketch the water treatment process.

Course objectives: sanitary
After completion of the course, the students will be able to:
1. Understand the basic knowledge on sanitation and health, main diseases transmitted due to unsanitary excreta disposal;
2. Understand the basic knowledge on wastewater collection, conveyance, treatment and disposal methods and design of sewers;
3. Be familiar with the fundamental problems, issues related to wastewater and its management;
4. Describe the onsite sanitation systems and
5. Explain the importance and methods of solid waste disposal.

Part I: Water Supply Engineering

Course Contents:

Theory

Unit 1: Introduction: [2 Hours]
  1.1 Water supply system and its importance.
  1.2 Present status of water supply in Nepal.
  1.3 Components of water supply system (Rural and Urban)

Unit 2: Sources of Water Supply: [3 Hours]
  2.1 Surface Sources: River, Streams, Pond, Lake, Impounded reservoir
  2.2 Ground Sources: Springs, Wells - artesian and tube wells, Infiltration galleries
  2.3 Alternative Water Source: Rain Water Harvesting

Unit 3: Quantity of Water: [3 Hours]
  3.1 Per capita consumption
  3.2 Type of water demand: domestic, livestock, commercial, industrial and public uses, firefighting and losses and wastage
  3.3 Design period: definition, factors affecting design period (selection basis)
  3.4 Population forecasting: necessity and methods
  3.5 Variation in water demand: types of variation, average demand , peak demand, factors affecting water demand
  3.6 Numerical exercise on population forecasting, total water demand computation

Unit 4: Quality of Water: [4 Hours]
  4.1 Wholesome Water, Contaminated Water
  4.2 Impurities in water, their classification and effects
  4.3 Hardness in water, types of hardness, alkalinity in water
  4.4 Living organisms in water: virus, algae, worms and bacteria
  4.5 Water sampling and storing
  4.6 Physical analysis (temperature, color, turbidity, taste and odour)
  4.7 Chemical analysis (total solids, pH, chlorine)

Unit 5: Treatment of Water: [8 Hours]
  5.1 Screening: coarse and fine screens
  5.2 Plain Sedimentation: purpose, types of sedimentation tank
  5.3 Sedimentation with coagulation: purpose, process
  5.4 Methods of aeration
  5.5 Filtration: purpose; theory of filtration, types of filter; slow and rapid sand filter
  5.6 Disinfection: purpose, methods of disinfection
  5.7 Chlorination: residual chlorine, break point chlorination
  5.8 Softening: removal of temporary hardness by boiling and lime treatment, removal of permanent hardness by lime soda and zeolite or ionization process
  5.9. Arsenic water treatment.

Unit 6: Gravity Water Supply System: **[3 Hours]**
      6.1 Concept of gravity water supply
      6.2 Schematic diagram of a typical gravity water supply system
      6.3 Break pressure tank
      6.4 Valves (flush out valve, air relief valve, gate valve)
      6.5 Public tap stand post.
      6.6 Supply of water from water main to household.
      6.5 Residual head requirement

Part II: Sanitary Engineering

Course Contents:

Unit 7: Introduction: **[3 Hours]**
      7.1. Sanitation and its present status in Nepal
      7.2. Main diseases transmitted by unsanitary excreta disposal
      7.3. Transmission routes
      7.4. Preventive measures
      7.5. Sewerage systems and types
            7.5.1. Separate system
            7.5.2. Combined system
            7.5.3. Partially separate system
            7.5.4. Comparison in tabular form between separate and combined systems

Unit 8: Quantity of Sewage: **[2 Hours]**
      8.1. Sources of sanitary sewage
      8.2. Dry Weather Flow (DWF) and Wet Weather Flow (WWF)
      8.3. Factors affecting quantity of sanitary sewage
      8.4. Numerical on determination of quantity of wastewater for separate, combined
             and partially separate systems

Unit 9: Wastewater Disposal: **[4 Hours]**
      9.1. Necessity and objectives of wastewater disposal
      9.2. Wastewater disposal by Dilution process and essential conditions for dilution
      9.3. Self-purification of rivers/streams and sag curve
      9.4. Wastewater disposal by land treatment and Suitability of land treatment
      9.5. Methods of application of sewage on land - flooding, surface irrigation, ridge and
             furrow method, subsurface irrigation and spray irrigation
      9.6. Sewage sickness and its prevention

Unit 10: Wastewater Treatments: **[6 Hours]**
      10.1. Objectives of wastewater treatment
      10.2. Primary treatment process
            10.2.1. Racks and Screens - purpose, design criteria, construction and working
               10.2.1.1 Skimming tank – purpose, design criteria, construction, and working
            10.2.2. Grit chamber - purpose, design criteria, construction, and working
      10.3. Waste stabilization pond - purpose , design criteria, construction and working
      10.4. Constructed wetland - purpose, design criteria, construction and working

Unit 11: On site Sanitations for Isolated / Unsewered Area: [3 Hours]
      11.1. Necessity
      11.2. Pit privy - purpose and construction
      11.3. Ventilated Improved Pit (VIP) latrine - purpose, construction, design criteria
      11.4. Septic tank - purpose, construction, design criteria and working
      11.5. Soak pit - purpose, construction and design criteria

Unit 12: Solid Waste Disposal: [4 Hours]
      12.1. Importance of solid waste disposal
      12.2. Collection, segregation and transportation methods
      12.3. Methods of solid waste disposal
            12.3.1. Dumping
            12.3.2. Sanitary landfill
            12.3.3. Incineration
             12.3.4. Composting
             12.3.5 Energy generation

Tutorials: Water supply   [7.5 Hours]

Drawing of:
      1.1 Typical sedimentation tank
      1.2 Filtration ; slow and rapid
      1.3 Storage tank (RVT)
      1.4 Break pressure tank
      1.5 Tap stand
      1.6 Layout of distribution system

Practical   [15 Hours]

      1.1 Determine physical parameters (Colour, Turbidity, Temperature)
      1.2 Determine pH value
      1.3 Perform jar test
      1.4 Determine total solids
      1.5 Determine dissolved oxygen

Tutorials: sanitation   [7.5 Hours]

   1.0   Introduction   **[0.5 Hour]**
      Definitions
   2.0   Quantity of Wastewater   **[1 Hours]**
      Definitions, Numerical on determination of sanitary sewage and storm water,
      determination on quantity of wastewater for separate, combined and partially
      separate systems

3.0   **Design and Construction of Sewers**   **[1 Hours]**
Design criteria of sewers, partial flow conditions in sewers, Numerical on design of circular and rectangular sewers for separate and combined systems

4.0   **Sewer Appurtenances**   **[1 Hours]**
Definitions and sketches

5.0   **Sampling and Characteristics of Wastewater**   **[0.5 Hour]**
Definitions, standards

6.0   **Wastewater Disposal**   **[0.5 Hour]**
Definitions, drawing sag curve

7.0   **Wastewater Treatment**   **[1 Hours]**
Numerical on design of Racks and Screens, Skimming tank, Grit chamber

8.0   **Disposal of Sewage from Isolated Buildings**   **[1.5 Hours]**
Definitions, Numerical on design of VIP latrine, Pour flush latrine, Septic tank and Soak pit

9.0   **Solid Waste Disposal**   **[0.5 Hour]**
Definitions, purpose, classification

References:

1. Birdie, G.S. and Birdie, J.S, Water Supply and Sanitary Engineering, Dhanapat Rai & Sons Publishers, Nai Sarak, Delhi- 110006, India.
2. Dr. Punmia B C, jain A, and Jain, A, Water Supply Engineering, Laximi Publications (P) Ltd, New Delhi
3. Barry, R, The Construction Of Building (Volume 4) Building Services, Affiliated East- west Press Pvt. Ltd., New Delhi

4.   B. C. Punmia and Ashok Jain, "Wastewater Engineering", Laxmi Publications (P) Ltd., NewDelhi, 1998.
5.   P.N. Modi, "Sewage Treatment & Disposal and Wastewater Engineering", Standard Book House, Delhi, 2001.

6.   G. S. Birdie and J, S, Birdie, "Water Supply and Sanitary Engineering", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2002.

Hydropower Engineering I
(EG 3114 CE)

Year: III   **Total: 5 hours /week**
Semester: I   **Lecture: 4 hours/week**
                                                            Tutorial: hour/week
                                                            Practical: 1 hours/week
                                                            Lab: hours/week

Course description:
The course focuses on different civil components of RoR and Storage Hydropower Scheme. It helps students to understand about power and energy.

Course Objectives:
After completion of the course the students are able to understand the Basics of Hydropower Generation May search for different possible layout options for a hydropower potential area Know Typical Components of RoR and Storage Schemes and Their Basic Design Principle Draw the typical layout arrangements.

Unit 1: Introduction   [4 hours]
1.1   Energy and its sources, Present Scenario of Energy Consumption in Nepal.
1.2   Brief historical Background of Power development in Nepal
1.3   Organizations involved at present in hydropower development.
1.4   Hydro-power Potential in Nepal, Gross, technical and economic potentials.
1.5   Hydropower Development Policy of Nepal.
1.6   Challenges of Hydropower Development in Nepal.

Unit 2: Planning of Hydropower Projects   [8 hours]
2.1 Types of Hydropower plants based on head, storage and capacity.
2.2 Stages of hydropower development: Reconnaissance, Pre-feasibility study, Feasibility study and detailed Engineering design and data requirement
2.3 General layout and major components of i) micro-hydro ii) RoR iii) Peaking RoR and iv) storage hydropower Projects
2.4 Estimation of Long Term Mean Monthly Flow in Gauged and Ungauged Rivers: (MIP, HYDEST, CAR) methods and their applications.
2.5 Reliability of Flow and Flow Duration Curve [FDC]
2.6 Introduction to Sediment Analysis and its importance in Design of RoR and Storage Projects

Unit 3: Power and Energy Potential study   [6 hours]
3.1 Gross and Net Head and Estimation with and without Draft Tube.
3.2 Different types of Efficiencies: Conveyance, Turbine, Generator, Transformer and Overall Efficiency
3.3 Derivation of Power Equation, $P=\eta \Upsilon QH$
3.4 Fixing Installed Capacity of a Hydropower Plant Using Flow Duration Curve

3.5 Mean and peak load, load curve, load factor, diversity factors and plant factor.

Unit 4: Headwork of Storage Plants [9 hours]

4.1 Components in a typical storage power plant: Spillways, bottom outlets or under sluices, intakes with examples.
4.2 Dam Engineering
4.3 Types of dam based on materials, function and head
4.4 Dam site evaluation and selection of type of dam
4.5 Forces acting on dam and their role on it's stability (sliding, overturning)
4.6 Failure modes of concrete and embankment dams and their remedies
4.7 Intakes
4.8 Typical arrangement of Dam Intake, Tower Intake and Submerged Intake
4.9 Spillways and Energy Dissipaters
4.10 Purpose of spillways, general arrangement, types, and hydraulics (sizing) of spillways
4.11 Methods of dissipating energy below a dam, stilling basin

Unit 5: Headwork of Run-of- River (RoR) Plants [9 hours]

5.1 General requirements of a functional RoR headwork
5.2 General Arrangement of components of a typical RoR plant: Weir/Barrage, Undersluices, Intakes with examples
5.3 General requirements of a functional RoR headworks
5.4 Intakes of RoR Headworks
5.5 Types: Side Intake, Frontal Intake, Bottom Intake, Himalayan Intake with their Suitability.
5.6 Control of bed load and floating debris in RoR intakes
5.7 Sediment Handling measures: Methods of bed load and suspended load handling in RoR headworks,
5.8 Gravel Trap and its Working Principle
5.9 Settling Basin, its Purpose and Types, Fall Velocity and Design Principle

Unit 6: Water Conveyance Structures [7 hours]

6.1 Canal (canal sizing, permissible velocity, headloss)
6.2 Tunnel (Geometrical shapes, Headloss)
6.3 Forebay and Surge Tanks: importance, typical arrangement and design principle
6.4 Penstocks: importance, general arrangement, hydraulic transients (water hammer).
6.5 Anchor blocks and support piers.

Unit 7: Powerhouse [2 hours]

7.1 Introduction
7.2 Types of powerhouse (surface, semi-underground, underground), general arrangement (typical plan and section)

Practical: **[15 hours]**

1. Preparation of alternative layouts of ROR plant on a given topographical map and assessing the most favorable one.
2. Preparation of section of each alternative layout
3. Estimation of hydrology
4. Estimation of power and annual energy
5. Preparation (A-CAD Drawing) of general layout of headworks of RoR plant.
6. Preparation typical layout, sections and elevations of powerhouse (A-CAD).
7. Field report and presentation about the visited site plant.

Excursion:
- One day observation trip to a hydropower plant in the vicinity followed by a brief report

References:
1. Water Power Engineering, Dandekar and Sharma, Vikas Publishing house, New Delhi
2. Hydraulic Structures, Novak, P. et al., Taylor and Francis, London
3. Water Power Development, Volume 1: Low-head Hydropower Plants, Mosonyi, E., Academia Kiado, Budapest
4. Water Power Development, Volume 2: High-head Hydropower Plants, Mosonyi, E., Academia Kiado, Budapest
5. Hydropower Engineering, Warnick CC et al., Prentice Hall, Inc, Englewood Cliffs, NJ
6. Irrigation Engineering and Hydraulic Structures, Garg, SK, Khanna Publishers, New Delhi
7. Hydropower Development- Series (17 Volumes), Vol. 8, 9, 10, 12,13, 14, Norwegian University of Science and Technology (NTNU), Norway
8. Fundamentals of Hydropower Engineering by Sanjib Baral, Second revised edition, Engineering and Education Services Pvt. Ltd.

Minor Project: Survey Camp
EG 3107 CE

Year: III   Total: 4 hours /week
Semester: I   Lecture: hours/week
                                                   Tutorial: hour/week
                                                   Practical: 4 hours/week
                                                   Lab: hours/week

Course description:
This course is designed to equip students with hands on practice on field survey of different survey techniques. The duration of this programme will be not less than 7 days (60 hours).

Objectives:
After completion of this course students will be able to:
1. Provide an ample opportunity to consolidate and update their practical and theoretical knowledge in surveying, with facing actual field conditions and problems and
2. Provide real field based exposure to learn and apply different surveying methods, modern surveying instruments, computational practices, and ways of presentation of their final reports including plotting.

Course Contents:

A.   Horizontal and Vertical Control Practices for Topographic Surveying: [4 Days]
  1.   Instrument for Horizontal Control: Theodolite and Total Station
  2.   Instrument for Vertical control: Auto level
  3.   Detailing by: Theodolite and Total Station
  4.   Conduct horizontal control practices around 2 hectares of land (about **8** control points) with semi built up area. Traverse must be enclosed and detailed topographic survey must be conducted within the periphery of that area. Coordinates (XYZ) of these traverses including details must be controlled by using theodolite, total station and auto level. Link traverse exercise can be done if necessary.
  - **Horizontal Control: 1 set horizontal angles**
  - **Allowable difference between FL and FR observations = 180^0 ±2 *Least Count**
  - **Angular Accuracy =1.5'√n**
  - **Linear accuracy: 1:1000**
  - **Plotting scale: 1:500**

  5.   Vertical control for control points must be done by fly leveling using auto level and detailing can be done by using total station or by theodolite.
  - **Leveling misclosure: 25√K mm, where K = Circuit distance in Km**

B. **Bridge Site Survey:**   **[1.5 days]**

Conduct triangulation survey for horizontal control. Conduct detailed topographic survey of bridge site area (125m *90m) to produce topographic map, L- section, X section etc.

Plotting scale:
Topographic Map: 1:200 or 1:500
L section: H- scale: 1:1000, V- scale 1:100
X section: H= V scale: 1:200

No of triangulation stations not more than 6

Coverage Area: Upstream 75m and downstream 50m from propose bridge axis& side width 30 m on either side of river bank.

Allowable angular accuracy = ±1.5'√n

One set horizontal angle observations with FL and FR difference of $180^0\pm$ 2*Least Count

Conduct reciprocal leveling and fly leveling for vertical control.

Allowable accuracy = ±25√K mm

C. **Road Alignment Survey:**   **[1.5 Days]**

Perform at least **300m** road alignment survey and plot plan, L section, X section etc at standard scale.

Establish BC, MC and EC while setting out of horizontal curves, and compute chainages.

L sectioning data must be taken by auto level at 15m regular interval with plus stations if necessary.

X sectioning data must be taken up to 10m left and 10m right from centre line.

Plotting scale:
Plan: 1:500
L- sectioning: H scale: 1:1000,   V scale: 1:100
X sectioning: H and V scale: 1:200

Requirements:
As far as possible, no of students for each group should not be more than 5 (five).

Evaluation Scheme:

Internal Assessment:
Continuous assessment throughout the 7 days as well as viva for computation and plotting of traverse, viva for road and bridge site survey should be taken. The weightage of internal assessment will be 60% (60 marks).

Final Assessment:
Each group must submit survey camp report in standard format. During compilation of report, data must be submitted content wise including reference sketches and standard drawings must be compiled in A**3** size. Original data and drawings must be presented during final viva voce. The weightage of final assessment will be 40% (40 marks).

Sixth Semester

Subjects:

1	EG 3201 MG	Entrepreneurship Development
2	EG 3211 CE	Construction Management
3	EG 3212 CE	Estimating and Costing III
4	EG 3213 CE	Hydropower Engineering II
5	EG 3214 CE	Major Project
6		Elective (one of the followings)
	EG 3215 CE	A: Micro Hydro
	EG 3215 CE	B: Hydropower Structure
	EG 3215 ME	C: Energy Management

Entrepreneurship Development
EG 3201 MG

Year: III
Semester: II

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

Course description:

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

Course objectives:

After completion of this course students will be able to:
1. Understand the concept of business and entrepreneurship;
2. Explore entrepreneurial competencies;
3. Analyze business ideas and viability;
4. Learn to formulate business plan with its integral components and
5. Manage small business.

Course Contents:

Theory

Unit 1: Introduction to Business & Entrepreneurship: **[9 Hours]**
1. Overview of entrepreneur and entrepreneurship
2. Wage employment , self- employment and business
3. Synopsis of types and forms of enterprises
4. Attitudes, characteristics & skills required to be an entrepreneur
5. Myths about entrepreneurs
6. Overview of MSMEs (Micro, Small and Medium Enterprises) in Nepal

Unit 2: Exploring and Developing Entrepreneurial Competencies: **[10 Hours]**
1. Assessing individual entrepreneurial inclination
2. Assessment of decision making attitudes
3. Risk taking behavior and risk minimization
4. Creativity and innovation in business
5. Enterprise management competencies

Unit 3: Business identification and Selection: **[4 Hours]**
1. Sources and method of finding business idea(s)
2. Selection of viable business ideas
3. Legal provisions for MSMEs in Nepal

Unit 4: Business plan Formulation: [17 Hours]
1. Needs and importance of business plan
2. Marketing plan
   - Description of product or service
   - Targeted market and customers
   - Location of business establishment
   - Estimation of market demand
   - Competitors analysis
   - Estimation of market share
   - Measures for business promotion

3. Business operation plan
   - Process of product or service creation
   - Required fix assets
   - Level of capacity utilization
   - Depreciation & amortization
   - Estimation office overhead and utilities

4. Organizational and human resource plan
   - Legal status of business
   - Management structure
   - Required human resource and cost
   - Roles and responsibility of staff

5. Financial plan
   - Working capital estimation
   - Pre-operating expenses
   - Source of investment and financial costs
   - Per unit cost of service or product
   - Unit price and profit/loss estimation of first year

6. Business plan appraisal
   - Return on investment
   - Breakeven analysis
   - Risk factors

Unit 5: Small Business Management: [5 Hours]
1. Concept of small business management
2. Market and marketing mix
3. Basic account keeping

Practical

Unit 1: Overview of Business & Entrepreneurship   **[2 Hours]**
    1. Collect business information through interaction with successful entrepreneur

Unit 2: Exploring and Developing Entrepreneurial Competencies   **[2 Hours]**
    1. Generate innovative business ideas

Unit 3: Product or service Identification and Selection   **[2 Hours]**
    1. Analyze business ideas using SWOT method

Unit 4: Business Plan Formulation   **[22 Hours]**
    1. Prepare marketing plan
    2. Prepare operation plan
    3. Prepare organizational and human resource plan
    4. Prepare financial plan
    5. Appraise business plan
    6. Prepare action plan for business startup

Unit 5: Small Business Management   **[2 Hours]**
    1. Prepare receipt and payment account
    2. Perform costing and pricing of product and service

पाठ्यपुस्तक :

क) प्रशिक्षकहरुका लागि निर्मित निर्देशिका तथा प्रशिक्षण सामग्री, प्राविधिक शिक्षा तथा व्यावसायिक तालीम परिषद्, २०६९ ।

ख) प्रशिक्षार्थीहरुका लागि निर्मित पाठ्यसामग्री तथा कार्यपुस्तिका, प्राविधिक शिक्षा तथा व्यावसायिक तालीम परिषद् (अप्रकाशित), २०६९ ।

References:
    1. Entrepreneur's Handbook, Technonet Asia, 1981.

Construction Management
EG 3211 CE

Year: III
Semester: I

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

Course description:
This course focuses on management of construction works. This course imparts knowledge on accounts, procurement of works, contract management, planning, scheduling, and managing construction works.

Course objectives:
After completion of this course students will be able to:
1. Acquire basic knowledge on management of construction works;
2. Plan and schedule different activities of construction project;
3. Plan and schedule resources required in construction project and
4. Understand basic knowledge of procurement/contract management.

Course Contents:

Unit 1: Introduction: **[4 Hours]**
    1.1 Definition of Project
    1.2 Characteristics of Project
    1.3 Definition of Management
    1.4 Need of Construction Management
    1.5 Functions of Construction Management

Unit 2: Project Planning and Scheduling: **[12 Hours]**
    2.1   Definition of Planning
    2.2   Steps in Planning
    2.3   Importance of Planning
    2.4   Construction Site Planning
    2.5   Work Breakdown Structure
    2.6   Bar Chart
    2.7   Linked Bar Chart and Milestone Chart
    2.8   Advantages of Construction Schedule
    2.9   Preparation of Construction Schedule
    2.10 Material Schedule
    2.11 Labor Schedule
    2.12 Equipment Schedule
    2.13 Financial Schedule

Unit 3: CPM and PERT: [14 Hours]

    3.1 Introduction to CPM
    3.2 Elements of Network
    3.3 Network Rules
    3.4 Definition of the Terms: Network Diagram, Activity, Event, Forward Pass, Backward Pass, Critical Path
    3.5 Determination of Critical Paths and Floats
    3.6 Introduction to PERT

Unit 4: Contract Administration and Accounts: [12 Hours]

    4.1 Definition of Contract
    4.2 Essentials elements of a Valid Contract
    4.3 Types of Construction Contracts
    4.4 Information to be given in Tender Notice
    4.5 Tender Document
    4.6 Bid Bond and Performance Bond
    4.7 Contract Document
    4.8 Conditions of Contract
    4.9 Supervising Work of a Contractor
    4.10 Duties and Responsibilities of a Site Supervisor
    4.11 Site Order Book
    4.12 Materials at Site Account
    4.13 Muster Roll
    4.14 Measurement Book
    4.15 Running Bill and Final Bill
    4.16 Completion Report
    4.17 Relation between Owner, Consultant, and Contractor

Unit 5: Quality: [3 Hours]

    5.1 Definition of Quality
    5.2 Characteristics of Quality
    5.3 Factors affecting Quality
    5.4 Stages of Quality Control

Unit 6: Monitoring, and Control: [5 Hours]

    6.1. Introduction to Monitoring
    6.2. Purpose of Monitoring
    6.3. Introduction to Control
    6.4. Elements of Control: Quality, Cost, and Time
        6.4.1. Quality Control
        6.4.2. Cost Control
        6.4.3. Time/Schedule Control

Unit 7: Construction Equipment: [6 Hours]
    7.1. Advantages of using Construction Equipment
    7.2. Equipment for Excavation
    7.3. Equipment for Concrete Mixing
    7.4. Equipment for Transportation and Compaction
    7.5. Equipment for Lifting of Materials and Parts

Unit 8: Safety: [4 Hours]
    8.1. Introduction to Accidents
    8.2. Causes of Accidents
    8.3. Importance of Safety
    8.4. Safety Measures

References:

1. Adhikari, R. P., Construction Management.
2. Punmia, B. C., PERT and CPM.
3. Shrestha, S.K.; Adhikari, I. A text book of Project Engineering, Chandeswori Publication.
4. Dutta, B. N., Estimating and Costing.

Estimating and Costing III
EG 3212 CE

Year: III

Semester: II

Total: 6 hours /week

Lecture: 3 hours/week

Tutorial: hour/week

Practical: 3 hours/week

Lab: hours/week

Course description:

This course focuses on familiarization of estimating and costing. It also deals with the specifications of sanitary, water supply and irrigation works.

Course objectives:

After completion of this course students will be able to:

1. Understand the procedures methods of measuring and quantity of irrigation, water supply and sanitary, culvert and RCC T beam decking works and hydropower components;
2. Analyze rates for irrigation, hydropower, water supply and sanitary;
3. Provide the basic knowledge of specification for water supply and sanitary and irrigation works
4. Prepare the cost estimate relating to irrigation, water supply, sanitary and hydropower works

Course Contents:

Theory

Unit 1: Method of Estimating: [10 Hours]

    1.1. Water supply and sanitary works
    1.2. Irrigation works
    1.3. Culvert and RCC T- beam decking
    1.4. Hydropower components (weir, side intake, gravel trap, settling basin)

Unit 2: Analysis of Rate for Irrigation, water supply and sanitation [10 Hours]

    2.1 Factors affecting the cost of irrigation, water supply and sanitary works
    2.2 Government procedure of preparing analysis or rate for irrigation, water supply and sanitary works.

Unit 3: Analysis of Rate for Hydropower [10 Hours]

    3.1 Factors affecting cost of hydropower works
    3.2 Government procedure for preparing analysis of rates for hydropower works

Unit 4: Specifications: [15 Hours]

    4.1 WC pan with cistern
    4.2 Supplying and laying PVC pipe and fittings
    4.3 Canal lining
    4.4 Hume pipe
    4.5 Penstock pipes
    4.6 Expansion Joints

4.7 Valves (spherical, butterfly)
4.8 Turbines (Francis, Pelton, Kaplan)
4.9. Gates (Vertical, radial)
4.10. Trash rack

Practical [45 Hours]

Taking out detailed quantities and preparing estimate for the following:
1. Estimate earthwork in channel/canal
2. Estimate canal lining
3. Estimate sewer line, manholes and surface drain
4. Estimate slab culvert
5. Estimate RCC T-beam decking
6. Estimate aqueduct structure
7. Estimate slow sand filter
8. Estimate of side intake
9. Estimate of gravel trap
10. Estimate of settling basin
11. Estimate of penstock pipe

References:
1. Amarjit Aggarwal "Estimating civil quantity surveying and valuation" katson publishing house,
   ludhiyana, 1985
2. G.S. Berdie "Test book of estimating and costing"
3. M. Chakraborti "Estimating, costing, specification and valuation in civil engineering"
4. B.N Dutta "Estimating and costing, specification and valuation"
5. Hydraulic Structures, Novak, P. et al., Taylor and Francis, London
6. Water Power Development, Volume 1: Low-head Hydropower Plants, Mosonyi, E., Academia Kiado, Budapest
7. Water Power Development, Volume 2: High-head Hydropower Plants, Mosonyi, E., Academia Kiado, Budapest
8. Hydropower Engineering, Warnick CC et al., Prentice Hall, Inc, Englewood Cliffs, NJ
9. Irrigation Engineering and Hydraulic Structures,Garg, SK,KhannaPublishers, New Delhi
1. Hydropower Development- Series (17 Volumes), Vol. 8, 9, 10, 12,13, 14, Norwegian University of Science and Technology (NTNU), Norway
2. Fundamentals of Hydropower Engineering by Sanjib Baral, Second revised edition, Engineering and Education Services Pvt. Ltd.

Hydropower Engineering II
EG 3213 CE

Year: III **Total: 8 hours /week**
Semester: II **Lecture: 4 hours/week**
Tutorial: 2 hours/week
Practical: 2 hours/week
Lab: hours/week

Course Description:
The Course deal with electro-mechanical system in hydro power which deals feature and classification of electromechanical system in Hydro-Power.

Course Objectives:
1. Known the concept of electricity(ac and dc, phase angle, power factor, three phase star/delta, AC waves)
2. Choosing the supply system AC or DC.
3. Synchronous generator
4. AVR(Automatic Voltage Regulator), Excitor system.
5. Switchgear Protection.
6. Transmission line and Distribution line
7. Penstock Joining, Penstock Support and Anchor, valves sizing and costing
8. Understand the operation of different type of turbines
9. Understand OIL pressure Governor
10. Drive system
11. Concept of repair and maintenance(Electro-Mechanical system in Power house)

Course Contents

Unit 1: Basic Electricity **[6 Hours]**
1.1. A.C. and D.C. system, advantage and disadvantage
1.2. Phase angle and power factor, ac waves
1.3. Star/delta connection of 3-phase system
1.4. Active power, reactive power and Apparent power

Unit 2: Choosing the supply AC or DC system **[6 Hours]**
2.1 Battery Charging system in hydro power
2.2 AC system versus DC battery charging system
2.3 DC system using an inverter to supply AC load in Hydro Power.
2.4 Electromechanical components of hydro power

Unit 3: Synchronous generator **[8 Hours]**
3.1.Basic construction and working principle
3.2.Three phase synchronous generate and its specification
3.3.Over speed occurs load is remove or reduce
3.4.Excitation system, type, concept of working principle, voltage regulation

3.5. Working principle and circuit diagram of AVR

3.6. Synchronizing, generator in Hydro power

Unit 4: Switchgear and Protection [6 Hours]

4.1. Bus-bar, panel board, metering unit

4.2. Relays: over current and earth fault

4.3. Circuit Breaker and Isolator

4.4. Power transformer, distribution transformer and their components

Unit 5: Transmission line and distribution Line [6 Hours]

5.1. To understand primary and secondary transmission, primary and secondary distribution

5.2. Feeder service main line distributor

5.3. Components of transmission and distribution system (poles, insulator, conductor-ACSR and ABC)

Unit 6: Penstock Jointing and Valves [4 Hours]

6.1 Flanged joints Spigot and socket joint

6.2 Type of Valves , gates and their components using in Hydro power plant

6.3 Penstock supports and Anchor

Unit 7: Turbine [8 Hours]

7.1. Basic Concept, Type of turbine

7.2. Working principle of turbine, spiral casing

7.3. Adjustment process of turbine and generator, flywheel application

7.4. Installation of Turbine and its' maintenance

7.5. Coupling system with generator

Unit 8: Governor [4 Hours]

8.1 Working principle of oil pressure governor

8.2. Associate components of oil pressure governor and their uses

Unit 9: Drive system [4 Hours]

9.1. Introduction of Drive system in hydro power

9.2. Types and their components

9.3. Shaft sizing (calculation of shaft diameter)

9.4. Safety guards of drive system in hydro power.

Unit 10: Repair and Maintenance Electromechanical [8 Hours]

10.1. Corrosion (Rusting) moisture, heating machine, high noise, high speed

10.2. Process of check synchronous generator (Meggering, Test clamp)

10.3. Process of dismantle turbine from generator

10.4. Replace process of turbine and generator

10.5. Alignment of shaft generator-turbine

Practical: [2*15=30 Hours]

Educational visit is necessary on the Hydro power after completion of this course.

References:
1. Standards/manuals/ guidelines for small hydro development: Electro-mechanical works-operation and maintenance of small hydro power plant, IIT Rorkee, India.
2. Installation and commission manual for Micro Hydro power plant by ICIMOD-Kathmandu 1999
3. Micro design manual by Adam Haves

Major Project
EG 3214 CE

Year: III

Semester: II

Total: 10 hours /week
Lecture: hour/week
Tutorial: hour/week
Practical: 10 hours/week
Lab: hour/week

Course description:
This course is designed to make students aware of using theoretical and practical application in integrated manner to their knowledge gained during whole course related to civil engineering. Topics will normally contain measurement, design, drawing, cost estimate of components of hydropower, building, water supply and sanitary, irrigation and road. Reading assignments and lecture on report design and oral presentations techniques will be in beginning of session. Preparation of the report and an oral seminar will occur at the end of the session.

Course objectives:
After completion of this course students will be able to:
1. Prepare design, drawing and cost estimate of residential/small office hydropower projects;
2. Prepare design, drawing and cost estimate of small and micro-hydropower projects.
3. Prepare design, drawing and cost estimate of a building
4. Prepare and design layout and cost estimate of Water supply and Irrigation works.
5. Prepare and design layout and cross-section and cost estimate of road

The overall assignment will be as follows

    A. Hydropower   4.0 Hours/week (Compulsory)

    Choose any two from following.

i. Building:	3 Hours/week
ii. Sanitary and Water supply:	3 Hours/week
iii. Highway:	3 Hours/week
iv. Irrigation:	3 Hours/week

Each part of the subjects will be evaluated as a continuous process.

Course Contents:

Unit 1: Hydropower   [60 Hours]
1.1. Collection of available literatures and information about hydropower site.
1.2. Preparing a tentative layout of all civil components of hydropower based on topographical map.
1.3. Collection of all data about discharge at intake site (use any of empirical methods used in Nepal if the river is ungauged) and fix the design discharge.
1.4. Estimate power potential (not less than 500Kw) and monthly and annual energy.

1.5. Carryout sizing of each civil components and approximate sizing of electro-mechanical components.
1.6. Prepare a final layout with design of each civil components
1.7. Calculate the total cost of the project and energy cost and carry out financial analysis of the project (B/C ratio and IRR).

Unit 2 Building: [75 Hours]
2.1 Measure a plot of land for building layout.
2.2 Collect materials and labour rate for rate analysis.
2.3 Carryout architectural design and drawing of a 3 or 4 rooms and 2 to 4 storey residential/office building (site plan, floor plans, elevations, sections, flooring, roofing, staircase, finishes, fire place details).
2.4 Design/interpret structural components (foundation, wall, column, beams, ties, floors, and roof trusses) including seismic details drawings.
2.5 Prepare design and drawing of internal plumbing details (bathroom, hot and cold water supply system, waste water and rain water systems).
2.6 Study drawing of electrical system (power, light layout) and telephone network system.
2.7 Rate analysis and detailed cost estimate.
2.8 Prepare drawings both manually and using CADD software.

Unit 3: Sanitary and Water Supply: [22 Hours]
3.1. Prepare/observe external drainage system, sewer pipe layout, septic tank, soak pit design and drawings.
3.2. Prepare design and drawings of a rural water supply scheme (gravity flow).
3.3. Prepare bill of quantities and cost estimate.

Unit 4: Highway: [23 Hours]
4.1. Study of contour map.
4.2. Draw layout of road alignment, profile, cross-section with the help of given data/topographic map.
4.3. Design horizontal and vertical curve.
4.4. Provide typical retraining structures, drains and culverts.
4.5. Prepare bill of quantities and cost estimate.

Unit 5: Irrigation: [30 Hours]
5.1. Draw layout, profile and cross-section of small hill irrigation project with the help of given data/topographic map.
5.2. Draw typical head works structure (weir, trash-rack), aqueduct, fall, Siphon, lined canal sections etc.
5.3. Prepare bill of quantities and cost estimate.

Evaluation Scheme:

S. No.	Subjects/Topics	Marks distribution %	Internal %	Final %
1	Hydropower	40	25	15
2	Building	15	9	6
3	Sanitary and Water Supply	15	9	6
4	Highway	15	9	6
5	Irrigation	15	8	7
Total		**100**	**60**	**40**

References:

1. Course notes provided by the teachers/department.
2. Sample drawings of different municipality office, Nepal Government Projects.
3. Building bye-laws.
4. Building Construction Hand Book by Roy Chudley and Roger Greeno.
5. Nepal National Building Codes.
6. Village water systems- A technical journal (Nepal and Bhutan)
7. Estimating and Costing by B. N. Dutta.
8. Text books of related courses.
9. Government norms of rate analysis.

Micro Hydropower
(EG 3215 CE)
(Elective)

Year: III
Semester: II

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

Course description:
This course is aimed at providing general background knowledge of micro-hydropower projects, assessing hydro-potential, load demand and supply, its components, functions and design of main features.

Course objectives:
After completion of this course, students will be able to:
1. Understand the concept of micro-hydropower;
2. Be familiar with the its components and functions and;
3. Understand the principles of sizing and design

Course Contents:
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Theory   **[45 Hours]**
</div>

Unit 1: Introduction   **[2 Hours]**
    1.1 Introduction and working principle
    1.2 History of MHP in Nepal
    1.3 Multipurpose use of MHP
    1.4 Site selection for MHP

Unit 2: Hydrology   **[6 Hours]**
    2.1 Introduction and definitions
    2.2 Guidelines and standards
    2.3 Discharge measurement
    2.4 Hydrology and Nepali MHP
    2.5 Hydrological data
    2.6 Medium Irrigation Project (MIP) Method
    2.7 WECS/DHM (HYDEST) Method
    2.8 Flood flows

Unit 3: Head works   **[4 Hours]**
    3.1 Introduction and definitions
    3.2 Guidelines and standards
    3.3 Functions of weir, intake, track rack and spillway
    3.4 Design criteria of weir and intake
    3.5 Detail drawing of head works

Unit 4: Headrace/Tailrace [4 Hours]

    4.1 Introduction and definitions
    4.2 Functions and components of headrace canal
    4.3 Guidelines and standards
    4.4 Design of canal and pipe
    4.5 Detail drawings of headrace/tailrace

Unit 5: Settling Basins [5 Hours]

    5.1 Introduction and definitions
    5.2 Functions and components of settling basins
    5.3 Guidelines and Standards
    5.4 Settling basin theory
    5.5 Design criteria of gravel trap, settling basin and forebay
    5.6 Detail drawings of settling basin

Unit 6: Support System [4 Hours]

    6.1 Introduction and function of support system
    6.2 Design criteria of anchor block,
    6.3 Design criteria of support pier
    6.4 Design criteria of machine foundation

Unit 7: Penstock and Power Calculations [4 Hours]

    7.1 Introduction and definitions
    7.2 Guidelines and standards
    7.3 Detail drawings of penstock pipe and alignment

Unit 8: Turbine Selections [4 Hours]

    8.1 Introduction and definitions
    8.2 Guidelines and standards
    8.3 Detail drawing of turbine

Unit 9: Electrical Equipment Selections [4 Hours]

    9.1 Introduction and definitions
    9.2 Guidelines and standards
    9.3 Selection of generator size and type
    9.4 Sizing and RPM of synchronous and induction generator
    9.5 Detail drawings of electrical component (line diagram)

Unit 10: Transmission and Distribution [3 Hours]

    10.1 Introduction and definitions
    10.2 Guidelines and standards
    10.3 Design criteria of transmission and distribution
    10.4 Detail drawings of transmission and distribution

Unit 11: Loads And Benefits   [2 Hours]
     11.1   Introduction and Definitions
     11.2   Guidelines and Standards
     11.3   Calculation of load and benefits

Unit 12: Operation and Maintenance (O&M)   [3 Hours]
     12.1 O&M of civil structures
     12.2 O&M of mechanical equipments
     12.3 O&M of electrical equipments

Practical: [45 Hours]

Perform the design and draw followings:
1. Appropriate sizing of plant
2. Balancing energy demand and supply
3. Measurement of head and flow
4. Calculation of mean monthly flow and design flow
5. Sizing of orifice, spillway, headrace canal, pipes etc.
6. Desander and forebay tank
7. Sizing of turbines, generators, conductors

References
1. Allen R. Inversin (1986), Micro-Hydropower Sourcebook, A Practical Guide to Design and
2. Implementation in Developing Countries, NRECA International Foundation, 1800 Massachusetts Avenue N. W., Washington, DC 20036.
3. Adam Harvey (1993), Micro-Hydro Design Manual, A guide to small-scale water power schemes, Intermediate Technology Publications, ISBN 1 85339 103 4.
4. BPC Hydro consult, Intermediate Technology Development Group (ITDG), Kathmandu, Nepal (2002), Civil Works Guidelines for Micro-Hydropower in Nepal.
5. GTZ/Department of Energy Development, Energy Division, Papua New Guinea, Micro HydropowerTraining Modules (1994), Modules 1-7, 10, 13, 14 & 18B.
6. European Small Hydropower Association (1998), Layman's Guidebook on How to Develop a Small Hydro Site
7. AEPC, Micro-Hydro Detail Feasibility Study Guideline
8. AEPC, Micro-Hydro Reference Standard
9. AEPC/NMHDA (2013), Micro/Mini-Hydropower Survey & Design Tools

Hydropower Structures
(EG 3215 CE)
(Elective)

Year: III
Semester: II

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

Course description:
This course is aimed to provide basic knowledge of hydropower structures that used in any hydropower projects.

Course objectives:
After completion of this course, the students will be able to:
1. Identify the different structures used in Hydropower projects;
2. Able to find the positioning of the structures in projects layout (drawing and ground)
3. Know the principles of sizing of different hydropower structures

Course Contents:

Theory	[45 Hours]

Unit 1: Introduction   [2 Hours]
    1.1 Introduction
    1.2 Layout of Hydropower Projects
    1.3 Principles of Hydraulic Systems Analysis

Unit 2: Dam engineering   [8 Hours]
    2.1 Introduction
    2.2 Embankment dam types and characteristics
    2.3 Concrete dam types and characteristics
    2.4 Site assessment and selection of dam types
    2.5 Loads on Dams
    2.6 Basic Design of embankment and Concrete dams

Unit 3: Flow control Structures   [9 Hours]
    3.1 Classification and Use of Structures for Flow Control
    3.2 Flow Regulating Structures (Weirs, Broad-crested Weirs (Free and Submerged Flow), Sharp-crested Weirs (Free and Submerged Flow), Sluice Gates, Vertical Sluice Gates (Free and Submerged Flow) Radial Sluice Gates (Free and Submerged Flow), Hydraulic Jumps
    3.3 Downstream of Sluice Gates, Diversion Barrages (containing sluices and weirs in parallel)
    3.4 Channel Intake and Outlet (Diversion) Structures: Gated Pipe Diversion Structure, Weirs and Sluice Gates as Diversion Structures

Unit 4: Structures in Conveyance System [5 Hours]
    4.1 Canal: shapes, characteristics, basic design concepts
    4.2 Settling basin / De-sanding basin: design concepts
    4.3 Tunnel: shapes, characteristics, / pipe: shapes, characteristics
    4.4 Fore-bay / Surge tank: types, characteristics and basic design concept
    4.5 Pressure pipe / penstock: characteristics and basic design concepts

Unit 5: Outlet structures at Head Work [9 Hours]
    5.1 Dam Spillways
    5.2 Ungated and Gates spillway: Ogee Crests spillway
    5.3 Gate Piers spillway
    5.4 Shaft Spillways
    5.5 Design principle of Spillways (Crest Elevation, Dimensions, and Shape)
    5.6 Energy Dissipation Structures
    5.7 Hydraulic Jumps (Sequent Depths, Length, Profile)
    5.8 Stilling Basins
    5.9   Roller Buckets and Flip Buckets
    5.10 Dam Bottom Outlet Works

Unit 6: Power house Structures [7 Hours]
    6.1 Principle of Power house sizing
    6.2 Powerhouse for Francis Turbine
    6.3 Draft Tube and its principle
    6.4 Power house for Pelton Turbine
    6.5 Tail water (canal / tunnel) structures
    6.6 Flow control Gate valves: types and characteristics
    6.7 Turbine shaft and its necessity
    6.8 Governor and its necessity

Unit 7: Power Transmission from Power house [5 Hours]
    7.1 Introduction of Transistors and its components
    7.2 Introduction of Substation and its components
    7.3 Introduction of Transmission lines and its components

Practical

Perform the four days' field visit to the students to make familiar with different structures. [45 Hours]

References
1. BPC Hydroconsult, (2002), Civil Works Guidelines for Micro Hydropower in Nepal, Practical Action, Nepal.
2. Garg, S. K. (2006), Irrigation Engineering and Hydraulic Structures, Khanna Publishers.
3. Harvey, A., (1993), Micro-Hydro Design Manual: A Guide to Small-Scale Water Power Schemes, ISBN-13: 978-1853391033
4. Inversin, A. R., (1986), Micro-Hydropower Sourcebook: A Practical Guide to Design and Implementation in Developing Countries, ITDG Publishing
5. Modi, P. N. (2008), Irrigation Water Resources and Water Power Engineering, Standard Book House
6. Novak, P, Moffat, A I B and Nalluri, C (2007), Hydraulic Structures, Taylor and Francis, London
7. Penche, C. and Minas, Ingeniero (1998), Layman's Handbook on how to develop a small Hydro site, European Commission

Energy Management
(EG 3215 ME)
(Elective)

Year: III   **Total: 6 hours /week**
Semester: II   **Lecture: 3 hours/week**
                                                                   Tutorial: hour/week
                                                             Practical: 3 hours/week
                                                                       Lab: hours/week

Course description:
The course is aimed at proving in basic knowledge of "energy system and its management issues related to it. The syllabus covers a comprehensive set of topics related to energy technology, management, environmental, economical and contemporary issues.

Course objectives:
After completion of this course, students will be able to:
4. Understand the concept of different types of energy system;
5. Be familiar with the management of energy demand and supply;
6. Understand the principles of sizing and design

Course contents:
Theory [45 Hours]

Unit 1: Energy Resources [4 Hours]
    1.1   Perpetual, renewable and non-renewable energy resources
    1.2   Conventional and non-conventional; traditional and commercial
    1.3   Global and national energy scenarios
    1.4   Importance of energy resources in Nepal
    1.5   Development of energy systems in Nepal

Unit 2: Renewable Energy Technology (RET): Micro-hydro, Solar, Biomass and other
[8 Hours]
    2.1   Micro-hydro: Introduction, history, application, working principles
    2.2   Components of Hydro Power Plants
    2.3   Improved water mill and its application
    2.4   Solar PV: Introduction, types, application and components
    2.5   Solar water pumping for rural water supply
    2.6   Solar thermal: introduction, application
    2.7   Biomass: Introduction, types, application and components
    2.8   Wind, wave, tidal, geothermal: introduction, applications

Unit 3: Non-Renewable Energy Technology: Coal, Gas, Oil, Nuclear [6 Hours]
    3.1   Coal: introduction and application
    3.2   Gas: introduction and application
    3.3   Oil: introduction and application
    3.4   Nuclear energy: introduction and application

3.5 Environmental consequences

Unit 4: Environmental Aspects [6 Hours]
4.1 Environmental pollution and health impacts from energy use
4.2 Global warming, climate change and environmental impact
4.3 Environment assessment: Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA)

Unit 5: Energy Management [6 Hours]
5.1 Introduction of energy management
5.2 Principle of energy management
5.3 Energy management skill and strategy
5.4 Energy conservation and energy efficiency

Unit 6: Demand Side Management [6 Hours]
1.1 Introduction
1.2 Energy saving: energy saving options, technical/economical potential
1.3 Energy efficiency: lighting, appliances, heating
1.4 Energy audit

Unit 7: Supply Side Management [4 Hours]
7.1 Introduction
7.2 Energy saving: energy saving options, technical/economical potential
7.3 Energy efficiency: generation, conversion, transmission, distribution
7.4 Operational management

Unit 8: Energy Planning [5 Hours]
8.1 Planning tools: introduction, types
8.2 Steps in energy planning and planning cycle
8.3 Decentralized energy planning
8.4 Integrated energy planning

Practical: [45 Hours]
1. Perform energy consumption and supply scenario of Nepal
2. Perform energy demand and supply scenario
3. Assignment of any of the above topics

References
1. ICIMOD, 1999: Energy used in mountain areas
2. Energy Data and Directory and Year Book 1997/98: Tata Energy Research Institute
3. Energy Statistic Yearbook- United Nations Publication
4. Prasanna Chandra, Projects: Planning, Analysis, Selection, Implementation and Review, Tata-McGraw Hill Publishing Company Limited, New Delhi
5. Integrated Energy planning, Vol. 1,2,3; APDC, Malaysia
6. Different publications of AEPC, MoPE, MoF, WECS, MoFALD, ITDG, ICIMOD etc.

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