CURRICULUM

DIPLOMA

Electrical Engineering

(Three year program-semester system)

Council for Technical Education and Vocational Training

Curriculum Development Division

Sanothimi, Bhaktapur

Developed in 2008

First Revision, 2014

Table of Content

1. Introduction:

Electrical Engineering is one of the prominent and popular disciplines within engineering. Many people in the developed countries, developing countries and under developed countries have given emphasis for the broader application of electricity. This field has been helping the world for the technological development and it has been creating wage and self-employment opportunities both in public and private sectors. This curriculum is designed with the purpose of producing the middle level technical workforce equipped with knowledge and skills related to the field of electrical engineering so as to meet the demand of such workforce in the country to contribute in the national economic development of Nepal. The knowledge and skills incorporated in this curriculum will be helpful to deliver the individual needs as well national needs in the field of electrical engineering.

2. Curriculum title:

Diploma in Electrical Engineering (DEE)

3. Objectives:

This curriculum has the following objectives:

3.1 To produce the middle level competent technical workforce/human resource (Technical and Supervisory staff) in electronics engineering.

3.2. To prepare such technicians who are able to work in the industrial settings of the country.

3.3. To prepare such technical workforce who will demonstrate positive attitude and respect for the profession and socio-cultural values.

3.4. To help meet the demand of such technical workforce for the industries of Nepal.

3.5. To reduce the dependence on employing such technicians from foreign countries.

4. Program description:

This course is based on the job required to perform by an electrical technician at different related industries and organizations in Nepal. The diploma in electrical engineering program extends over three years. Each year is divided into two semesters. There are six semesters within the period of three years. This curriculum includes the core subjects like physics, chemistry, and mathematics applicable in the field of engineering. It also includes Nepali and English subjects for the communication. The course structure and the subject wise contents reflect the details of the curriculum. In short, the aim of this curriculum is to produce competent and highly employable middle level technical workforce in the field of electrical engineering.

The contents of individual subjects prescribed in the curriculum are incorporated in the light of "must know and must do" principle.

5. Duration:

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

6. Group size:

The group size is maximum 48 (Forty eight) in a batch.

7. Target location:

The target location is all over Nepal.

8. Entry criteria:

- SLC or equivalent with English, Science, and Mathematics or related TSLC
- Should pass the entrance examination.
- Appropriate fitness required by the program.

9. Selection:

Applicants fulfilling the entry criteria are selected for the admission on the basis of merit.

10. Medium of instruction:

The medium of instruction is in English and/or Nepali.

11. Pattern of attendance:

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

12. Teacher and student ratio:

- For theory: As per the nature of the course.
- For practical / demonstration: 1:12
- For bench work: 1:8

13. Teachers and demonstrators:

- The disciplinary subject related teacher should be a bachelor's degree holder in the related area with three years experience in the related field.
- The demonstrators should be the 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 holders in the related areas.

14. Mode of education:

There is a both inductive and deductive mode of education.

15. Instructional media and materials:

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

- ***Printed Media Materials*** (Assignment sheets, Case studies, Handouts, Information sheets, Individual training packages, Procedure sheets, Performance Check lists, Textbooks etc.).
- ***Non-projected Media Materials*** (Display, Models, 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.).

16. Teaching learning methodologies:

The methods of teaching will be a combination of several approaches, such as Illustrated talk, Lecture, Tutorial, Group Discussion, Demonstration, Simulation, Guided practice, Practical experiences, Fieldwork, Report writing, Term paper presentation, Case analysis, Tutoring, Role-playing, Heuristic, Project work and Other Independent learning.

- Theory: Lecture, Discussion, Seminar, Interaction, Assignment, Group work.
- Practical: Demonstration, Observation, Guided practice, Self-practice, Project work, Industries practice

17. Examination and marking scheme:

- The subject teacher internally assesses the students' achievement in each subject during the course followed by a final examination at the end of each semester.
- A weightage of 20% for the internal assessment and 80% for the semester final examination will be allocated for theoretical components of a subject.
- The final semester examinations of all theory components will be conducted through written tests.
- Generally the method of continuous assessment will be adopted for practical components.
- In some cases semester final examinations are also conducted for practical components as per the needs.
- The student who fails in the internal assessment will not be allowed to sit in the semester final examination and will also not be allowed continuing the following semester study.

18. Provision of back paper:

There is a provision of back paper; however, students must pass all the subjects of all six semesters within six years from the date of enrolment.

19. Disciplinary and ethical requirements:

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

20. Pass marks:

The students must secure minimum 40% marks both in theory and practical (Lab). Moreover, the students must secure minimum 40% marks in the internal assessment and 40% in the final semester examination of each subject to pass all subjects offered in each semester.

21. Grading system:

The overall achievement of each student will be measured by a final aggregate percentage of all final semester examinations and graded as follow;

- Distinction : > or =80 %
- First division : 65 % to < 80 %
- Second division : 50 % to 65 %
- Pass : 40 % to < 50 %

22. Certification and degree awards:

- Students who have passed all the components of all subjects of all six semesters are considered to have successfully completed the course.
- Students who have successfully completed the course will be awarded with a degree of **Diploma in Electrical Engineering**.

23. Career path:

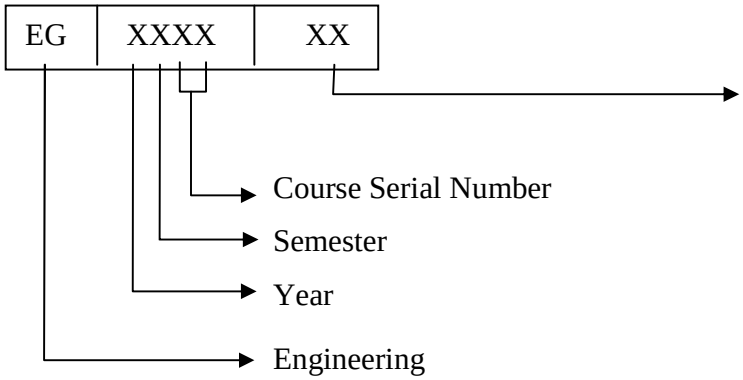
The graduates will be eligible for the position equivalent to non-gazetted 1st class (technical) as electrical technician or as prescribed by the public service commission of Nepal. The graduate will be eligible for registration with the related council in the grade as mentioned in the related council act (if any).

24. Curriculum and credits:

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

25. Subjects codes

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



Offering Departments:

AE: Automobile Engineering

AR: Architecture Engineering

CE: Civil Engineering

CT: Computer Engineering

EE: Electrical Engineering

EX: Electronics Engineering

ME: Mechanical Engineering

MG: Management

SH: Science and Humanities

26. Provision of elective subjects:

There will be a provision of one elective subject in the final semester of this curriculum. Subjects of electrical engineering discipline such as Micro Hydro, Instrumentation and Transducers, Electric Drives and Renewable Energy Technology are offered here with the provision of the elective.

DIPLOMA IN ELECTRICAL ENGINEERING
Curriculum Structure

Year: I **Part: I**

Teaching Schedule			Mode					DISTRIBUTION OF MARKS						Total Marks	Remark
								Theory			Practical				
SN	Course Code	Course Title	L	T	P	Lab	Total Hour	Asst. Marks	Final Marks	Time Hours	Asst. Marks	Mark Final	Time Hrs.		
1	EG 1101 SH	Communication Nepali	2				2	10	40	1.5				50	
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 1106 ME	Engineering Drawing I			4		4				60	40	4	100	
7	EG 1110 CT	Computer Application	2			3	5	10	40	1.5	30	20	3	100	
8	EG 1112 ME	Workshop Technology	2		8		10	10	40	1.5	120	80	6	250	
		Total =	**18**	**3**	**12**	**7**	**40**	**100**	**360**		**230**	**160**		**850**	

Year: I **Part: II**

Teaching Schedule			Mode					DISTRIBUTION OF MARKS						Total Marks	Remark
								Theory			Practical				
SN	Course Code	Course Title	L	T	P	Lab	Total Hour	Asst. Marks	Final Marks	Time Hours	Asst. Marks	Mark Final	Time Hrs.		
1	EG 1201 SH	Engineering Mathematics II	3	1			4	20	80	3	0	0		100	
2	EG 1202 SH	Engineering Physics II	3	1		2	6	20	60	3	10	10	1.5	100	
3	EG 1103 SH	Engineering Chemistry II	3	1		2	6	20	60	3	10	10	1.5	100	
4	EG 1204 ME	Engineering Drawing II			4		4				60	40	4	100	
5	EG 1209 ME	Applied Mechanics	3	1			4	20	80	3				100	
6	EG 1212 EE	Safety Rules and Regulation	2				2	10	40	1.5				50	
7	EG 1213 EE	Electrical Workshop	1		6		7				90	60	6	150	
8	EG 1215 EE	Principles of Electrical Engineering	4			3	7	20	80	3	30	20	3	150	
		Total =	**19**	**4**	**10**	**7**	**40**	**110**	**400**		**200**	**140**		**850**	

DIPLOMA IN ELECTRICAL ENGINEERING
Curriculum Structure

Year: II **Part: I**

Teaching Schedule			Mode					DISTRIBUTION OF MARKS							Remark
								Theory			Practical				
SN	Course Code	Course Title	L	T	P	Lab	Total Hour	Asst. Marks	Final Marks	Time Hours	Asst. Marks	Mark Final	Time Hrs.	Total Marks	
1	EG 2111 CT	Computer Programming	2		3		5	10	40	1.5	30	20	3	100	
2	EG 2112 EX	Basic Electronics	3			3	6	20	80	3	30	20	3	150	
3	EG 2113 CE	Civil Construction and Survey	3		3		6	20	80	3	30	20	3	150	
4	EG 2114 EE	Electrical and Electronic Engineering Material	3				3	20	80	3				100	
5	EG 2115 EE	Electric Circuit Theory	3	1		3	7	20	80	3	30	20	3	150	
6	EG 2103 MG	Principles of Management and Costing	4				4	20	80	3				100	
7	EG 2116 EE	Electrical Installation I			6		6				90	60	6	150	
8	EG 2117 EE	Electrical Engineering Drawing I			3		3				60	40	4	100	
		Total =	**18**	**1**	**15**	**6**	**40**	**110**	**440**		**270**	**180**		**1000**	

Year: II **Part: II**

Teaching Schedule			Mode					DISTRIBUTION OF MARKS							Remark
								Theory			Practical				
SN	Course Code	Course Title	L	T	P	Lab	Total Hour	Asst. Marks	Final Marks	Time Hours	Asst. Marks	Mark Final	Time Hrs.	Total Marks	
1	EG 2206 EX	Microprocessor & Microcontroller	3			2	5	20	60	3	10	10	1.5	100	
2	EG 2211 EE	Computer Aided Design	2		3		5	10	40	1.5	30	20	3	100	
3	EG 2212 EX	Electronic Devices and Logic circuits	4			2	6	20	80	3	30	20	3	150	
4	EG 2213 EE	Electrical Installation II			5		5				60	40	4	100	
5	EG 2214 EE	Electrical Engineering Drawing II			3		3				60	40	4	100	
6	EG 2215 EE	Electrical Machines I	3	1		2	6	20	80	3	30	20	3	150	
7	EG 2216 EE	Electrical Measurements and Measuring Instruments	3	1		2	6	20	80	3	30	20	3	150	
8	EG 2219 EE	Power Stations	3	1			4	20	80	3				100	
		Total =	**18**	**3**	**11**	**8**	**40**	**110**	**420**		**250**	**170**		**950**	

DIPLOMA IN ELECTRICAL ENGINEERING
Curriculum Structure

Year: III **Part: I**

Teaching Schedule			Mode					DISTRIBUTION OF MARKS							Remark
								Theory			Practical				
SN	Course Code	Course Title	L	T	P	Lab	Total Hour	Asst. Marks	Final Marks	Time Hours	Asst. Marks	Mark Final	Time Hrs.	Total Marks	
1	EG 3111EE	Electrical Installation Design, Estimating and Costing	3		2		5	20	60	3	10	10	1.5	100	
2	EG 3112 EE	Switch Gear and Protection	3	1		3	7	20	80	3	30	20	3	150	
3	EG 3113 EE	Power Electronics	3			2	5	20	60	3	10	10	1.5	100	
4	EG 3114 EE	Electrical Machines II	3	1		3	7	20	80	3	30	20	3	150	
5	EG 3115 EE	Utilization of Electrical Energy	3	1			4	20	80	3				100	
6	EG 3116 EE	Control System Components	3			2	5	20	60	3	10	10	1.5	100	
7	EG 3117 EE	Electrical Repair and Maintenance I			4		4				60	40	4	100	
8	EG 3118 EE	Project I			3		3				60	40	4	100	
		Total =	**18**	**3**	**9**	**10**	**40**	**120**	**420**		**210**	**150**		**900**	

Year: III **Part: II**

Teaching Schedule			Mode					DISTRIBUTION OF MARKS							Remark
								Theory			Practical				
SN	Course Code	Course Title	L	T	P	Lab	Total Hour	Asst. Marks	Final Marks	Time Hours	Asst. Marks	Mark Final	Time Hrs.	Total Marks	
1	EG 3211 EE	Electrical Energy Audit and Conservation	3		1		4	20	80	3				100	
2	EG 3213 EE	Project II			6		6				90	60	6	150	
3	EG 3214 EE	Power System Operation and Maintenance	3			3	6	20	80	3	30	20	3	150	
4	EG 3215 EE	Electrical Repair and Maintenance II			4		4				60	40	3	100	
5	EG 3216 EE	Industrial Attachment			6		6				100			100	
6	EG 3201MG	Entrepreneurship Development	3		2		5	20	80	3				100	
7	EG 3219 EE	Transmission and Distribution of Electrical Power	3	1			4	20	60	3	10	10	1.5	100	
8	EG 3218 EE	Elective (One of the followings)	3		2		5	20	60	3	10	10	1.5	100	
		a) Micro Hydro													
		b) Instrumentation & transducers													
		c) Electric Drives													
		d) Renewable Energy Technology													
		Total =	**15**	**1**	**20**	**4**	**40**	**100**	**360**		**300**	**140**		**900**	

First Year (First Semester)

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 1106 ME Engineering Drawing I**
7. **EG 1110 CT Computer Application**
8. **EG 1112 EE Workshop Technology**

कम्युनिकेसन नेपाली

ई.जी. ११०१ एस.एच.

वर्ष : प्रथम **जम्मा: २ घण्टा/ हप्ता**
सेमेष्टर : प्रथम **प्रवचन: २ घण्टा/ हप्ता**

कोर्षको परिचय

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

कोर्षको उद्देश्य :

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

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

पाठ्यांशको विषयवस्तु

एकाइ १: संचारात्मक नेपाली भाषा **(७)**

१.१ भाषिक भेदको परिचय

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

१.२ दैनिक कार्यमा प्रयोग हुने भाषाको ज्ञान र प्रयोग

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

एकाइ २: लेखन सीप **(१८)**

२.१ बोध, शब्दनिर्माण र शब्दभण्डारको ज्ञान र अभ्यास

क) शब्द भण्डार निर्माण र अभ्यास

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

ख) प्राविधिक/पारिभाषिक शब्दहरूको शब्दस्रोत,

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

२.२ 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 कोर्ष (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 पत्रिकाका सम्पादकीय, टिप्पणी र लेखहरू ।
- प्रशिक्षकहरूले आफ्नो पुस्तक तयार गर्न वा बजारमा पाइने सामग्री छानेर पढाउन सक्ने, तर परीक्षा महाशाखालाई यसको पूर्व जानकारी दिनुपर्ने

Communication English

EG1102SH

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. Demonstrate various writing skills

Course Contents:

Unit 1. English sound and basic structures:

1.1. Define with examples: [2]
- Phonemes
- Morphemes

1.2. Introduction to English sounds with examples: [2]
- The Vowels
- The Consonants

1.3. Dictionary skills [3]
- Alphabetical order
- Dictionary entry
- Guide words, head words

1.4. Spellings [1]
- 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/decling
- Suggesting/advising
- Making and receiving telephone calls
- Group discussing and presentation

Unit 3. Reading: [2]

- Reading comprehension
- Defining trade related terminologies

Unit 4. Writing skills in English: [12]

4.1. Writing paragraphs
4.2. Writing dialogues
4.3. Writing precies/summaries
4.4. Writing letters

- Job application with resumes
- Leave application
- Business letters
- Orders
- Complains

4.5. Writing essays
4.6. Writing technical reports
4.7. Writing meeting minutes
4.8. Writing notices
4.9. Writing notices
4.10. Writing instructions
4.11. Writing technical proposal

Learning materials:

1. Poudel, R.C., A Manual to Communicative English, K.P. Pustak Bhandar, Kathmandu, 1956/57.
2. Shah, B.L., A text book of writing skills in English, First edition Hira Books Enterprises, Kathmandu,
3. Fruehling, R. T. and Oldham N. B., Write to the point, McGraw- Hill, Inc. New York NY 10020
4. Tayior, G., English conversation practice, 1975.
5. Maharjan L. B., A textbook of English sounds and Structures, Vidyarthi Pustak Bhandar, Kathmandu, 2000.

6. Todd, LAN introduction to Linguistics, Longman York press, 1991.
7. Blundell, Jon, Higgens, Jonathan & Middlemiss, Nigel, Function of English, Oxford University Press
8. Naterop, Jean, Reuell, Rod, Telephoning in English, Cambridge 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

EG1103SH

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:

- x^n, $(ax+b)^n$, $\sin(ax+b)$, e^{ax}, a^x , and $\log x$.

5.3. Derivatives of sum, difference, product and quotient of functions, chain rule, parametric and implicit functions

5.4. Integration, Rules for finding integrals.

5.5. Standard integrals and their uses.
5.6. Definite integrals- definition and evaluation.
5.7. Definite integral as limit of sum.

Learning materials:

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

Engineering Physics I

EG1104SH

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]

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]

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, Cp-Cv =R.
- Second law of thermodynamics.
- Efficiency of heat engine

Unit 3. Optics: [8]

3.1 Reflection by plane surfaces

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

3.2 Refraction by plane Surfaces:

- Review of refraction by plane surfaces.
- Lateral shift
- Total internal reflection, critical angle
- Real and apparent depth.

3.3 Reflection by Spherical Surfaces:

- Review of reflection by spherical surfaces.
- Construction of image by ray diagrams and nature of images
- Real and virtual images.
- Nature of images formed by spherical mirrors.
- Mirror formula for concave and convex mirror

3.4 Refraction through Prisms and Lenses:

- Deviation due to prism and minimum deviation.

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

Unit 4. Magnetism: [10]

4.1 Magnets and Magnetic fields:

- Magnetic poles, magnetic moment, magnetic axis, and magnetic meridian.
- Magnetic field.
- Coulomb's law for magnetism.
- Magnetic field due to magnetic poles and bar magnets.
- Intensity and flux density of magnetic field.
- Neutral point.
- Tangent law.

4.2. Earth's Magnetism:

- Horizontal and vertical components of earth's magnetic field.
- Declination and angle of dip.

4.3. Magnetic properties of materials;

- Molecular and modern theory of magnetism.
- Para magnetism and diamagnetism:
  - Permeability and
  - Susceptibility.
- Intensity of magnetization.
- Domain theory of ferromagnetism.
- Hysterisis

Engineering Physics Practical I ***[30]***

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

EG1105SH

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 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 Contents:

Unit: 1: Language of chemistry: [4]

1.1 Symbol:
- Definition
- Significance (qualitative and quantitative)

1.2 Formula:
- Definition
- Significance (qualitative and quantitative)
- Concept of valency in terms of combining capacity with H_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]

2.1 Atom and molecule:
- Definition
- Dalton's atomic theory and modern position of the theory

2.2 Atomic weight:

- Definition
- Determination of atomic weight by Dulong and Petit's method and Related numerical problems

2.3 Molecular Weight:

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

2.4 Equivalent weight:

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

2.5 Simple mole concept:

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

Unit: 3: System of classification: [33]

3.1 Acid, Base and Salt:

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

3.2 Volumetric analysis:

- Definition of titration (acidimetry and alkalimetry),
- Indicator
- End-point (neutralization point)
- Standard solution (primary and secondary standard solution), Normal, Decinormal, Molar, Molal solution
- Requisites of primary standard substance
- Volumetric equation,

- Express the strength of solution Normality, Molarity, Molality, 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]**

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

Text books:

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

Reference books:

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

Other learning materials:

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

Engineering Drawing I

EG 1106ME

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

Course Description:

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

Course Objectives:

After completing this course the students will be able to

1. represent different shapes accurately by applying geometrical constructions,
2. project point, line, plane and geometrical solids,
3. represent three dimensional objects in orthographic form and dimension them,
4. use freehand techniques to sketch different shapes.

Course contens:

Unit 1: Introduction **[4]**

- 1.1 Engineering drawing as graphic language
- 1.2 Drawing instruments
- 1.3 Scale: reduced scale, enlarged scale, full size scale
- 1.4 Conventional line types
- 1.5 Sheet size and sheet layout
- 1.6 Drawing exercises on above sub units

Unit 2: Technical lettering &dimensioning **[4]**

- 2.1 General procedure for freehand technical lettering: letter stroke, letter proportion, use of pencil and pens, uniformity of letters
- 2.2 Single stroke vertical capital letters, Single stroke inclined capital letters, Single stroke vertical lowercase letters, Single stroke inclined lowercase letters, vertical and inclined numerals, vertical and inclined fractions
- 2.3 Dimensioning terms and notations
- 2.4 Techniques of dimensioning: Size and location of dimensioning
- 2.5 Types of dimensioning: Aligned and Unidirectional
- 2.6 Rules for dimensioning
- 2.7 Drawing exercises on above sub units

Unit 3: Geometrical construction **[12]**

- 3.1 Draw parallel and perpendicular lines
- 3.2 Bisection and trisection on straight lines and angles
- 3.3 Divide a straight line into any number of equal parts and proportionately.
- 3.4 Construction of polygons (triangles, squares, regular pentagon, regular hexagon, regular heptagon, regular octagon) inscribing and circumscribing about a given circle.
- 3.5 Determine center and draw tangent on circular arcs and circles (including open, cross belt tangents and ogee curve between two parallel lines)

3.6 Construction of standard curves (Conic section - parabola, ellipse, and hyperbola; Special Curves- cycloid, helix, spiral, involute)
3.7 Drawing exercises on above sub units

Unit 4: Projection of points, lines and planes [8]

4.1 Principle of projection
4.2 Principle planes of projections, four quadrants
4.3 Projection of point, line and plane on HP and VP
4.4 True Length of an oblique line
4.5 True shape of an oblique plane
4.6 Drawing exercises on above sub units.

Unit 5: Projection of geometrical solids [4]

5.1 Types of solids: polyhedral and solids of revolution
5.2 Projection of prismatic objects (triangular square base, circular base, hexagonal base)
5.2 Projection of pyramidal objects (triangular square base, circular base, hexagonal base)
5.3 Projection of points on the surfaces solids
5.4 Drawing exercises on above sub units.

Unit 6: Orthographic projection [24]

6.1 Principle of orthographic projection
6.2 Systems of orthographic projection: first angle and third angle
6.3 Draw an orthographic drawing (rectangular objects with horizontal, vertical and inclined surfaces, objects with cylindrical surfaces)
6.4 Analysis of three views including missing views
6.5 Drawing exercises on above sub units with dimensioning

Unit 7 Freehand Sketching [4]

7.1 Techniques of sketching: pencil hardness, paper with grid or lines
7.2 Techniques for horizontal and vertical lines; arcs and circles
7.3 Free hand exercise of different shapes with lines, arcs, and circles

Reference:

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

Computer Application

EG 1110 CT

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

Course Description:

This course focuses on familiarization of computer hardware parts and use of standard packages for word processing, spreadsheet and database application.

Course Objectives:

On completion of this course the students will be able to
1. Identify major components of computer and their role.
2. Use operating systems like MS-DOS, Windows etc.
3. Use computer for preparation of formatted documents, spreadsheets and databases.
4. Use multimedia, internet/email and other utility software.

Course contents:

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

Unit 2 Hardware Components [5]
- 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 [8]
- 3.1 Importance and use of operating systems(OS)
- 3.2 Type of OS: MS-DOS, Windows, Unix, Linux
- 3.3 Function of 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

Unit 4 Application Packages [8]

4.1 Text Editors (edit in DOS, notepad in Windows, vi editor in Linux
4.2 Word Processing Package: Microsoft Word and its features.
4.3 Spreadsheet Package: Microsoft Excel and its features.
- Entering data
- Using formula
- Basic calculations
- Financial calculations
- Charts

4.4 Concept of Database management system
4.5 Database management package: Microsoft Access and its features.
4.6 Presentation Package: Microsoft PowerPoint and its features.

Unit 5 Utility Programs [2]

5.1 Computer virus and its removal (antivirus programs)
5.2 Multimedia: Audio, Video and Graphics

Unit 6 Computer Networking and Data Communication [5]

6.1 Network topologies and protocols
6.2 Client and server concept
6.3 File and print sharing
6.4 Email/Internet
- World Wide Web
- Internet Client: Web browsers like Internet Explorer, Netscape Navigator, Mozilla Firefox etc,
- Email clients like Outlook Express, Netscape Mail,

Practical Exercise: [3x15]

1. Identification of major components of computer and familiarization with keyboard and mouse.
2. Internal and External DOS commands
3. Windows Graphical User Interface and file/folder management
4. Microsoft Word
    a. Editing text
    b. Formatting document
    c. Creating tables
    d. Creating graphics and word art
5. Microsoft Excel
    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
    a. Creating and manipulating data tables
    b. Query
    c. Forms/Reports
7. Using Multimedia and Internet/Email
8. Creating effective presentation using Microsoft PowerPoint

9. Project Work

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

Text Books:

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

Reference Books:

1. B Ram, "*Computer Fundamentals*", Willey Eastern Publishers
2. S Saxena, *"A First Cou7rse in Computers"*, Vikash Publishing

Workshop Technology I

EG 1112ME

Total: 8 hours/week
Year: I **Lecture: 2 hours/week**
Semester: I **Tutorial: hours/week**
Practical: 6 hours/week
Lab: hours/week

Course description:
This subject deals with the identification, uses and care of basic hand tools, measuring instrument, power tools, and apply safety precautions in mechanical and wood work.

Course Objectives:
After the completing this course the students will be able to:
1. Apply the safety rules in the workshop.
2. Identify the tools measuring instrument, power tools.
3. Operate the hand tools, power tools for the marking, measuring and cutting the metal in shape.
4. Joining the metal by different processes by hand.
5. Maintenance and care of the measuring instrument, hand tools and power tools.
6. Prepare different project of metal and wood.

Course Contents:

Unit 1: Safety in the workshop [1]

1.1: Workshop rules.
- Define safety.
- Use personal protective equipment.
- Apply workshop safety.
- Apply machine safety.

Unit 2: Laying Tools [2]

2.1: Layout tools
- Identify the scriber, punch, divider, surface plate, v-block and vernier height gauge.
- Use the tools for the line and point on the surface.
- Care and maintain the layout tools,

2.2: Hammer \hammering
- Identify the ball, cross, straight, claws and soft hammers.
- Select appropriate hammers for different work.
- Care and maintain the hammer

2.3: Wrenches
- Identify the single, double, pipe and the adjustable wrenches.
- Select appropriate wrenches for different work.
- Apply appropriate procedure of tightening and opening the elements.

2.4: Work holding device
- Identify the bench, machine, pipe and chain vices.
- Select suitable device according to use uses.

- Apply safety in vices, protect voice jaws and work pieces.

Unit 3: Cutting tools [10]

3.1: Chisels
- Identify the cross, diamond and round chisels.
- Select appropriate chisels while removing metal from the surface.
- Apply suitable holding techniques for chisel and chipping processes.
- Uses the chipping guard, care and maintain the chisel.

3.2: Hand saw and sawing
- Select the hand saw, blade, cutting metal.
- Fix the blade in hacksaw frame.
- Apply method of holding work piece and explain rules of sawing.

3.3: Files and filing
- Label the different parts of file.
- Differentiate file by their shapes, sizes and cuts.
- Select file for the shaping different types of the metal and surface finish accuracy +-0.2mm.
- Apply method of the holding, balancing and the direction of the filing.
- Clean and store the files.

3.4: Reamer and reaming
- Select appropriate types of reamers, hand, taper and adjustable reamers.
- Select the holding device and drill speed.
- Apply proper method for reaming on different size of hole.
- Clean and store the reamers.

3.5: Thread and threading
- Explain the taps, dies, handle, kinds of the thread, size, angle, main part of the thread and uses.
- Apply appropriate method of the producing the thread by the taps and dies, lathe machine, rolling, pressing.
- Clean and store the tools.

3.6: Scraper and scraping
- Identify the flat, three side and curve scraper.
- Apply the method of the scraping and the qualities of the surface.

Unit 4: Measuring instrument [2]

4.1: Identify the vernier caliper, micrometer, try square, bevel protractor, wire, and filler radius and thread gauge.

4.2: Label main parts of the measuring instrument, accurately reading the scale of the measuring instrument.

4.3: Apply the rules of measuring and using the measuring instrument.

4.4: Care and store the measuring instrument.

Unit 5: Rivet and riveting [1]

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

Unit 6: Solder and soldering [1]

6.1: Name of the soldering iron, types of solder, cleaning tools and the fluxes.

- Select the source of heat and temperature.
- Explain the procedure of cleaning and the joining work metal.
- Care and the prevent solder.

Unit 7: Shear and shearing [1]

7.1: Identify the hands, press, torch, snip, shear tools.

- Select the method of the shearing sheet, rod, and square, flat angle metal.
- Shear different metals with appropriate shearing machine.
- Care and maintain the shearing machine.

Unit 8: Bend and bending [1]

8.1: Name of the bending devices, vice pliers, range, hand bar and fork.

- Select the folding, radius bending and rolling.
- Explain the method of bending the metal bar, flat and the plate.
- Bend the metal into many shapes and maintain of the tolls and equipments.

Unit 9: Power tools [2]

9.1: Drill machines

- Identify the hand drill machine, bench, gang, colon and radial drill machine.
- Select the correct types of the machine.
- Apply the correct method of using the drilling machine.
- Calculate the correct speed and the fit different size of the drill bits.
- Explain the holding technique for different shape of metal..

9.2: Drill and drilling

- Identify the different kinds of drill bits, size, purpose and angle.
- Select appropriate drill bit holding accessories, equipments.
- Explain the procedure to operating different types of drill machine, drill holes and acceptable standards.
- Label the parts of the drill machines and explain the function.
- Operate the machine safely and use safety equipments.

Unit 10: Hand tools [4]

10.1: Hand tool metal

- Identify the all hand tools (divider, saw, wood chisel, hammer, wild stone, planner, boring, drilling, driving, cramping and the holding tools) used in mechanical workshop.
- Explain their uses in mechanical workshop.
- Care and maintenance of hand tools.

10.2: Marking tools

- Identify sheet metal, marking tools, scriber, rules, try square, punch, divider, trammel, depth gauge and explain uses of sheet metal.
- Select appropriate hand tools and uses such as the hand snipes, stacks, punch plat, hatchet, blow horn, hand punch, pop riveters fork devices, hammers, fly cutter, groove, seaming tools.

10.3: Power tools

- Identify the drill machine, jig saw, planner, circular saw, hand saw and routers bending, rollers, folders etc.
- Explain, select, adjust, controls and to operate the power tools.
- Operate different power tools.

10.4: Development sheet

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

10.5: Sheet metal joining

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

10.6: Safety

- Explain different machine and tool safety.
- Explain safety for different metal handling.
- Care and maintain different tools and equipments used in mechanical workshop.

Unit 11: Wood work and working [5]

11.1: Timber

- Explain different types of timber.
- Identify the defects of timber.
- Select appropriate timber for different furniture.
- Store and seasoning of the timber.

11.2: Timber work

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

Practical

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

1. Marking : straight, curve ,dot
2. Measuring: rules, vernier caliper, gauge
3. Hammering: ball, cross, soft straight pin
4. Sawing: hand hacksaw and power
5. Filling: single, double and rasp cut files
6. Chiseling: flat, cross, concave, power chisel

7. Reamering: hand and adjustable
8. Threading: tap and dies
9. Riveting: riveting sets pup riveter
10. Soft soldering: Solder, heat joint metal
11. Shearing: Snip, press folds
12. Bending: plier, range, hand, bar, fork and power tools
13. Power tools operating: drill, folding, rolling, radius bending, spot welding, grinding, beading, creping, edge forming, hacksaw machines
14. Drilling: Counter sink, counter boring, reaming, thread cutting
15. Sheet metal working: Hands pipe bend plot, blow horn, groove and seaming
16. Developing: templates, for the sheet boxes, book stand, scoop funnel, pipe and the machine guards
17. Wood working: Marking, measuring, sawing, chiseling, boring, planning, drilling, cramping, holding, size facing
18. Joining: Halving, notching, cogging, bridle, tenon dovetails joints, wide and angle joining

Project list

S. N.	Project	Skill	Metal	Size (mm)	Time (hrs)
1.	Paper weight	Measuring, marking, sawing, filing	M. S. rod 1 pc	Ø 30x30	8
2.	Dove tail	Measuring, marking, drilling, sawing, fitting, male and female, Scrapping	M.S. flat 2 pc	6x30x51	10
3.	G. Clamp	Measuring, marking, dot, punching, drilling, chiseling, sawing, filing		10x100x70	18
4.	Try square	Measuring, marking, cutting, filing, riveting, drilling	M.S. flat M.S. sheet	10x20x80 2x15x120	16
5.	Hanger	Measuring, marking, bending, joining	G. I. wire	Ø 3x800 or 1000	4
6.	G.I. box	Measuring, marking, cutting, hem, seaming, folding, riveting, soldering	G.I. sheet 22 gauge	200x200	5
7.	Funnel	Measuring, marking, rolling, seaming, soldering	G.I. sheet 22 gauge	100x300	5
8.	Store box	Measuring, marking, hamming, seaming, cutting, folding, riveting	G.I. sheet 22 gauge	400x500	6
9.	Practical test	Sharping the hand tool and power tool, evaluate all the bench work	As per need	As per need	8
10.	Make a platform (pirka)	Measuring, marking, sawing, chiseling, planning, angle joining, fitting	Required Wood	Required Wood	10
				Total (hours)	**90**

References:

1. Workshop technology (Vol -1), S.K. Hajra Chaudhary
2. Shop theory (Vol -1), Henp Fort trade school
3. Manufacturing process, S.K. Hajra Chaudhary

First Year (Second Semester)

Second Semester
Subjects:

EG1201 SH	**Engineering Mathematics II**
EG1202 SH	**Engineering Physics II**
EG1203 SH	**Engineering Chemistry II**
EG1214 ME	**Engineering Drawing II**
EG 1209 ME	**Applied Mechanics**
EG1212 EE	**Safety Rules and Regulation**
EG1213 EE	**Electrical Workshop**
EG1215 EE	**Principles of Electrical Engineering**

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 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, Vidhyarthi 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

EG1202SH

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 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 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

EG1203SH

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: **[30]**

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, MK.Sthapit

Reference books:

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

Engineering Drawing II

EG1204 ME

Total: 4 hours /week

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

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

Practical: 4 hours/week

Lab: hours/week

Course Description:

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

Course Objectives:

After completing this course the students will be able to

1. draw sectional view of the given three dimensional solid,
2. draw pictorial projections from the given orthographic views,
3. develop the surfaces of the geometrical solids, and,
4. draw interpenetration line/curve for the given intersecting solids.

Course content:

Unit 1: Sectional views **[8]**

- 1.1 Use of sectional views
- 1.2 Cutting plane line and hatching lines
- 1.3 Types of section (full, half, partial, removed, rotated and offset)
- 1.4 Drawing exercises on above sub units

Unit 2: Isometric drawing **[12]**

- 2.1 Introduction to axonometric projection
- 2.2 Isometric projection and isometric drawing
- 2.3 Procedure of making an isometric drawing (box and co-ordinate construction method)
- 2.4 Non isometric lines and surfaces
- 2.5 Angles in isometric
- 2.6 Circles and circular arcs in isometric
- 2.7 Orientation of object in isometric drawing
- 2.8 Isometric drawing (rectangular objects with horizontal, vertical and inclined planes; objects with cylindrical surfaces and holes)
- 2.9 Drawing exercises on above sub units

Unit 3: Oblique drawing **[4]**

- 3.1 Oblique projection and oblique drawing
- 3.2 Procedure of making an oblique drawing
- 3.3 Rules for placing object in oblique
- 3.4 Angles, circles and circular arcs in oblique

3.5 Cavalier and cabinet projection
3.6 Oblique drawing of objects with plane and curved surfaces
3.7 Drawing exercises on above sub units

Unit 4: Surface development [16]

4.1 General concepts and practical considerations
4.2 Development of right and oblique solids (prismatic and pyramidal: circular, triangular, square, hexagonal base)
4.3 Development of truncated right and oblique solids (prismatic and pyramidal: circular, triangular, square, hexagonal base)
4.4 Drawing exercises on above sub units

Unit 5: Intersection of solids [12]

5.1 Lines of intersection of geometric surfaces
5.2 Intersection of solids (two prisms, prism and pyramid)
5.3 Drawing exercises on above sub units

Unit 6: Pattern making [8]

6.1 Pattern of geometrical solids
6.2 Pattern of intersecting solids
6.4 Pattern making exercises on above sub units

Reference:

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

Applied Mechanics

EG 1209 ME

Total: 4 hours /week
Year: I **Lecture: 3 hours/week**
Semester: II **Tutorial: 1 hours/week**
Practical: hours/week
Labs: hours/week

Course Description:

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

Course objective

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

1. Describe fundamental principles and concepts of mechanics.
2. Explain the principles of forces and their effects on particle and rigid body
3. Describe the concept of equilibrium in two dimensions and three dimensions
4. Analyze concentrated and distributed forces
5. Describe theory and concept of dry friction
6. Solve different types of numerical problems of statics
7. Describe kinematics and kinetics of particles and rigid bodies
8. Explain Newton's laws of motions
9. Describe principles of work and energy

Course Contents

Unit 1. Introduction **[3]**

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

Unit 2. Statics of particles and rigid bodies **[7]**

- 2.1 Introduction to statics
- 2.2 Concepts of force and force system
- 2.3 Resultant of a force system
- 2.4 Determination of resultant of different force systems
- 2.5 Resolution and composition of forces
- 2.6 Rectangular components of force
- 2.7 Moment of a force about a point
- 2.8 Moment of a force about an axis
- 2.9 Principle of Moments
- 2.10 Torque and couple
- 2.11 Related problems

Unit 3. Equilibrium **[2]**

- 3.1 Introduction to the concept of equilibrium
- 3.2 Conditions of equilibrium in two- and three dimensions

3.3 Body constraints and free body diagrams

Unit 4. Distributed forces [6]

4.1 Concept of concentrated and distributed forces
4.2 Centre of gravity and centroids
4.3 Calculation of centroids and centre of gravity of bodies with regular and omposite shapes and forms
4.4 Second moment of area and moment of inertia
4.5 Related problems

Unit 5. Friction [3]

5.1 Introduction
5.2 Definition
5.3 Nature of friction and types
5.4 Theory of dry friction
5.5 Laws of friction
5.6 Angle of friction and coefficient of friction
5.7 Friction on an inclined plane
5.8 Related problems

Unit 6. Dynamics [14]

6.1 Introduction to dynamics
6.2 Kinematics of particles
6.3 Motion and its types
6.4 Rectilinear motion of particles: displacement, velocity, speed, acceleration and distance traveled by particles
6.5 Curvilinear motion of particles: radius vector, displacement, velocity, and acceleration
6.6 Motion under gravity
6.7 Relative motion and dependent motion
6.8 Kinematics of rigid bodies
6.9 Introduction to kinetics
6.10 Newton's laws of motion
6.11 Equations of motion and related problems
6.12 Linear momentum of particles
613 Angular momentum of particles
6.14 Principle of impulse and momentum
615 Related problems

Unit 7. Work, power and energy [10]

7.1 Work of a force
7.2 Principle of work and energy
7.3 Power and efficiency
7.4 Relation between rpm, torque and power
7.5 Application of work and energy principles to rigid bodies
7.6 Potential and kinetic energy
7.7 Law of conservation of energy and its application
7.8 Related problems

References

1 Beer F.P & Johnston ER: Mechanics for Engineers, 8th Edition, Mc Graw Hill.
2 Malhotra, M.M, Subramanian, R., Gahlot Rathor P.S, B.S: Text book in applied mechanics, Wiley Eastern Limited.
3 Kumar, D.S: Engineering Mechanics, Kataria S.K & Sons.
4 Hibbler R.C: Engineering mechanics, Statics and Dynamics,

Safety Rules and Regulations

EG1212EE

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

Course Description:

The course deals with the possible basic damages and safety precaution while working with the electrical equipments and circuits.

Course Objectives:

After completing this course the students will be able to know:
1. The damages to human due to electric shocks and precautions to be taken care of
2. The cause of fire hazards due to electricity and fire fighting techniques

Course content:

Unit 1: Safe use of Electrical components [6]
- 1.1 Safe use of electrical tools
- 1.2 Static charge in high voltage equipment
- 1.3 Electrical insulation techniques
- 1.4 Safety tools

Unit 2: Electric shocks [10]
- 2.1 Possible damages due to electric shocks
- 2.2 Reason behind electric shocks
- 2.3 Bio-physical characteristics of human body against electric current
  - Typical value and characteristics of electrical resistance of human body
  - Effect of environmental factors
  - Effect of sate of the organism
- 2.4 Safe value of electric current and voltage through human body
- 2.5 First Aid for electric shock
- 2.6 Cardiopulmonary Resuscitation (CPR)
- 2.7 Safety precautions and regulations

Unit 3: Equipment earthing [6]
- 3.1 Definition
- 3.2 Types of equipment earthing
- 3.3 Concept of 3-pin plug for high rating equipments
- 3.4 Touch and step potential
- 3.5 Various types of electrodes used for earthing
- 3.6 Earthing mat
- 3.7 Concepts of instruments used for earth resistance measurement

Unit 4: Fire hazards and fire fighting techniques in electrical equipment [8]

4.1 Causes of fire hazards due to electricity

4.2 Fire classification

- Ignition of dusts
- Electrostatic charges in liquids
- Batteries
- Insulating oils

4.3 Fire Fighting Techniques

References:

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

Electrical Workshop

EG 1213 EE

Total: 7 hour /week

Year: I **Lecture: 1 hours/week**

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

Practical: 6 hours/week

Lab: hours/week

Course Description:

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

Course Objectives:

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

i. Understand electrical hazards and safety.
ii. Identify, use and care of electrical tools required for wiring Installation.
iii. Identify different types and size of wires and cable
iv. Perform different types of cable joints and termination.
v. Identify various wiring accessories and install them with PVC duct.

Course content:

Unit 1: **[6]**

L: Electrical hazards, safety rules and practice, conditions and cause of electric shocks removal of casualties and artificial respiration.

P: Type and size of wire, forming stripping and termination of various wires and cable with eyelet, cable shoe, soldering and crimping

Unit 2: **[6]**

L: Identify the following tools and measuring instruments
Types and sizes of screw drivers, line tester, electric pliers, end cutting, diagonal cutting, combination, flat nose and round nose, electrician knife, wire stripper, crimpers.

P: Practice on various types of cable joints – straight light joint, T joint with solder, mechanical connector, soldering practice

Unit 3: **[8]**

L: Use of multimeter, ohmmeter and oscilloscope

P: Make a 220/6v adaptor with diode in bridge connection and capacitor measure 6V AC and DC by voltmeter as well as oscilloscope.

Unit 4: **[7]**

L: Introduction and identification of wiring accessories switches, sockets, plugs, fuse, MCB, MCCB, ELCB holders, ceiling rose, J.B etc.

P: Installation of 220V bell with push bottom switch. Draw symbol – lay out diagram – connection diagram

Unit 5: **[7]**

L: Introduction of mutual, gang call system.

P: Installation of 6 gang indicator call bell system – understand connection diagram

Unit 6: **[7]**

L: Introduction of extension lamp and power cord, current carrying capacity.

P: a) Make extension lamp set for 100W lamp
b) Make Iron cord for 750W iron
c) Make power extension cord 15Amp socket
d) Use current carrying table to select the size of wire for above work.

Unit 7: **[7]**

L: Introduction of light point (lamps) in a circuit.

P: Installation of one lamp controlled by one 10Amp switch in PVC duct as per given lay out.

Unit 8: **[7]**

L: Methods of addition, renovation of lighting work.

P: Additional installation of two number of 5Amp 2 pin socket on above job.

Unit 9: **[7]**

L: Behaviour of lamps in series and parallel connection

P: Installation of two lamps controlled by one switch.

Unit 10: **[7]**

L: Introduction of Power point wiring (sockets) in a circuit.

P: Installation of two number of 15Amp 3 pin switch socket with MCB in PVC duct.

Unit 11: **[6]**

L: Method of lamp controlled from multi places

P: Installation of a lamp controlled by two numbers of alternate switches (two way switches) from two separate places.
Using live line is one of the common terminals of one switch.

Unit 12: **[5]**

L: Introduction of fluorescent lamp.

P: Installation of fluorescent lamp holders, switch, starter holder, ballest and inter connection one of them, fit tube and starter and connect to supply.

Unit 13: **[5]**

L: Introduction of ring circuit.

P: Installation of four numbers of 15Amp power switch socket in ring circuit with 16Amp sp MCB

Unit 14: **[5]**

L: Relation and connection of Ballest power and tube wattage.

P: Installation of two number of 20Watt tubes with 40Watt ballest in series

Unit 15: **[5]**

L: Introduction of capacitor connection with tube set

P: Install, two numbers of 40Watt tube in parallel with separate ballast and power factor connection condenser.

Unit 16: **[5]**

L: Introduction of LED lamp

P: Install different types of LED lamp with dimmer switch

References

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

Principles of Electrical Engineering

EG 1215 EE

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

Course Description:

This course provides a basic framework for understanding the fundamental concept of Electric circuits. The course deals with circuit fundamentals and Electrostatics and electromagnetic phenomena.

Course Objectives:
After completing this course the students will be able to:
1. understand the fundamental concept of electric circuits
2. understand the fundamental principles of electricity, magnetism
3. understand the electromagnetic phenomena and its applications.

Course content:

Unit 1: Basic Concept of Electricity [10]
- 1.1. Matter, molecule and atom
- 1.2. Electric charge and current
- 1.3. Conventional versus electron flow
- 1.4. Potential difference and electromotive force
- 1.5. Conductors, insulators and electron flow
- 1.6. Resistance and its variation with temperature
- 1.7. Direct and alternating current

Unit 2 Electric Circuit Fundamentals [12]
- 2.1 Definitions of Electric current and voltage
- 2.2 Circuit elements: Resistor, Inductor, Capacitor
- 2.3 Voltage and current sources
- 2.4 Independent and dependent sources
- 2.5 Series and parallel circuits
- 2.6 Ohm's law
- 2.7 Voltage divider circuits and Kirchhoff's Voltage Law (KVL)
- 2.8 Current divider circuits and Kirchhoff's Current Law (KCL)
- 2.9 Electric power and energy

Unit 3 Electrostatics [10]
- 3.1 Laws of electric forces
- 3.2 Electric field and electric field intensity
- 3.3 Electric fluxes and flux density
- 3.4 Dielectrics, permittivity and relative permittivity
- 3.5 Electrostatic induction phenomena
- 3.6 Electric potential, potential difference and potential gradient
- 3.7 Capacitors and capacitance
- 3.8 Series and parallel connection of capacitors
- 3.9 Factors affecting capacitance
- 3.10 Some constructional examples of practical capacitors

3.11 Energy stored in charged capacitor
3.12 Charging and discharging of capacitor, time constant for charging/discharging

Unit 4 Magnetism and Electromagnetism [12]

4.1 Definition of magnetic field, magnetic flux, flux density, filed intensity and permeability of magnetic material, domain theory of magnetism
4.2 Permanent magnets and electro-magnets
4.3 Permeability and relative permeability of magnetic material
4.4 Dia-magnetic, para-magnetic and ferro-magnetic materials
4.5 Magnetic field due to current carrying conductor, force on a current carrying conductor
4.6 Hysteresis loop for magnetic material, hard and soft magnetic material

Unit 5 Electro Magnetic Induction [8]

5.1 Relation between electricity and magnetism, production of induced emf & current
5.2 Faraday's Laws of Electromagnetic induction, direction of induced emf & current.
5.3 Lenz's law, dynamically induced emf, statistically induced emf.
5.4 Self inductance, coefficient of self inductance (L), Mutual inductance, coefficient of mutual inductance (M), coefficient of coupling.
5.5 Energy stored in a current carrying inductor
5.6 Inductance in series, inductance in parallel.
5.7 Magnetic circuit concept, analogy to electric circuit

Unit 6 Electrolysis and its Application [8]

6.1 Faraday's law of electrolysis and its applications
6.2 Primary and secondary cells: definitions and examples, internal resistance of cell
6.3 Lead acid cell: construction, chemical reaction during charging and discharging, methods of charging (constant voltage and constant current charging)
6.4 Dry cell, Mercury cell, Ni-Cd cell, Li-ion cell
6.5 Series and parallel connection of cells

Practical Exercises: [3x15 hrs]

1. Use of Ammeter and Voltmeter to measure current and voltage. Identify and scale and range settings of such meters.
2. Verification of Ohm's law
3. Verification of Kirchhoff's current and voltage laws
4. Resistance and resistivity of wire
5. Wheatstone bridge
6. Charging and discharging of capacitor
7. B-H Curve for hard and soft magnetic materials
8. Basic application of electromagnets
9. Electromagnetic induction
10. Inductance and capacitance in DC circuits
11. Measurement of internal resistance of batteries
12. Charging and discharging of lead acid battery

References:

1. *A textbook of Electrical Technology* by B.L Theraja and A.K. Theraja
2. *Fundamentals of Electrical Engineering* by J. B. Gupta
3. *Principles of Electrical Engineering* by Vincent Del Toro
4. *Foundations of Electrical Engineering* by R.J. Cogdell

Second Year (First Semester)

Third Semester

Subjects:

EG2111 CT Computer Programming
EG2112 EX Basic Electronics
EG2113 CE Civil Construction and Survey
EG2114 EE Electrical and Electronic Engineering Material
EG2115 EE Electric Circuit Theory
EG2103 MG Principles of Management and Costing
EG2116 EE Electrical Installation I
EG2117 EE Electrical Engineering Drawing I

Computer Programming

EG 2111CT

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

Course Description:

This is an introductory course covering programming principles. It has major focus on learning programming syntax and solving engineering problems using C language.

Course Objectives:

On completion of this course the students will be able to
1. Introduce students with programming principles.
2. Acquaint them with C programming syntax.
3. Develop programming skills.
4. Apply programming skills to solve engineering problems.

Course content:

Unit 1. Programming Fundamentals [4]
- 1.1 Introduction to programs and programming languages
- 1.2 Types of programming languages
  - Low level languages (Machine language and assembly language)
  - High level languages (Basic, Fortran, Cobol, Pascal, C, C++, Visual C++, Visual Basic, Java etc.)
- 1.3 Program design methodology: Algorithm and flow-charts
- 1.4 Stages of software development: Analysis, Coding, Testing and debugging, Program Documentation etc.

Unit 2. Introduction to C [6]
- 2.1 C language basics character set, keywords, idendifiers, constants and variables, expressions, statements and comments.
- 2.2 Data type
- 2.3 C operators, precedence and associativity, conversion specifications.
- 2.4 Input/Output statements
- 2.5 Built-in functions and inclusion of header files.

Unit 3. Control statements and loops [8]
- 3.1 Conditional operators
- 3.2 if, if – else, nested if-else, switch statements
- 3.3 for loop
- 3.4 while, do – while loops
- 3.5 Nested loops

Unit 4. Arrays and strings [4]
- 4.1 Introduction to arrays
- 4.2 Initializing arrays
- 4.3 Multi-dimensional arrays
- 4.4 Strings

4.5 Introduction to Pointers
4.6 Introduction to structures and unions

Unit 5. Functions [4]

5.1 Defining functions
5.2 Function arguments
5.3 Recursive functions
5.4 Preprocessor directives: Macro expansion and file inclusion

Unit 6. File Handling [2]

6.1 Creating and processing data files
6.2 Opening and closing data files
6.3 Input/Output with data files
6.4 Formatted/unformatted data files

Unit 7. Project Work [2]

7.1 The students will be assigned (individually or in group) a programming problem. The students are required to analyze the problem and implement the C programming concept to prepare program with basic documentation.

Practical Exercise [3x15]

1. Initial practical works will emphasize on familiarization of C compiler and implementing basic syntax. (2 sessions)
2. Additional lab exercise will focus programs illustrating the use of the following concepts: (10 sessions)
   a. conditional statement
   b. loops
   c. arrays and strings
   d. functions
   e. structures and unions
   f. file handling.
3. The remaining lab sessions will be used for coding and testing of project work as well as evaluation purpose. (3 sessions)

Text Books:

1. Kelly and Phol, "*A book on C*",
2. Yeshavant Kanetkar, "*Let us C"*, BPB Publishers

Reference Books:

3. Kerighan, Brain and Dennis "*The C programming language*",
4. V. Rajaraman, "*Computer programming in C"*, Prentice Hall of India
5. E. Balaguruswami, "P*rogramming in ANSI C"*, Tata McGraw Hill
6. Byron Gottfried, "Schaum'a Outline of Programming with C", 2nd Edition, Tata McGraw-Hill Publishing Company Ltd.

Basic Electronics

EG 2112EX

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

Course Description:

The use of Electronics, specifically the Semiconductors in Electrical Controls has expanded in recent years has made a strong need of knowledge in Electronics for Technician engineers. Keeping in view with this need, the electronics course has designed to provide practical and essential theory about modern components in particular on linear circuits.

Course Objective:

On completion of this course the students will be able to
1. provide practical and essential theory on modern electronic linear components.
2. provide technical and analytical skills required by Electrical Engineers, Technicians to use of Electronics in Electrical Controls.

Course Content:

Unit 1. Introduction : [1]
- 1.1 Importance of electronics in modern society.
- 1.2 Use of electronics in Electro Mechanical Control system and automation.

Unit 2. Introduction to electronic passive components [6]

2.1 Resistors and potentiometers
- Introduction, Classification and Demonstration of various types of Fixed Resistors and Variable
- Resistors, Resistor Color Codes.
- Resistor Circuits. Series Circuit, Parallel Circuit and Series - Parallel Combined Circuits.
- Characteristics, Application and Demonstration of Thermistors, LDR.

2.2. Inductive components
- Introduction, Classification and Demonstration of various type of to Inductive Components and basic

2.3 Construction.
- Types of Inductors used in electric & electronic circuit.
- Inductance Circuits. Series Circuit, Parallel Circuit and Series - Parallel Combined Circuits.

Capacitors
- Introduction, Classification and Demonstration of Capacitance and Capacitor and basic construction and units.
- Types of Capacitors and their application in Electrical & Electronic circuit.
- Capacitor Circuits. Series Circuit, Parallel Circuit and Series - Parallel Combined Circuits.

Unit 3. Miscellaneous components and accessories [4]

3.1 Loud speakers and microphones

- Introduction to dynamic Loud Speaker, Head Phones and Ear Phones.
- Basic construction and principles of operation of Microphone.
- Introduction, Classification and application Various types of Microphones (Carbon Microphone, Dynamic Microphone, Ribbon Microphone, Condenser Microphone).

3.2 Allied components

- Basic construction, principles of operation and application of Switches, Magnetic Relays, Fuses and PCBs.
- Demonstration of above components and briefing their application.
- Basic construction, principles of operation Cathode Ray Tube (CRT).

Unit 4. Principles of semiconductors [3]

4.1 Introduction to Semiconductor, Atomic structure, Semi-conductor Crystals and their characteristics.

4.2 Adding impurities to semiconductors, Donor and Acceptor impurity in intrinsic Germanium.

4.3 N Type and P Type Semiconductor.

Unit 5. Semiconductor diode [4]

5.1 PN junction diode

- Introduction to PN Junction Diode, basic construction, forward and reverse characteristics.
- Types of Diode and their application in Electric and Electronic Circuit.
- Checking of Diode using Ohm Meter.

5.2 zener diode

- Basic construction and operation of a Zener diode.
- Forward and reverse bias Characteristics of a Zener diode.
- Application of Zener Diode as a Voltage Regulator.

Unit 6. Introduction to bi-polar junction transistor (bjt). [4]

6.1 Basic structure of BJT, PNP and NPN type.

6.2 Biasing of PNP and NPN Transistor principles of operation.

6.3 Voltage and Current Characteristics. Input and Output Characteristics, Collector current as a function of base current (Family of Collector characteristics curve), Cutoff, Saturation and DC Load line.

6.4 Demonstration various types of Transistors, Transistor Rating and interpretation of Transistor Data sheet.

6.5 Testing of Transistor by using Ohm meter.

Unit 7. Transistor amplifiers circuits [9]

7.1 Introduction, Principles of operation and characteristics to Common Emitter (CE) Amplifier, Common Collector (CC) Amplifier and Common Base (CB) Amplifier circuit.

7.2 Transistor Leakage current (I_{CBO}, I_{CES}, & I_{CEO}) & Temperature stability Transistor circuit, use of Heat sink to prevent the Transistor from overheating..

Unit 8. RC coupled small signal common emitter amplifier [5]

8.1 Introduction and principles of operation Class of operation (Class A, Class B and Class C) of RC coupled Amplifier, Transformer coupled Amplifier and Direct coupled Amplifier circuit.

8.2 Introduction to feedback. Positive and Negative feedback in Transistor Amplifier.

Unit 9. Special semiconductor devices [9]

9.1 Basic construction, Voltage - Current characteristics and application of SCR, UJT, JFET, MOSFET, Photo Diode, Opto Coupler and Varactor Diode.

LIST OF LABORATORY EXPERIMENTS: [45]

1. Introduction to Laboratory Equipment.
2. Measurement of Voltage, Current , Resistance and Series & Parallel Resistance Circuit
3. PN Junction Diode and Zener Diode Characteristics.
4. Diode Rectifier and Filter Circuits.
5. Testing BJT Transistor CE Characteristics.
6. Transistor Small Signal CE Amplifier Circuit.
7. Testing JFET Transistor Characteristics.
8. Testing SCR Characteristics.

Reference Text Books:

1. Basic Electronics by Bernard Grob
2. Electronics Principles by Malvino
3. Electronic Devices by Floyd

Civil Construction and Survey

EG 2113 CE

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

Course Description:

This course deals with the fundamental concept of surveying & basic civil construction works related to electrical Engineering.

Course Objectives:

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

1. Describe building materials, walls, roofs, floor, foundation, cable trench, select and use correct building materials
2. Understand concrete and mortar mixes
3. Identify and use surveying instruments to measure length, angles, and heights.
4. Level survey and peg for overhead power lines.

Course content:

Section A: Civil Construction

Unit 1. Introduction [5]

1.1 Construction materials – types of materials, availability (sand, line, cement, brick, block, wood, steel etc.), their main characteristics, supply sources and prices.
1.2 Walls – load bearing and partition, their features, material used and construction.
1.3 Types of roofs – pitched and flat, their features
1.4 Floors – solid and suspended floors, their features.
1.5 Cable trench through floor, its construction detail

Unit 2. Foundations: [6]

2.1 Basic soil mechanics, basic requirements for load bearing structures, drainage, soil bearing capacity.
2.2 Functions of foundation
2.3 Types of foundations commonly used with special emphasis on electrical machines, poles and towers, requirements and design criteria.
2.4 Foundation plans and sections – interpretation and use
2.5 Concrete mixes and mortar preparations, use and applications
2.6

Unit 3. Walls and Supports [4]

3.1 Load bearing walls/support – brick, concrete block, stone and rubble, method of construction and tools used
3.2 Openings in walls – for doors, window etc. Use of lintel, sills and jambs. Timber and steel for construction of window and door, methods of construction

Unit 4. Drainage [5]

4.1. Need for adequate drainage in and around the building
4.2. Simple surface water drainage system, water flow principle.
4.3. Combined surface water and sewage drains, connection and fittings

Practical Exercises: [15]

1. Tour around the campus and nearby building to note constructional features.
2. Safety in building sites – use of scaffolding, ladder, hoist and lifting equipment. Damper from falling objects, safe handling, stacking of materials.
3. Observe drainage, trench system around the campus area and plumbing system
4. Read and interpret civil/building drawings in detail

Section B: Surveying

Unit 5. Introduction [4]

5.1.The need for surveying and leveling in overhead line construction
5.2.Principles used in surveying and labeling
5.3.Major divisions of surveying

Unit 6. Distance Measurement [4]

6.1 The chain and tape – their construction, use and care
6.2 How to use a tape – errors and accuracy in taping
6.3 How to use a chain – accuracy in chain measurements

Unit 7. Angle Measurement [6]

7.1 Measurements of horizontal angles by using compass, level, and theodolite
7.2 Measurement of vertical angles using theodolite and clinometer
7.3 Methods of measuring vertical heights

Unit 8. Leveling for Building Sites [5]

8.1 The Principles of leveling choice of datums, use of staff and level.

Unit 9. Survey and Leveling of Power Lines [6]

9.1 The principle factors in routing overhead power lines, leveling, surveying and pegging of route

Practical Exercises: [30]

1. Identify instrument and equipment commonly used in surveying
2. Measure with tape and chain over different ground conditions and record distance measurement
3. Perform distance measurement across an obstacle
4. Perform measurement of horizontal and vertical angles
5. Perform measurement of vertical heights (overhead line poles, towers)
6. Draw cross-section of a site to show variations in level

References:

1. *Reinforced Concrete Foundation* by Fergusen
2. *A text book of Surveying* by C. L. Kochher
3. *Standard Handbook of Civil Engineers* by F.S. Neritt
4. *Building Drawings* by Shaha

Electrical and Electronics Engineering Material

EG 1214 EX

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

Course Description:

This course deals with the properties of Magnetic, Resistor, and Dielectric and Semiconductor materials from the peripherals of electrical engine.

Course Objectives:

On completion of this course the students will be able to:
1. identify and use magnetic materials used in electrical system.
2. identify the working of semiconductor material.
3. get knowledge of dielectric, Dielectric, Resistor alloys

Course content:

Unit 1. Conducting Material [8]
- 1.1 Description of commonly used resistors, alloys of Nickel, Iron, Chromium, Aluminum.
- 1.2 Band structure of conductors, energy gap
- 1.3 Electrical properties: resistivity, conductivity, effect of temperature, concept of drift and mobility
- 1.4 Resistor alloys:
  - 1.4.1 Alloys of Ni, Fe, Cr, Al
  - 1.4.2 Mechanical characteristics
  - 1.4.3 Industrial application

Unit 2. Magnetic material [20]
- 2.1.Classification based on ferrous material and non-ferrous material
- 2.2.Use and their characteristics
- 2.3.B-H characteristics
- 2.4.Hysteresis loop, eddy current losses
- 2.5.Magnetic permeability and susceptibility
- 2.6.Domain structure
- 2.7.Ferrous materials
  - 2.7.1. Common ferrous materials and their engineering characteristics
  - 2.7.2. Industrial applications
  - 2.7.3. Corrosion: cause , effect and methods of prevention
- 2.8.Non-ferrous materials
  - 2.8.1. Common non-ferrous materials and engineering characteristics
  - 2.8.2. Some non-ferrous alloy (copper, aluminum, brass, bronze, silver, gold) and their Industrial application
  - 2.8.3. Carbon as an electrical material, its product (brushes) and application
  - 2.8.4. Chemical/corrosion characteristics of some commonly used non-ferrous metals

Unit 3. Dielectric materials [18]

3.1 Definition of dielectric, macroscopic approach

3.2 Polarization, Dielectric constant, Electric Dipole moment, Electronic polarization, Ionic polarization

3.3 Dielectric breakdown

- Dielectric breakdown in gases
- Dielectric breakdown in liquids
- Dielectric breakdown in solids

3.4 Ferro electricity and Piezo-electricity

3.5 Properties of some dielectric materials

3.6 Insulating materials

3.7 Identification of insulating materials in general uses and their characteristics

3.8 Electrical characteristics of some insulating materials e.g. plastics, resign, porcelain, glass, fiber glass, mica, oil, insulating varnishes, gases (SF6)

Unit 4. Semiconductor materials [14]

4.1.Definition, elements of semi-conductor materials, electrical nature.

4.2.Band structure of Group IV materials, energy gap.

4.3.Atomic structure of silicon, germanium

4.4.Formation of electron and hole

4.5.Electrical conduction in semi-conductors

4.6.Intrinsic and Extrinsic semiconductor, concept of doping

4.7.N type semiconductor

4.8.P type semiconductor

References:

1. Electrical engine mater, P.B. Tonega
2. An Introduction to Electrical engine, C.S. Irdal van

Electric Circuit Theory

EG 2115 EE

Total: 7 hour /week

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

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

Practical: hours/week

Lab: 3 hours/week

Course Description:

This course elaborates the electric network theorems and incorporates fundamental concepts of AC networks along with three phase systems.

Course Objectives:

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

- understand the basic circuit theorems and their application for analysis of DC networks
- gain the fundamental knowledge of AC circuits and analysis of AC networks
- understand the 3 phase AC systems and their application

Course content:

Unit 1: DC Network Theorems and Circuit Analysis [10]

1.1. Thevenin's theorem
1.2. Nortorn's theorem
1.3. Superposition theorem
1.4. Maximum power transfer theorem
1.5. Mesh current method of circuit analysis
1.6. Node voltage method of circuit analysis

Unit 2: AC Fundamentals [24]

2.1 Generation of alternating voltage & currents, equations of alternating voltages & currents, Sine Wave.
2.2 Terminologies: Frequency, time period, amplitude angular velocity, average value, rms value, phase & phase differences.
2.3 Average & rms value of different waves
2.4 Representation of alternating quantities vector diagram, Vector diagram of sine waves of same frequency, addiction & subtraction of two alternating quantities, different form of vector such as trigonometrically form, polar form, Cartesian form. Use of 'J' operator & its significance.
2.5 AC through pure ohmic Resistance, phaser diagram, wave form of current & voltage, wave form of power & necessary mathematical expression with analysis
2.6 AC through pure inductance only, phaser diagram, wave form of current & voltage, power, variation of reactance with frequency.
2.7 AC through pure capacitor only, phaser diagram, wave form of current, voltage, power & necessary mathematical expression with analysis.
2.8 Analysis of series R-L, R-C, R-L-C circuits
2.9 Analysis of parallel R-L, R-C, R-L-C circuit
2.10 Resonance in AC series circuit
2.11 Resonance in AC parallel circuit

2.12 Related numerical problem.

Unit 3: Three phase system [11]

3.1 Generation of three phase voltages, phase sequence, phase sequence at load, star & connection, neutral point.
3.2 Value of voltage & current in star & D connection balanced.
3.3 Power consumed by star/s connected balanced load.
3.4 Effect of unbalanced load in three phase system, current through the neutral.
3.5 Star delta or delta star conversion.
3.6 Related numerical problems.

Practical [45]

1) Handling of oscilloscope to measure ac quantities such as peak values, rms value, tune period & frequency.
2) Measurement of voltage, current & power of R-L-C series circuit.
3) Measurement of voltage, current & power in RL & RC parallel circuit.
4) Performing resonance analysis of R-L-C series
5) Analysis of R-L series circuit & R-L series circuit with the help of oscilloscope.
6) Study of 3 phase circuit in star/delta connected balanced load & measurement of power.
7) Study of unbalanced three phase circuit with star/delta connected loads.
8) Changing & discharging of capacitor using oscilloscope.
9) Verification of maximum power transfer theorems.

References:

1. *A textbook of Electrical Technology* by B.L Theraja and A.K. Theraja
2. *Fundamentals of Electrical Engineering* by J. B. Gupta
3. *Principles of Electrical Engineering* by Vincent Del Toro
4. *Foundations of Electrical Engineering* by R.J. Cogdell
5. *Network analysis and synthesis by sudhakar and shayamamohan*
6. *Fundamental of Electrical Engineering by Ashpha Husain*

Principles of Management and Costing

EG 3101MG

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:

First Part: Management

Unit 1: Organization and Management [6]

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]

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]

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]**

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]**

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]**

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]**

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]**

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.), Dhanpat Rai and Co. (P) Ltd., Delhi
6. Chan S. Park, 2002, Comtemporaru Engineering Economics, Third Edition, Prentice-Hall IndiaPvt. 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.

Electrical Installation I

EG 2116 EE

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

Course Description:

This course deals with PVC and metal conduit wiring from supply intake to load point, conceal wiring in new buildings and motor starters.

Course Objectives:

On completion of this course the students will be able to:
1. Identify wiring system, wiring accessories, protection devices;
2. Select and install accessories and fitting for 1ph and 3ph wiring Systems with PVC conduit, ms conduit:
3. Read and interpret architectural plan with electrical lay-out, prepare Schedule
4. of quantities and cost estimate
5. Read circuit diagram and install according to diagram;
6. Install and test earthing system;
7. Test the installation system
8. Understand and use rules of wiring and code of practice

Course content:

Unit 1. PVC Conduit wiring preferably in Cubical [10]

1.1 Identification and selection of pipe, junction box, bend, tee, reducer etc. Symbols, layout diagram and connection diagram.

1.2 Perform installation of two lamps in series controlled by a common switch and observe the light output. Reconnect those two lamps in parallel and observe light output and compare with the previous case. Carryout - continuity test, polarity test & insulation test.

1.3 Perform the installation of two lamps controlled by two way switches. Use second method (live line on both switches) as per lay –out diagram. Carry out - continuity test, polarity test

Unit 2. Metal conduit wiring preferably in cubical [5]

2.1 Introduction of different types of light fixtures – their comparison and application (incandescent light fixtures, fluorescent light fixtures, compact fluorescent lamp – CFL fixtures, streetlight fixtures, flood light fixture, surface – recessed type fixtures)

2.2 Install one fluorescent tube light fixture and 40 watt incandescent lamp in parallel controlled by two separate switches in one place; marking as per lay-out, carryout continuity test, Polarity test and function.

Unit 3. Installation of Distribution Board [5]

3.1 Introduction of the wiring accessories such as switch, socket, distribution box, junction box, pull box- their construction and function.

3.2 Protective devices - such as fuse, MCB, MCCB, ELCB, types and Application

3.3 Install two /up to three numbers of 5/15Amp switch socket in parallel controlled by a 16Amp marking as per lay out diagram and carryout test.

Unit 4. Consumer Intake [7]

4.1 Preparation of connection diagram and description of MCB, DB, and kWh meter, power circuit – Nos. of socket, light circuit, number of lamps, incoming cable –MCB, outgoing cable – MCBs

4.2 Install 6 ways MCB distribution board as a consumer control unit along with kWh meter

Unit 5. Installation of Earth Electrode [7]

5.1 Purpose of earthing, Earth loop impedance, types, system earthing, protection of earthing, electrode, plate, rod, mesh., star, size, depth, 8 S.W.G wire, strip, charcoal, common salt, watering provision brazing. Protection, function, test, recommended ohm, correction.

5.2 Install the electrode and test it with an earth tester. i) New earthing ii) Existing earthing

Unit 6. Wiring Project in Cubical [7]

6.1 Prepare plan in Elevation of the Cubical with Electrical lay-out diagram of a wiring system with 6-ways DB (two light circuit, 1 power socket, two spare MCB),2×40 fluorescent lamps, celling dome, wall bracket, call bell, power sockets, dimmer, regulator

Unit 7. Installation Testing [7]

7.1 Describe importance of testing procedure and testing instruments. Continuity test, Insulation test, Polarity test.

- Perform test on previous project with no bulbs/ fuses switch ON and all bulbs/ fuses switch OFF.
- Prepare list of material

Unit 8. Installation of Fan/Pump motor [7]

8.1 Installation of 1ph – Universal/ capacitor start – run motor with DP switch and protection (use multicore cable with saddle, Direction of rotation, Clockwise/ Anti clockwise

Unit 9. Use of DOL starter for motor [7]

9.1 Replace DP switch by DOL starter in the above job.

Unit 10. Use of reversible starter for three phase motor [7]

10.1 Connect and start 3 phase, Squirrel cage induction motor (up to 3H.P.) using drum types reverse switch and HRC fuse to run the motor in both direction

Unit 11. Star/Delta starting of 3 phase motors. [7]

11.1 Using basic circuit diagram, connect and star 3ph induction motor with Y/Δ drum type switch and TP MCB.

Unit 12. Connection of meter and indicator [7]

12.1 Voltmeter, ammeter, CT, selector switch, RYB indicator in a typical DB. Understand the circuit Diagram. .

Unit 13. Observation visit [7]

13.1 Visit to understand the PVC pipe laying for conceal wiring of new building. Identify switch point, light point, socket point, junction point, DB

Reference:

- Electrical wiring Fundamentals, Foley
- Electrical Installation and workshop practice, F.G. Thompson
- Electrical Installation –estimation costing, J.B. Gupta
- Manufacture's catalogue for starters, MCB, MCCB, ELCB etc.

Electrical Engineering Drawing I

EG 2117 EE

Total: 3 hours /week

Year: II **Lecture: hours/week**

Semester: I **Tutorial: hours/week**

Practical: 3 hours/week

Lab: hours/week

Course Description:

This course deals with lighting, D.C. motor, D.C. generator, and motor winding diagrams distribution diagrams

Course Objectives

On completion of this course the students will able to:

1. Know, understand describe and use electrical symbol.
2. Read and interpret wiring diagrams.
3. Prepare the layout and wiring diagrams for buildings and equipment.
4. Prepare schematic diagrams from wiring diagrams.
5. Draw free hand sketches of components, equipment and electrical circuits.

Course Contents:

1. Introduction to subject, size of drawing sheet, type of diagrams, drawing symbols. Draw bell, indicator, fire, and burglar alarm circuits, explain working principle and lay out diagram. [2]

2. Draw simple, two way and intermediate switches connection for building lighting and impulse relay and timer for street lighting. [3]

3. Design connection diagram for ammeter and voltmeter
   a) Direct on line b) Using shunt and multiplier c) Using current transformer and Potential transformer [3]
4. Draw layout diagram for single-phase consumer "intake" including 8-way distribution board, eight numbers of 15 amp power socket, twenty two no. of light point and one single phase pump motor on an architect's floor plan of a simple residential building with four rooms. Make a bill of quantities of all the items required for the conceal installation. [3]
5. Draw connection diagram of DC generator and its control circuit
   a) Separately excited b) Series c) Shunt d) Compound wound [3]

6. Draw connection diagram of armature winding and its control circuit
   a) Series b) Shunt c) Compound wound [3]
7. Draw connection diagram of 220V/ 6V.AC to DC conversion adopter with half Wave and full wave rectification providing necessary filter. [3]

8. Draw wiring and connection diagram for a refrigerator compressor motor circuit using single phase capacitor motor, starting relay, thermostat and series over load relay. [3]

9. Draw connection and diagram of capacitor start, capacitor run and capacitor start and Run motor. [3]

10. Draw Armature winding diagram of 9 slots with 9 no of coils, pitch of coil 1:5, Simplex lap winding and discuss about Duplex and Triplex windings. [3]
11. Draw Armature winding diagram of four pole, simplex, retrogressive wave winding with commutator pitch of 1 and 12. [3]

12. Draw detail installation diagrams of plate electrode earthing system with watering provision. [3]
13. Draw detail layout and installation diagram of 3 phase 4 wire distribution line along street with provision for street light, pole, brackets, stay-pole protection-shackle insulator, stay insulator set. [3]

14. Draw detail panel board fabrication diagram of 250 Amp incoming MCCB –
3×100 Amp outgoing MCCB –
2×60 Amp outgoing MCCB –
2×40 Amp outgoing MCCB –
2×20 Amp outgoing MCCB –
1×20 Amp Black space
300 Amp TPN Busbar, earth busbar, Voltmeter, Ammeter CTS – selector switches, indicator all complete. [4]

15 Draw layout diagram of typical indoor/ outdoor substation –11KV/ 33KV/66KV system. [3]

References:

- Electrical circuit and machines, E.C Lister
- Practices and procedures of Industrial Electrical design, L.B. Roe
- Electrical engineering design manual, M.G.Say
- General Electrical Drawing, Surjit singh
- Electrical Motor repair, Robort Rosenberg
- Design Estimating and Costing, J.B. Gupta

Second Year (Second Semester)

Subjects:

EG2206 EE	**Microprocessor and Microcontroller**
EG2211 EE	**Computer Aided Design**
EG2212 EX	**Electronic Devices and Logic circuits**
EG2213 EE	**Electrical Installation II**
EG2214 EE	**Electrical Engineering Drawing II**
EG2215 EE	**Electrical Machines I**
EG2216 EE	**Electrical Measurements and Measuring Instruments**
EG2219 EE	**Power Stations**

Microprocessor and Microcontroller

EG 2206 EE

Total: 5 hours /week

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

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

Practical: hours/week

Lab: 2 hours/week

UNIT 1: Intel 8085 Microprocessor: Introduction [8]

1.1 Need for Microprocessors and its evolution

1.2 Intel 8085 Hardware Architecture ,Pin description ,Internal Registers – Arithmetic and Logic Unit, Control Unit

1.3 Instruction word size, Addressing modes, Instruction Set, Assembly Language Programming, Stacks and Subroutines, Timing Diagrams.

UNIT 2: Intel 8085 Interrupts and DMA: [8]

2.1 8085 Interrupts – Software and Hardware Interrupts, 8259 Programmable Interrupt Controller

2.2 Data Transfer Techniques – Synchronous, Asynchronous and Direct Memory Access (DMA) and 8237 DMA Controller- 8253 Programmable Interval Timer.

UNIT 3: Memory & I/O Interfacing: [9]

3.1 Types of memory, Memory mapping and addressing, Concept of I/O map

3.2 Types – I/O decode logic – Interfacing key switches and LEDs – 8279 Keyboard/Display Interface - 8255 Programmable Peripheral Interface – Concept of Serial Communication – 8251 USART – RS232C Interface.

UNIT 4: Intel 8086 Microprocessor: [10]

4.1 Introduction-Intel 8086 Hardware – Pin description – External memory Addressing

4.2 Programming model of 8086, addressing, assembler directives

4.3 Instruction set- data transfer group, Arithmetic group, logical group, control transfer group, miscellaneous instruction groups

4.4 Some programming examples based on 8086 assembly language.

UNIT 5 Microcontrollers: Intel 8051 Microcontroller: [10]

5.1 Introduction, Architecture, Memory Organization

5.2 Special Function Registers , Pins and Signals ,Timing and control , Port Operation – Memory and I/O interfacing , Interrupts , Instruction Set and Programming.

5.3 Interfacing with keyboards, LEDs, LCDs, ADC/DACs etc.

5.4 Introduction to high end processors and Introduction to AVR family architecture

Practical Lab exercises: **[30]**

1. To familiarize with 8085 microprocessor and run a program to add two 8 bit data.
2. Write and execute a program to subtract two 8 bit data on 8085
3. Write and execute a program to add two 16 bit data on 8086 microprocessor
4. Write a logic program for the multiplication & division of numbers signed & unsigned both.
5. Write a logic program to find the square of a number without using multiplication instruction.
6. Write a logic program to find square of a number using look-up table.
7. Write a logic program to find the factorial of a given number.
8. Write a program to control LEDs connected at output port of 8051 microcontroller
9. Write a program to speed of dc shunt motor
10. Write and execute a program for traffic light control

Reference books:

1. Douglas V Hal, 'Microprocessor and Interfacing, Programming and Hardware' TMH 2006
2. Liu and Gibson,' Micro computer System 8086/8088 family architecture, programming and design' PHI 2nd edition.
3. K Uma Rao, The 8051 Microcontroller, architecture, programming and applications', Pearson 2009.

Computer Aided Design

EG221EE

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

Course Description:

This course deals with creation of two-dimensional drawing and layout drawing using standard electrical symbols using AutoCAD. It also deals with the inserting dimensions and text in drawing.

Course Objectives:

After completing this course the students will be able to
1. draw two dimensional objects using AutoCAD,
2. draw electrical layout using standard symbols , and
3. Insert dimension and text on drawing.

Course content:

Unit 1: Introduction **[4]**
- 1.1 Loading AutoCAD, Screen organization
- 1.2 Communicate with AutoCAD using the keyboard, the cursor menu, the screen menu, the pull-down menu, the toolbar menu and the dialogue box
- 1.3 AutoCAD command and system variables, Command options and default
- 1.4 Setting UNITS and DRAWING LIMITS
- 1.5 Coordinate System: entering distances and angles

Unit 2: Basic Drawing Commands **[8]**
- 2.1 LINE command and its options
- 2.2 POINT command
- 2.3 XLINE command and its options
- 2.4 ARC command and its options
- 2.5 CIRCLE command and its options
- 2.6 POLYGON command and its options
- 2.7 PLINE command and its options
- 2.8 MLINE command and its options
- 2.9 SPLINE command and its options

Unit 3: Modifying commands **[8]**
- 3.1 Object selection methods
- 3.2 ERASE, OOPS, UNDO, REDO commands
- 3.3 OFFSET command
- 3.4 COPY, MOVE, ROTATE, MIRROR, ARRAY commands

3.5 SCALE, STRETCH commands
3.6 CHAMFER, FILLET commands
3.7 TRIM, EXTEND commands
3.8 EXPLODE, BREAK, LENGTHEN, DIVIDE commands
3.9 PEDIT command
3.10 CHPROP command, ltype, ltscale, lweight and color
3.11 DDSELECT, DDMODIFY commands
3.12 Use of Grips

Unit 4: Drawing Aids in AutoCAD [5]

4.1 ORTHO, GRID, SNAP commands
4.2 ROTATED SNAP, OSNAP commands
4.3 Creation of layers and layer properties
4.4 Point filter
4.5 Use of Calculator

Unit 5: Display commands [1]

5.1 ZOOM, PAN, VIEW commands
5.2 REGEN command
5.3 Creating Viewports

Unit 6: Inquiry Commands [3]

6.1 HELP command
6.2 ID, DIST, AREA commands
6.3 MASSPROP command
6.4 LIST, DBLIST, STATUS commands
6.5 TIME command

Unit 7: Fine tuning drawings [3]

7.1 HATCH and BHATCH commands
7.2 Creating Isometric drawing

Unit 8: Grouping in AutoCAD [4]

8.1 BLOCK, WBLOCK commands
8.2 INSERT, MINSERT commands
8.3 EXPLODE, BASE commands

Unit 9: Working with text in AutoCAD [2]

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

Unit 10: Dimensioning in AutoCAD [2]

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

Unit 11: Layout Drawing [3]

11.1 Use of AutoCAD Design center
11.2 Layout drawing using standard symbols

Unit 12: Plotting drawings [3]

12.1 Layout management
12.2 Device information, pen parameters, paper size and orientation
12.3 Scale, rotation and origin

Practical: **[30]**

1. Familiarize with AutoCAD. [*Week 1*]
2. Exercise on Drawing and Modifying commands [*Week 2 to 7*]
3. Exercise on Drawing Aids and Display Commands [*Week 8 and 9*]
4. Exercise on Inquiry commands [*Week 10*]
5. Exercise on Hatching and Isometric Drawing [*Week 11*]
6. Exercise on BLOCK command [*Week 12*]
7. Exercise on Text and Dimensions [*Week 13*]
8. Exercise on Layout Drawing [*Week 14*]
9. Exercise on Plotting [*Week 15*]

Reference:

1. G. Omura; Mastering AutoCAD, Latest Edition

Electronic Devices and Logic Circuits

EG2212EX

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

Course Description:

The use of Electronics, specifically the Semi-conductors in Electrical Controls has expanded in recent years has made a strong need of knowledge in Electronics for Technician engineers.

Keeping in view with this need, the electronics course has designed to provide practical and essential theory about modern components in particular on digital circuits.

Course Objective:

On completion of this course the students will be able to understand, essential theory and practical use on Digital Components.

Course Content:

Unit 1. Introduction to digital electronics [5]

1.1. Introduction to Analogue and Digital Signal
1.2. Two state operation and its advantages
1.3. Transistor Switch and Relay operation.

Unit 2. Introduction to number system [12]

2.1 Decimal Number System
2.2 Binary Number System
2.3 Octal Number System
2.4 Hexa -Decimal Number System
2.5 Conversion of Number system
2.6 Addition, Subtraction, Multiplication, Division.
2.7 Signed and Unsigned Binary Numbers.
2.8 Binary Coded Decimal Numbers and ASCII Codes.

Unit 3. Fundamentals of digital electronics [10]

3.1 Introduction to Logic Gates (NOT, AND, OR, NAND, NOR XOR).

- Symbols, Truth Tables, Boolean algebra and Associate Rules.
- Boolean algebra and Associate Rules.
- De-Morgan's Theorem.
- Universal Gate conversion.
- Minimization of Logical Expressions using Boolean Algebra.
- Application of Karnaugh Map (K-Map) for minimization of Logical expressions.

Unit 4. Introduction to combinational logic devices [8]

4.1.Encoder / Decoder-Decimal to Binary, Binary to Gray Code, Priority Encoder.
4.2.Seven Segment Display Decoder.
4.3.Multiplexer and De-Multiplexer.
4.4.Parity Generator and Checker.

4.5.Half Adder, Full Adder and Subtractor.
4.6.Nibble and Bite Adder and Subtractor.

Unit 5. Introduction to logic families and basic characteristics [8]

5.1. TTL Family and Devices.
5.2. CMOS Family and Devices.
5.3. ECL Family and Devices.
5.4. Comparison of above mentioned Logic families in terms of Input/Output Voltage, Current, Supply
5.5. Voltage, Operation temperature, Fan-in, Speed and Noise Margin.
5.6. Standard available Devices in different families and Compatibility. –
5.7. External Driving Devices. Opto -Coupler, LED, Relays.

Unit 6. Introduction to sequential logic devices1 [4]

6.1 Mono-stable, Bi-stable and Astable Devices.
6.2 Latches and Filp-flop.
6.3 Triggering of Flip-flop.
6.4 SR and D Flip-flop.
6.5 Clocked Flip-flop.
6.6 JK, T Flip-flop.
6.7 Master –Slave Flip-flop.
6.8 Synchronous and asynchronous Counter.
6.9 Binary Counters, BCE Counters and Mode N counters.
6.10 Shift Registers – Shift left and Shift Right.
6.11 Serial and Parallel registers.
6.12 Ring Counters.
6.13 Application of counters – Digital clock, Frequency Counter.

Unit 7. Introduction to analog and digital conversion [8]

7.1 Analogue to Digital (A/D) Conversion.
7.2 Digital to Analogue (D/A) Conversion.
7.3 Basic characteristics of Converters – accuracy and speed.

Unit 8. Introduction to memory and addressing [5]

8.1 Functions of Flip-flop as Memory.
8.2 Types of Memory: ROM, RAM, PROM, EPROM, EEROM, UVPROM.
8.3 Static and dynamic Memory.
8.4 Memory addressing and address decoding logic.

LIST OF LABORATORY EXPERIMENTS [30]

1. Transistor Switch and Relay Control
2. Function and Operation of Logic Gates and Verification of Truth Table. NOT, AND, OR, NAND , NOR, XOR
3. Multiple (Three and Four) Input Gates.
4. Verification of De-Morgan's Theorem.
5. Construction and verification of Encoder and Decoder.
6. Construction and verification of Flip-Flops
7. Construction of Mono stable, Bi- Stable, Astable Multi-vibrators using 555 IC
8. Analogue to Digital (A/D) conversion using R- 2R Ladder Circuit.

Reference Text Books

1. Digital Computer Electronics by Albert Paul Malvino,
2. Digital Principles and Applications by Malvino, A.P and Leach, D.P.
3. Electronic Devices and Circuits by J.B. Gupta

Electrical Installation II

EG 2213 EE

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

Course Description:

This course deals with industrial control of motors, distribution overhead practices and installation of stand by generator.

Course Objective:

On completion of this course the students will be able to:
1. Read and interpret connection diagrams of the three phase induction motors.
2. Connect and start three phase induction motors with various control and protection arrangements.
3. Connect and start three phase induction motor from single phase supply.
4. Install overhead line work such as pole erection, conductor stringing, cable termination, Do-fuse, L.T. panel)

Course Contents:

Unit 1 Draw complete connection diagram with help of given control diagram and connect and start three phase squirrel cage induction motor using one air break contactor on position Indicator controlled from one station [6]

Unit 2 Draws complete connection one diagram and start three phase squirrel cage induction motor using one air break contactors, one overload protection on position indicator controlled from two stations. [6]

Unit 3 Draw complete connection diagram with help of given control diagram and connect and start three phase reversible squirrel cage induction motor using two air break contactors, overload protection and direction indicating lamps controlled from one station. [6]

Unit 4 Draw complete connection with hel of the given control diagram connect and start three phase Star/Delta squirrel cage induction motor using air break contactors, manually controlled operation one direction. [6]

Unit 5 Draw complete connection diagram with help of given control diagram and connect and start three phase reversible squirrel cage induction motor automatically star/Delta starting. [6]

Unit 6 Draw complete connection diagram with help of given control diagram and connect and start three phase squirrel cage induction motor using air break contactors, to run in single phase supply system using appropriate capacitor. [6]

Unit 7 Draw complete connection diagram with help of given control diagram and connect and start three phase slip ring induction motor using TPMCB as Isolator and manually operated rotor resistance starter, include three phase KWH meter [6]

Unit 8 Draw complete connection diagram with help of given control diagram and connect and start three phase slip ring induction motor using air break. Contactor as isolator automatically operated rotor resistance starter, use timer, overload relay and signal

lamps to indicate OFF- ON condition. Operate from one Start/Stop push button station. [6]

Unit 9 Draw complete connection diagram with help of given control diagram and connect ant start a two speed, three phase squirrel cage induction motor using contactors and relays. [6]

Unit 10 Draw complete connection diagram of automatic generator backup system and install he component for it. [6]

Unit 11 Draw complete connection diagram of auto transformer starting of three phase induction motor and install the components for it. [6]

Unit 12 Overhead line works: [24]

- Erection of pole
- Staying
- Fitting Accessories
- Stringing conductor
- Installation of DO – fuse, Lightening arrestor, L. T. Panel
- Cable and wire termination
- Dismantling
- Transformer

References:

- Basic principles of electrical craftsman, H.K. Martin
- The Art and Science of protective relaying, G. Mason
- Experiments with industrial Electrical System, D. Patric
- Power Contractor Catalogue, Manufacturer

Electrical Engineering Drawing II

EG 2214 EE

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

Course Description:

This course deals with control layout connection and schematic diagram of motor generators – OCBS and Winding diagram of motors.

Course Objective:

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

1. Draw and explain connection and control diagrams for three phase induction motors with various control arrangements.
2. Draw and explain circuit diagrams of three phase transformer showing winding connections and tapping.
3. Draw and explain wiring and connection diagram for three phase generator with Protection and OCB.
4. Draw and explain schematic diagram and tripping circuits with indications from Contactor's wiring diagrams.
5. Draw and explain winding diagrams.

Course Contents:

1. Draw connection diagram for 3-phase, 3hp380v star connection squirrel cage Induction motor controlled by manual controlled triple pole forward reverse switch and fuse [4]
2. Draw connection diagrams for 3-phase, 5 hp 380v delta connected squirrel age induction motor controlled by a star/delta rotary switch and fuses. [4]
3. Draw wiring and connection diagram for water pump installation using 3- phase, 3hp squirrel cage induction motor, DOL starter master ON/OFF rotary switch, float switch for underground and overhead tank. [4]
4. Draw connection and control diagram for 3-phase, 3hp 380 star connected squirrel cage induction motor with the help of 16 amp electromagnetic contactor, 1 NC, 1NO, 220V/380 V and bi-metal relay, ON/OFF momentary push button station and fuses. [4]
5. Draw connection and control diagram for 3 –phase, 3hp 380V star connected squirrel cage induction motor controlled with the help of 16amp electromagnetic contactor, 1 NC, 1 NO, 220/380V and bi-metal relay forward OFF reverse push button station and fuses. [4]
6. Draw connection and control diagram for 3–phase, 5hp 380V squirrel cage induction motor controlled with the DOL starting and automatic reversing using contactors and limit switches. [4]
7. Draw connection and control diagram for 3–phase, 10hp 380V delta connected squirrel cage induction motor with automatic star/delta starting, overload trips, a limit switch and electromagnetic breaker. [4]

8. Draw circuit diagram showing the winding and connections of a 3–phase delta/star 11kv/380Vstep down distribution transformer with 5 tapping on H.V. side and KWH meter with CT, PT. [4]
9. Draw circuit diagram of a 3-phase, 380V brushless alternator showing the winding connections and Auto manual excitation system. [3]
10. Draw winding diagram of induction motor stator for 24 slots 3-phase, single layer, 2-pole [3]
11. Draw winding diagram of induction motor stator for 24 slots 3-phase winding 4-poles.[4]
12. Draw the section view of three phase transformer. [3]

References:

1. Electrical Machine Design, A.K. Sawhney
2. Practices and procedure of industrial electrical Design, L.B. Roe
3. Hand book of electrical engineering, S.L. Bhatia

Electrical Machines I

EG 2215 EE

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

Course Description:

This course covers the electrical machines-transformer, dc generator and dc motor. It deals with the constructional details, operating principle, characteristics, testing methods of the above machines.

Course Objective:

After completion of this course, student will be able to explain the basic constructional details of single-phase transformer, three-phase transformer and dc machine, operation and characteristics of single-phase transformer, three-phase transformer, dc generator and dc motor, equivalent circuit of transformer and dc machines, testing of transformer.

Course content:

Unit 1. Single Phase Transformer : (14)

1.1 Operating Principle – Basic construction, Operation, Derivation of emf equation, Transformation ratio, Concept of ideal transformer.
1.2 Constructional Details – Core type and shell type core construction, Stepped type core cross-section, details of winding and its insulation.
1.3 No-load operation – phasor diagram, equivalent circuit for no-load operation
1.4 Operation of transformer with load – Magnetic circuit condition, amp-turn balance.
1.5 Capacity of transformer – Definition, factors affecting the capacity of transformer.
1.6 Equivalent circuit – Effect of winding resistance and leakage reactance, equivalent circuit of real transformer, phasor diagram for resistive load and inductive load, transformation of impedance, equivalent circuits refer to primary side and secondary side, percentage impedance, voltage regulation.
1.7 Efficiency of transformer- Losses in transformer, Calculation of efficiency, Condition for maximum efficiency, effect of load power factor on efficiency.
1.8 Testing of transformer – Polarity test, No-load test, Short-circuit test.
1.9 Auto transformer – Operating principle and application.
1.10 Parallel operation
1.11 Related numerical problems.

Unit 2. Three Phase Transformer : (8)

2.1 Introduction- Three units of single-phase transformers used as three-phase transformer, evolution of three-phase transformer.
2.2 Three-phase transformer connections- Star/Star, Delta/Delta, Star/Delta, Delta/Star, Open delta, their phasor group and applications, Relationship between primary and secondary line and phase quantities.
2.3 Parallel operation of three-phase transformers

2.4 Parts of power transformer- Tank, Conservator, Breather, Explosion vent, Transformer oil, Terminal bushing, Arching horns, Buchhloz's relay, tap-changer.

2.5 Study of name plate specification of transformer.

Unit 3. DC Generator : (13)

3.1 Constructional Details – Yoke, Field poles, Field winding, Armature and its winding.

3.2 Operation – Operating principle, emf equation,

3.3 Types of dc generator – Separately excited and self-excited and voltage build-up process, Shunt, series and compound generators, their circuit diagrams, relation between emf generated and load terminal voltage, characteristics and applications.

3.4 Losses and efficiency.

3.5 Armature reaction and method of reducing armature reaction.

3.6 Commutation

3.7 Related numerical problems

Unit 4. DC Motor : (10)

4.1 Operation – Operating principle, torque equation, back emf, roles of back emf.

4.2 Types of dc motor– Shunt, series and compound, their characteristics and applications.

4.3 Losses and efficiency.

4.4 DC motor starter

4.5 Speed control of dc motor

4.6 Related numerical problems

Practical Exercises: [30]

Expt. No.1 : Perform turn ratio test, No-load test and short circuit test of single and evaluate equivalent circuit parameters.

Expt. No.2: Perform load operation of single phase transformer to calculate efficiency at various loads and voltage regulation.

Expt. No.3: Test a three-phase transformer for various types of connections (Star/Star, Delta/Delta and Star/Delta) and verify the relation between line and phase quantities.

Expt. No.4: Perform polarity test on two separate single-phase transformers. Connect the transformers in parallel and study the load sharing.

Expt. No.5: Draw open circuit curve (OCC) of dc shunt generator. Calculate the steady state value of voltage build up at no-load from the graphical analysis and verify it with experimentally measured value. Determine its critical resistance and critical speed.

Expt. No.6: Determine the load characteristics and voltage regulation of dc shunt generator and dc compound generator and compare the results.

Expt. No.7: Determine the load characteristics and voltage regulation of dc series generator.

Expt. No.8: Experimental study of on dc shunts motor.

- Draw Speed/armature current, speed/torque and load/efficiency curves.

Expt. No.9: Experimental study on speed control of dc shunt generator.

- Speed control by field control method
- Speed control by armature control method

References:

1) I.J. Nagrath and D.P. Kothari, "Electric Machines", Tata Mc Graw-Hill publication.
2) J.B. Gupta, "Theory and performance of Electrical Machines" S.K. Kataria & Sons, India, 2004.

Electrical Measurements and Measuring Instruments

EG2216 EE

Total: 6 hour /week

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

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

Practical: hours/week

Lab: 2 hours/week

Course Description:

This course covers the electrical machines-transformer, dc generator and dc motor. It deals with the constructional details, operating principle, characteristics, testing methods of the above machines.

Course Objectives:

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

1. understand the construction and operating principles of various types of measuring instruments (e.g. moving coil, moving iron, electro-dynamometer, and induction type) for measurement of voltage, current, power, resistance, energy, power factor and frequency.
2. measure R, L and C using different types of bridge.
3. measure non-electrical quantities e.g. temperature, illumination, distance, velocity, strain etc.

Course content:

Unit 1. Electrical Measuring Instrument. (8)

- 1.1 Introduction
- 1.2 Types and application of indicating, recording, integrating, analog and digital measuring instruments.
- 1.3 Essential features of indicating instruments (deflecting, balancing and damping torque), their construction and operating principles.
- 1.4 Moving coil instrument – construction, operating principle, scale features and application as d.c. ammeter and voltmeter.
- 1.5 Moving iron instrument – construction, operating principle, scale features and application as a.c. ammeter and voltmeter.
- 1.6 Electrodynamometer instrument – construction, operating principle, scale features and application as ammeter, voltmeter, wattmeter and power factor meter.
- 1.7 Cathode-ray Oscilloscope – basic construction, operation and application.

Unit 2. Measurement of Resistance [6]

- 2.1 Classification of resistance.
- 2.2 Measurement of low resistance using ammeter and voltmeter method and Kelvin double bridge method.
- 2.3 Measurement of medium resistance using Wheatstone bridge method.
- 2.4 Measurement of high resistance and continuity using Megger

Unit 3. Measurement of Inductance and Capacitance [2]

- 3.1 Maxwell's inductance bridge and Anderson bridge for inductance measurement.
- 3.2 De Sauty Bridge and Schering bridge for capacitance measurement.

Unit 4. Extension of measuring range of instruments [5]

- 4.1 Shunts and Multipliers – use and characteristics.
- 4.2 Multi-range meters – ammeter, voltmeter, ohmmeter and multi-meter.

Unit 5. Potentiometer [4]

5.1 Operating principle, construction, connection into electric circuit and application of d.c. potentiometer.

5.2 Operating principle, construction, and application of inductive potentiometer

Unit 6. Measurement of Power, Energy and Frequency [8]

6.1 Power measurement in single-phase with wattmeter and three-phase with two and three wattmeter method.

6.2 Reactive power measurement using VAR meter.

6.3 Single-phase and three phase energy measurement using single and three phase energy meter.

6.4 Measurement of frequency using frequency meter.

6.5 Measurement of maximum demand using maximum demand meter.

6.6 Application of 'Time of Day' (TOD) meter

Unit 7. Measuring Instruments for measurement of Non-electrical Quantities. [6]

7.1 Thermocouple – construction, operation and application in measurement of voltage or current.

7.2 Lux-meter – construction, operation and application in measurement of illumination on working plane.

7.3 Piezometer – construction, operation and application.

7.4 Transducers – construction, operation and application in measurement of distance, velocity and strain.

Unit 8. Instrument Transformers. [4]

8.1 Current transformer – operating principle, construction, characteristics and application in measurements.

8.2 Potential transformer – operating principle, construction, characteristics and application in measurements.

Unit 9. Digital Measuring Instrument. [2]

9.1 Operating principle, construction, characteristics and application in measurements.

Practical Exercise: [30]

1. Measurement of d.c. voltage and current using moving coil instrument with shunt and multiplier.
2. Measurement of voltage, current and power using electro-dynamometer and compare with the result of power factor meter.
3. Measurement of energy for single/three phase system using kWhr meter for the inductive load. Check the accuracy.
4. Measurement of resistance using bridge, potentiometer and ammeter voltmeter method and compare the results.
5. Measurement of inductance and capacitance using a.c. bridge.
6. Measurement of temperature using thermocouple.

Reference book:

1. An Introduction to Electrical Instrumentation and Measurement System, B.A. Gregory.
2. Electrical Measurement and Measuring Instrument, Golding
3. Electrical Measurement and Measuring Instrument, A.K. Shawney
4. Elements of Electrical and Electronics Instrumentation, R.S. Lion.

Power Stations

EG2219 EE

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

Course Description:

The course deals with the characteristics, features and classifications of electrical power stations

Course Objectives:

After completing this course the students will be able to:
1. Gain knowledge about the various power system components
2. Understand the various power generating sources and their operating features
3. Understand the different Excitation systems and AVR used in alternators
4. Know the basic concepts of bus bar arrangements at substations

Course content:

Unit 1: Introduction [4]

1.1 Historical background of electricity generation (International and Nepalese scenario), early electrical system and voltage level
1.2 Schematic layout modern power system: generation, substation, transmission, distribution units
1.3 Need of voltage transformation
1.4 Significance of standard frequency used in A.C. system

Unit 2: Generation of Electrical Energy [4]

2.1 Advantage of Electrical energy in comparison with other form of energy
2.2 Type of generations: base load plant, peak load plant, renewable power plant
2.3 Typical layout for converting an energy into electrical energy
2.4 Sources of energy to be converted into electrical energy
- Hydro energy to electrical energy
- Thermal energy to electrical energy
- Renewable energy sources

2.5 Economic of power generation: plant capacity factor, plant utilization factor. Reserves, tariff

Unit 3: Power Plants [14]

3.1 Types of power plants
3.2 Diesel power plant
- Working principle and plant layout
- Component and accessories
- Manual and automatic starting
- Operation and maintenance features
- Applications

3.3 Hydro power plant
- Working principle and plant layout

- Dam, reservoir, forbay, spillway power cannel, tunnel, surge tank, penstock and other accessories
- Turbines and their classifications
- Sitting and sizing concept
- History of hydro power plant in Nepal

3.4 Thermal power plant

- Basic working principle and plant layout
- Component and accessories
- Operation and maintenance features
- Applications

Unit 4: Transmission and Distribution system [4]

4.1 Transmission System:

- Introduction, necessity of TS
- Transmission Layout, voltage level, insulation, right of way
- A.C. and D.C applications: introduction and comparison
- Transmission system in Nepalese context

4.2 Distribution system

- Introduction, necessity of DS
- Distribution Layout, voltage level
- Distribution system in Nepalese context

Unit 5: Major accessories in power plants [6]

5.1 Excitation system

- D.C. excitation system
- A.C. excitation system
- brushless excitation system

5.2 Automatic Voltage regulator construction and operation

5.3 Brief description of switch yard ; Bus Bars, Circuit breakers, lighting arrestors locations

Unit 6: Substations [13]

6.1 Necessity of substations
6.2 Substation layouts, incoming and outgoing line arrangements
6.3 Grid substations and distribution substations
6.4 Major equipment at substations
6.5 Selection of transformers based on applications
6.6 Fault limiting reactors
6.7 Circuit breakers, isolators, Lighting arrestors and other accessories
6.7 Bus bar arrangement

- Single bus bar
- Duplicate bus bars
- Ring main bus bars
- Sectionlization of bus bars

6.8 Communication system telephone, basic concept of PLCC and SCADA system
6.9 Switching stations

References:

1. M.L. Soni, P.V. Gupta, U.S. Bhtnagar & A Chkrabarti, “A text Book on Power System Engineering” , Dhanpat Rai & Co., India
2. Deshpande, “ Elements of Electrical Power Station Design”, Pitman & Sons

Third Year (First Semester)

Fifth Semester

Subjects:

EG3111 EE	**Electrical Design, Estimation and Costing**
EG3112 EE	**Switch Gear and Protection**
EG3113 EE	**Power Electronics**
EG3114 EE	**Electrical machines II**
EG3115 EE	**Utilization of Electrical Energy**
EG3116 EE	**Control System Engineering**
EG3117 EE	**Electrical Repair and Maintenance I**
EG3118 EE	**Project I**

Electrical Design, Estimation and Costing

EG 3111 EE

Total: 5 hour /week

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

Semester: I **Tutorial: hours/week**

Practical: 2 hours/week

Lab: hours/week

Course Description:

This course deals with general principles light and power circuit design consideration of electrical installation design of illumination scheme overhead and underground distribution systems and substations

Course Objective:

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

1. Design, estimating and costing of electrical installation for residential, commercial and industrial buildings
2. understand the various types of wiring system and selection of wiring material and accessories.
3. understand the various types of protections of electrical installation.

Course content:

Unit 1. General Principles [8]

- 1.1 Estimating: estimate of quantities and cost, analysis of cost.
- 1.2 Familiarization of catalogues
- 1.3 Recording of estimate
- 1.4 Determination of required quantity of material
- 1.5 Determination of cost of material and labour
- 1.6 Contingencies and overhead charges
- 1.7 Tender form: guidelines for inviting tenders, specimen tender

Unit 2. Design, estimation and costing of Illumination Scheme [8]

- 2.1 Introduction.
- 2.2 Terminology of illumination
- 2.3 Various types of light sources
- 2.4 Practical lighting schemes
  - Lighting arrangement
  - Illumination for different occupancies
  - Selection of luminaries.
- 2.5 Factory lighting.
- 2.6 Street lighting
- 2.7 Methods of calculation

Unit 3. Design, estimation and costing Consideration of Electrical Installation in buildings. [12]

- 3.1 Electric supply system: single phase two wire and three phase four wire systems.
- 3.2 Protection of electrical installation against overload short circuit and earth fault
- 3.3 Earthing: types of earthing and its applications.
- 3.4 General requirement of electrical installation
  - Electricity rules

- Testing of installation
- Neutral and earth wire
- Service connections
- Sub-circuits
- Location of outlets, control switches, MDB and SDB

3.5 Design and location of MDB and SDB
3.6 Design of lighting and power sub circuits
3.7 Guidelines for installation of fittings
3.8 Load assessment
3.9 Selection of cable size, wires and permissible voltage drop.
3.10 Design electric circuits with and with-out relays
3.11 Schematic (layout) and wiring diagram

Unit 4. Estimating and Costing of Overhead and Underground Distribution Lines [11]

4.1. Introduction
4.2. Supports for overhead distribution lines
4.3. Distribution lines materials used.
4.4. Poles and stay wires
4.5. Selection of underground cables

Unit 5. Estimating and Costing of Distribution Substations [6]

5.1. Introduction.
5.2. Outdoor substation pole mounted and pad type
5.3. Indoor substation floor mounted types.

Practical Exercise: [30]

1. Draw the electrical symbols and standards
2. Layout the system distribution of electricity
3. Layout the various system of wiring
4. Design of electrical installation for residential and commercial building
5. Any other practice as per the advice of teacher concerned

References:

1. Electrical Wiring Fundamentals, Foley
2. Electrical Installation Estimating & Costing, J.B. Gupta
3. Practices and Procedure of Industrial Electrical Design, L.B. Roe
4. Substations Design and Equipment, P.V. Gupta
5. Art and Science of Utilization of Electrical Energy, H. Pratap
6. Hand Book of Electrical Engineering, S.L. Bhatia.

Switchgear and Protection

EG3112 EE

Total: 7 hour /week
Year: III **Lecture: 3 hours/week**
Semester: I **Tutorial: 1 hours/week**
Practical: hours/week
Lab: 3 hours/week

Course Description:

The course deals with the power system protection components, their characteristics and application for proper detection and disconnection of the faulty part.

Course Objectives:

After completing this course the students will be able to:

1. understand the various faults that may happen in a power system
2. understand the applications, characteristics and operation of various protecting devices e.g. Fuse, MCB, relay and circuit breakers
3. enable to install and maintain different protecting devices
4. perform the short circuit analysis of typical power system
5. describe the importance of earthing in power system

Course contents:

Unit 1: The general concept of protection system [4]

1.1 Nominal ratings, abnormal conditions and need of protection system in power system
1.2 Short-circuit and their harmful effects
1.3 Open circuit and their consequences
1.4 Characteristics and type of protecting devices
1.5 Example of protection against short circuit

Unit 2: Short Circuit Faults [6]

2.1 Definition, reason and consequence of faults in power system
2.2 Concept of short circuit fault current and fault MVA
2.3 Representation of power system for fault calculation: per unit system, reactance diagram and fault calculation
2.4 Short circuit in different sections (generator, bus bar, transmission/distribution lines) and their consequences.

Unit 3: Protection system components [7]

3.1 Fuses
- Fuse elements and their time current characteristics
- Current ratings of fuses
- Types of Fuse based on construction and uses

3.2 MCB
- Construction characteristics and uses
- Comparison to Fuse

3.3 Contractors

- Construction and operation
- Normally open and close contacts

3.4 Isolator: construction characteristics and uses

Unit 4: Relays and instrument transformers [8]

4.1 Operating principle

4.2 Relay characteristics

- Instantaneous relays
- inverse relays
- IDMT relays
- Plug setting and time setting of relays

4.3 Classification of Relays based on construction

4.4 Electromagnetic induction relay

4.5 Characteristics of Directional relay

4.6 Introduction to static and digital relay

4.7 Buchholzs relay construction and characteristics

3.5 CT and PT

- Application of CT and PT in power system protection
- Standard ratios and accuracy class

Unit 4: Earthing [6]

4.3 Definition, purpose, Equipment and neutral earthing

4.4 Methods of earthing: Neutral earthing: isolated neutral, solid neutral earthing, resistive earthing, reactance earthing, peterson earthing.

4.5 Substation earthing: safe value of current through human body, soil resistivity, touch and step potential, grounding mat

4.6 Earthing and fault current

4.7 Overvoltage: cause and protection, OV due to lightning, LA

Unit 5: Protection scheme [8]

5.1 Application of IDMT relay for HV feeder protection

- Time graded and current graded protection

5.2 Earth fault detection schemes

- residual CT connection
- core balance
- earth lead

5.3 Application of directional relay in loop feeders

5.4 Basic principle of distance protection and protecting zone

5.5 Differential protection schemes for transformers generators and motors

5.6 Buchholzs relay for transformer protection alarm and tripping circuits

Unit 6: Circuit breakers [6]

6.1 Arc phenomena and arc extinction

6.2 Duties of circuit breakers

6.3 Classification of circuit breakers

- Air break circuit breakers
- Oil circuit breakers
- Air blast circuit breakers
- vacuum circuit breakers
- SF6 circuit breakers

Laboratory Exercises: **[45]**

1. Demonstration of different types of Fuses
2. Demonstration of Contractors and isolators
3. Draw magnetizing curve for a protective CT, check knee point voltage
4. Identify terminals of CT and make polarity test
5. Obtain the time current characteristics of an induction disc relay
6. Test an induction disc relay for earth fault protection
7. Check connection sensitive earth fault protection scheme.
8. Check connections on a biased differential protection scheme
9. Test an air circuit breaker for calibration
10. Demonstration of oil circuit breaker

Suggestions for instruction:

Show the sectionalize sketches of physical components using projectors and hardware itself as far as possible.

References:

1. M. Pandey, “Power system control and protection”
2. G. Mason, “The art and science of protective relaying”

Power Electronics

EG 3113 EE

Total: 5 hour /week

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

Semester: I **Tutorial: hours/week**

Practical: hours/week

Lab: 2 hours/week

Course Description:

This course covers the power electronics devices and schemes such as rectifier, chopper, inverter, ac voltage controller applied to electric circuits.

Course Objective:

After completion of this course, student will be able to

1. explain the basic constructional details and operation of power electronic devices- diode, power transistor, thyristor, GTO, Triac, MOSFET, IGBT,
2. Operation of rectifier, chopper, inverter and ac voltage controller.

Course content:

Unit 1. Power Electronics Devices (10)

1.1 Power diode – Construction, Characteristic and ratings.
1.2 Power Transistor - Construction, Characteristic, use as power switch
1.3 Thyristor – Construction, Characteristics, Turn on mechanism, Turn-on process with gate signal, thyristor firing circuit, thyristor commutation and its type
1.4 GTO - Construction, Characteristics,
1.5 TRIAC – Construction and Characteristics.
1.6 MOSFET - Construction and Characteristics.
1.7 IGBT - Construction and Characteristics.

Unit 2. Power Rectifier (11)

2.1 Half wave and full wave single-phase rectifier – Circuit diagram, operating principle, calculation of average value, rms value, ripple factor, efficiency, filtering – C, L and LC filters.
2.2 Single-phase full wave controlled rectifier with resistive load, RL load, inversion mode of operation.
2.3 Three-phase rectifier with three numbers of diode.
2.4 Three-phase bridge rectifier with six numbers of diode.

Unit 3. DC Chopper (6)

3.1 Step down chopper – Circuit diagram, operation, constant and variable chopping frequency operation.
3.2 Step up chopper – Circuit diagram and operation.
3.3 Application in speed control dc motor.

Unit 4. Inverter (10)

4.1 Single phase square wave inverter – Circuit diagram, operating principle, rms value of output voltage, operation with resistive load. Step down chopper – Circuit diagram, operation, constant and variable chopping frequency operation.

4.2 Three-phase bridge inverter with six-step output voltage wavefrorm – Circuit diagram, operating principle, rms value of output voltage, operation with resistive load.

4.3 Application of inverter in speed control of induction motor and synchronous motor.

Unit 5. AC voltage controller (8)

5.1. Single-phase ac voltage controller – Circuit diagram, operation with resistive load.

5.2. Three -phase ac voltage controller – Circuit diagram, operation with resistive load.

5.3. Applications in speed control of induction motor, Electronic load controller for MHP generator, light dimmer.

Practical Exercises: [30]

Exercise No. 1: To study SCR Characteristics

Exercise No. 2: Fabrication of full-wave single-phase rectifier with resistive load. Selection of capacitor for reducing the ripple factor below 0.1. Observe its output voltage waveforms with and without capacitor filter.

Exercise No. 3: Fabrication of full-wave single-phase controlled rectifier with thyristors. Observe its output voltage waveforms with resistive load.

Exercise No. 4: Fabrication of dc chopper using power transistor. Observe its output voltage waveforms with resistive load.

Exercise No. 5: Fabrication of single-phase ac voltage controller. Observe its output voltage waveforms with resistive load.

Exercise No. 6: Fabrication of single phase square wave inverter with resistive load.

References:

1) A Chakrabarti, "Fundamentals of Power Electronic and Drives" Dhanpat Rai and Co., 2002.

3) A.K. Gupta and L.P. Singh, "Power Electronics and introduction to Drives", Dhanpat Rai Publishing company (P) Ltd., India 2001.

Electrical Machines II

EG 3114 EE

Total: 7 hour /week
Year: III **Lecture: 3 hours/week**
Semester: I **Tutorial: 1 hours/week**
Practical: hours/week
Lab: 3 hours/week

Course Description:

This course covers the electrical machines-three-phase induction motor and generator, single phase ac motors, synchronous generator and synchronous motor. It deals with the constructional details, operating principle, characteristics, testing methods of the above machines.

Course Objectives:

After completion of this course, student will be able to:
1. explain the basic constructional details of three-phase induction machine, single phase ac motor and synchronous machine,
2. operate and characterize three-phase induction motor and generator, single phase ac motors, synchronous generator and synchronous motor, equivalent circuit of three-phase induction machine, single phase ac motors, synchronous generator and synchronous motor, testing of three-phase induction motor.

Course content:

Unit 1. Three Phase Induction Motor (15)

1.1 Constructional details – Yoke, stator, stator windings, and rotor – squirrel cage type and phase wound type.
1.2 Operation – Production of rotating magnetic field, operating principle, reversing the direction of rotation.
1.3 Stand still condition – equivalent circuit, starting current and starting torque.
1.4 Running condition - equivalent circuit, running current and torque.
1.5 Torque-Speed characteristics, effect of applied voltage on T-S characteristic, effect of rotor resistance on T-S characteristic.
1.6 Power stages, losses and efficiency
1.7 Starting methods – Direct On-line starting, Primary resistor method, Auto-transformer method, Star-Delta method.
1.8 Speed control – Primary voltage control method, Rotor resistance control method, frequency control method, Cascade connection method.
1.9 Induction generator – principle of operation, excitation requirement, voltage build-up process, isolated and grid connected modes of operation.

Unit 2. Single Phase AC Motors : (8)

2.1 Split-phase induction motor – Construction, concept of pulsating field produced by single phase winding, double revolving field theory, Torque-speed characteristic, self-starting by split-phase winding, Characteristics and applications.
2.2 Capacitor start and induction run motor – Operating principle, Characteristics and applications.

2.3 Capacitor start and run motor- Operating principle, Characteristics and applications
2.4 Shaded pole motor – Operating principle, Characteristics and applications
2.5 AC series motor – Operating principle, Characteristics and applications

Unit 3. Three-phase Synchronous Generator (12)

3.1 Constructional details and types.
3.2 Operation – Operating principle, emf equation, armature winding parameters and its effect on emf generation, relationship between speed, frequency and number of magnetic poles in rotor, concept of geometrical degree and electrical degree.
3.3 Advantages of stationary armature winding and rotating field winding.
3.4 Loaded operation – effect of armature winding resistance, leakage reactance, armature reaction, concept of synchronous impedance, equivalent circuit and phasor diagrams for resistive, inductive and capacitive load, voltage regulation.
3.5 Synchronizing action and synchronizing power Synchronous generator connected to infinite bus, effect of excitation.
3.6 Parallel operation and synchronization.
3.7 Related numerical problems.

Unit 4. Synchronous Motor (10)

4.1 Principle of operation and starting method.
4.2 General features and applications
4.3 No-load and load operation
4.4 Effect of excitation on armature current and power factor- V and inverted V curves.
4.5 Power-Angle characteristic.

Practical Exercises: [45]

Expt. No. 1: Experimental study on three-phase squirrel-cage induction motor.
- Connect and start the motor with star-delta starter
- Obtain the torque-speed characteristics and load-efficiency curve for operating range (i.e. no-load to full load)

Expt. No. 2: Experimental study on three-phase slip ring induction motor.
- Connect and start the motor with external rotor rheostat starter
- Obtain the torque-speed characteristics with and without external rotor resistance and compare the results.

Expt. No. 3: Experimental study on induction motor testing.
- Perform no-load test and blocked rotor test and evaluate the equivalent circuit parameters.

Expt. No. 4: Experimental study on single phase ac motor.
- Connect and start a split-phase motor and obtain its characteristics
- Connect and start a capacitor start and run motor and obtain its characteristics
- Compare their characteristics.

Expt. No. 5: Experimental study on single phase shaded pole ac motor.
- Connect and start a shaded pole ac motor and obtain its characteristics.

Expt. No. 6: Experimental study on single phase ac series motor.
- Connect and start a single-phase ac series motor and obtain its characteristics.

Expt. No. 7: Experimental study on synchronous generator.
- Obtain Open Circuit Curve of a synchronous generator.
- Obtain load characteristics of a synchronous generator with resistive, inductive and capacitive loads.

Expt. No. 8: Experimental study on synchronization of synchronous generator.

- Synchronize a three-phase synchronous generator to infinite bus.
- Study the effect of change in excitation.

Expt. No. 9: Experimental study on synchronous motor.

- Connect and start a synchronous motor
- Study the effect of change in excitation.

References:

1) I.J. Nagrath and D.P. Kothari, “Electric Machines”, Tata Mc Graw-Hill publication.
2) J.B. Gupta, “Theory and performance of Electrical Machines” S.K. Kataria & Sons, India, 2004.

Utilization of Electrical Energy

EG 3115 EE

Total: 4 hour /week
Year: III **Lecture: 3 hours/week**
Semester: I **Tutorial: 1 hours/week**
Practical: hours/week
Lab: hours/week

Course Description:

This course deals with the use of electrical energy for domestic, commercial and industrial sectors.

Course Objectives:

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

1. Describe and design the illumination system as per standard requirements.
2. Describe various lighting services-construction and operation.
3. Describe and select electric drives required for various industrial requirements.
4. Describe the various method of power factor correction.
5. Describe the various tariff schemes adopted in Nepal.

Course content:

Unit 1. Introduction [4]

1.1. Advantage of electrical energy over other form of energy
1.2. Conversion of electrical electricity into useful form : light enrgy, heat energy, electromechanical energy
1.3. Use of electrical energy into different secors: domestic, commercial and industrial application
1.4. Load characteristics: load curves, load duration curves, load factor, connected load, maximum load, and demand factors, diversity factor ect.

Unit 1. Illumination (16)

1.1 Difference between heat & light energy emitted by hot body, wave spectrum, electromagnetic waves, Nature of light
1.2 Terminology of illumination - light, luminous flux, luminous intensity, lumen, candle power, illumination, lux, candela, lamp efficiency, brightness or luminance, Glare, Stroboscopic effect, space-height ratio, utilization factor, maintenance factor, depreciation factor, absorption factor, reflection factor, solid angle, steradian
1.3 Laws of illumination - Law of inverse square law & Lambert's cosine law
1.4 Types of lamp: arc lamp, incandescent lamp, gaseous discharge lamp, LED lamp
1.8 Types of lightning schemes - direct lighting, semi-direct lighting, semi-indirect lighting, indirect lighting, general lighting
1.9 Design of lighting schemes - Illumination level, uniformity of illumination, colour of light shadows, glare, mounting height, spacing of luminaries colour of surrounding walls

1.10 Methods of lighting calculations - watt per square meter method, lumen of light flux method

Unit 2. Selection of Electric Motor (8)

2.1 Factors governing selection of electric motors.
2.2 Nature of electric supply
2.3 Types of drives & their choice based on the load
2.4 Electric braking
2.5 Choice of rating of motors
2.6 Types of motor used in industrial drives
2.7 Running & standing characteristics of drives
2.8 Numerical problem

Unit 3 Electric Traction (8)

3.1 Different systems of tractions
3.2 Systems of electric tractions
3.3 Speed-time curves for a traction system
3.4 General features of traction motors
3.5 Types of braking & their advantages & disadvantages.

Unit 4. Power factor correction (4)

4.1 Causes of low power factor
4.2 Disadvantages of low power factor
4.3 Methods of improving power factor, shunt capacitors, synchronous condenser thyristor controlled reactor, basis mathematical analysis

Unit 5. Tariff (5)

5.1 Objective of tariff
5.2 Types of tariff and applications
- Simple tariff
- flat rate tariff
- block rate tariff
- two part tariff
- max. demand tariff
- power factor tariff

5.3 Tariff in Nepal

References:

- Utilization of Electrical energy, Taylor
- Utilization of Electrical power & traction, Gupta
- A course in utilization of Electrical energy, G. Garry

Control System Components

EG 3116 EE

Total: 5 hour /week

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

Semester: I **Tutorial: hours/week**

Practical: hours/week

Lab: 2 hours/week

Course Description:

This course introduces the fundamentals of control system components and operation of an automatic control system.

Course Objectives:

After completing this course the students will be able to:

1. learn how a control system works and how its operating characteristics can be interpreted
2. understand the use of feedback loops and their applications in real-world control systems
3. explain how mechanical, hydraulic, pneumatic, electrical, and electronic components used in control systems

Course content:

Unit 1: The general concept of control system [4]

1.1 Representation of a control system with a block diagram incorporating actuator, controller, sensor and error detectors

1.2 Recognition of various control system types including open loop, closed loop, analog, and digital

1.3 Working of servomechanisms

1.4 Task of control engineers

Unit 2: Sensors and Transducers [8]

2.1 Function of sensors in a given control system.

2.2 Working of sensors to provide data in control systems.

2.3 Operating characteristics of electric transducers e.g. strain gauges, Potentiometers, tacho-generator, thermocouples

2.4 Pneumatic displacement detectors

Unit 3: Control System Actuators [4]

3.1 Recognition of the applications and operating characteristics of, electric, hydraulic, and pneumatic linear actuators.

3.2 Operating principles of control valves and other components in hydraulic and pneumatic systems.

Unit 4: Control System Switching Devices [6]

4.1 Operating principles

4.2 Applications for, relays, transistors, rectifiers, triacs and other switching devices.

4.3 Operational Amplifier and related signal conditioning circuits in control systems.

Unit 5: Controllers **[6]**

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

Unit 6: Relay Logic and PLCs **[8]**

6.1 Working of PLC
6.2 Interpretation of ladder logic diagrams.
6.3 Working of Analog and digital control circuits
6.4 tunning a process control system.

Unit 7: DC and Stepper Motors in Control Systems **[6]**

7.1 Review of DC motors operating principle.
7.2 Working of a DC motor for control systems.
7.3 Armature control and field control DC motors
7.4 Permanent magnet excited DC motors
7.5 Working of stepper motors and their driver circuits

Unit 8: AC Motors in Control Systems **[3]**

8.1 Review of AC motors operating principle.
8.2 Operation and characteristics of two axis AC motors.
8.3 Working of an AC motor for control systems.

Laboratory Exercises: **[30]**

1 Switching characteristics of Transistor and Operational Amplifier circuits
2 Demonstration for ON/OFF Temperature Control Using thermo-couple as sensor and operational amplifier as control switch
3 Construction of PID controller circuits using Operational Amplifier
4 Close loop Speed Control of DC servomotor with Tacho-generator as sensor
5 Demonstration for Pneumatic PID controllers
6 Study of PLC logic and programming in PLC
7 Demonstration for a process control system

Suggestions for instruction:

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

References:

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

Electrical Repair and Maintenance I

EG3117 EE

Total: 4 hour /week

Year: III **Lecture: hours/week**

Semester: I **Tutorial: hours/week**

Practical: 4 hours/week

Lab: hours/week

Course Description:

This course deals with the procedure of testing, repairing of essential domestic electrical equipment.

Course Objectives:

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

1. Test and identify the fault of appliance
2. Repair and Replace the faulty part
3. Reform and supervise repair work
4. Read and prepare circuit diagram

Course contents:

Unit 1. Electric Iron [3]

Ordinary electric iron and automatic electric iron. ON/OFF switch – indicator-eating element – plug-leads-visual inspection –continuity test.
Disassembling – assembling Procedure – Final test

Unit 2. Heater [3]

Ordinary - immersion ON/OFF switch, heat control, two rod heater
Visual and continuity test. Body leakage test, disassembling and assembling.
Final test

Unit 3. Fan [3]

Regulator- Fan Dimmer. – starting Coil, Running Coil, capacitor, fan direction
Types of fan - Stand fan, wall fan, celling fan, exhaust fan. Visual inspection continuity test, body leakage test, running test.

Unit 4. Fan Heater (Room heater) [3]

Fan, Single rod heater, two rod – 3 heat heater ON/OFF switch –gang switch – rotary switch- thermostat indicator-visual inspection- continuity, body leakage test disassembling, assembling
Final test

Unit 5. Hot plate [4]

Single hot plate, double hot plate selector switch, heat position thermostat, - timer, induction hot plate, visual inspection, continuity test- body leakage test- disassembling and assembling, final test.

Unit 6. Kettle [4]

Ordinary element, immersion, Thermostat – timer, element, load, switches, visual inspection continuity, body leakage, disassembling

Unit 7. Toaster [4]

Heating element latching device Thermostat/ Timer, visual inspection testing – disassembling- assembling- final test

Unit 8. Rice Cooker [4]

Thermal fuse, magnetic switch, Bi-metalic thermostatic switch ON/OFF switch indicator cooking element warmer element, visual inspection, testing disassembling and assembling.

Unit 9. Grinder, mixture and dryer [4]

Armature winding, field winding, capacitor supression, limit switch, carbon brush, holders, carbon eating element, visual inspection continuity test, body leakage test, dis-assembling and assembling procedure.

Final test

Unit 10. Geyser / Refrigerator [4]

The non-pressure type (NPT), the pressure type, single heating element, double heating, element, immersion type, thermostat indicating light, single and double control switch, flat switch, visual continuity, body ,earth test.

Unit 11. Refrigerator and air conditioner [4]

Refrigerator cycles identify evaporator, compressor, condenser system, motors Windings, capacitor, centrifugal switch, relays- fuses- thermostat door switch, defrosting system, timer.

Unit 12. Oven [4]

Control panel, ON/OFF switch, thermostat –timer indicator switch, Hob (boiling plate elements. Grill plate elements.

Oven element – visual inspection, continuity body leakage, test, earth test, disassembling and assembling, Final test

Unit 13. Volt - guard [4]

Transformer, spike suppression, electronic components, low-high cut system, relay unit, continuity of components and body leakage.

Unit 14. Auto-Transformer [4]

Auto- Transformer coil plug, leads, indicator ON/OFF switch, regulator brush, dial indicator, input-output, fuse, visual inspection, continuity test- body leakage test, Dis-assemble and assembling procedure.

Unit 15. Battery Charger [4]

Transformer, Electronic circuit, rectifiers-filter control, hydrometer, continuity test - Leakage test, Disassembling and assembling, Final test

Unit 16. Water Pump [4]

Single phase and three phase pump set. Priming of pump visual inspection of pump motor set, free rotation of rotor/pump smelling of burn out starting coil and running coil in single phase, use of capacitor, centrifugal switch, 3 phase winding -Y - Δ connection, Y - Δ starter – phase sequence, continuity – body leakage test.

References:

- Electrical Motor repair - Robert Rosenberg
- Electrical trade theory - CIMI Madras
- Manufacturer’s catalogue and repair manual.

Project I

EG 3118 EE

Total: 3 hour /week

Year: III **Lecture: hours/week**

Semester: I **Tutorial: hours/week**

Practical: 3 hours/week

Lab: hours/week

Course Description:

Students are required to carry out a small practical oriented fabrication project work under the supervision of teacher. The project work shall be related to the following topics. The project could be a new job or repeated job, which had been already carried out in the practical exercises of the previous courses. The project work shall be focused to develop the fabrication and testing skill. Students shall submit a form project report and give a presentation / demo
The project work shall be related to: Electrical machines, Power electronics, Protection system, Control system, Instrumentation system, Basic electronics, or any other topics related to electrical engineering approved by the department

Course Objective:

The objective of the course is to build up the fabrication skill of electrical system.

Note: A group of three students shall select a project. Students may propose their own project and get approval from the department or student may choose a project offered by the department. Each project shall be supervised by a teacher from the department.

Third Year (Second Semester)

Subjects:

EG3211 EE	**Electrical Energy Audit and Conservation**
EG3213 EE	**Project II**
EG3214 EE	**Power System Operation and Maintenance**
EG3215 EE	**Electrical repair and Maintenance II**
EG3216 EE	**Industrial Attachment**
EG3217 EE	**Entrepreneurship Development**
EG3219 EE	**Transmission and Distribution of Electric Power**
EG3218 EE	**Elective (One of the followings)**

a) Micro Hydro
b) Instrumentation & transducers
c) Electric Drives
d) Renewable Energy Technology

Electrical Energy Audit and Conservation

EG3211EE

Total: 4 hour /week

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

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

Practical: hours/week

Lab: 1 hours/week

Course Description:

This course deals with conservation of energy in electric motor, lighting system and process equipment.

Course Objectives:

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

1. Design and conduct the energy conservation program.
2. Power factor correction
3. Improving lighting system
4. Efficient operation of process equipment

Course Contents:

Unit 1 Introduction [3]

1.1 Electrical energy in Nepal.
- The growth of consumption.
- Energy audit
- Preliminary energy audit
- Electrical energy conservation: The national prospective.

Unit 2 Energy Audit Technique [4]

2.1 Familiarization of Industry
2.2 Organization of the field survey
2.3 Identification of conservation opportunities
2.4 Energy audit report
- Purpose
- Content
- Analysis

Unit 3 Electrical Energy Survey [4]

3.1 Electricity conservation program
- Understanding the electricity bill
- Electricity tariffs
- Analysis of electric bill
- Collecting historical data.

3.2 Monitor, measure and record electricity consumption and demand.
- Instruments use for electrical energy survey e.g. ammeter, voltmeter, wattmeter, power factor meter, power analyzer and lux meter.

Unit 4 Plant Electrical Distribution System [8]

4.1. Typical bus system:

- Simple radial single bus system
- Double bus system
- Sectionalized and special bus system

4.2. Voltage Levels and Wiring System

4.3. Conductor Size
- Energy losses in conductor
- Optimum conductor size

4.4. Transformer
- Transformer losses
- Transformer selection

4.5. Design of new plant distribution system

Unit 5: Power Factor **[8]**

5.1 Power factor fundamentals

5.2 Causes of low power factor

5.3 Leading and lagging power factor and kVAr flow

5.4 Effects of low power factor and benefits of its improvement
- System capacity
- Capital cost for new system
- Distribution system loss

5.5 Power factor correction
- Individual compensation
- Group compensation
- Central compensation
- Synchronous condenser

Unit 6: Load Management **[8]**

6.1 Maximum demand
- Measurement of maximum demand
- Demand charge
- Cost saving from demand control

6.2 Analysis of potential for demand control
- Load factor
- Load curve or demand profile
- Identification of load

6.3 Methods of demand control
- Manual demand control (load shedding and monitoring)
- Automatic demand control

Unit 7: Electric Motors **[4]**

7.1 Motor efficiency and motor losses
- Motor losses: stator and rotor losses, iron or magnetic core losses, friction and windage losses, stray load losses.

7.2 Standard motor efficiencies.

7.3 Factor affecting electric motor efficiency
- Motor size
- Motor load
- Motor selection and sizing
- Motor maintenance
- Motor rewinding

7.4 High efficiency motors.

Unit 8: Lighting **[4]**

8.1 Lighting sources
- Incandescent lamp,
- Fluorescent lamp
- LED lamp
- High intensity discharge lamp
- Mercury vapour lamp
- Metal halide lamp (metal arc lamp)
- High/low pressure sodium vapor lamp

8.2 Ballasts

8.3 Energy conservation opportunities in lighting system
- Turns off lights (time clocks and photo cells)
- Reduce light levels
- Use daylight to reduce artificial light
- Replace inefficient light source by efficient light source
- Clean and maintenance of lamp
- Use light control equipment, reflector, electronic ballasts, occupancy sensor

Unit 9: Energy saving opportunities **[2]**

9.1 Electrical system
- Sub- station and transformer
- Load management and power factor improvement
- Distribution system

9.2 Electric Drive
- Check list for motors

9.3 Lighting system
- Checklist of lighting system
- Management of lighting system

Lab/Practical: **[15]**

1. Visit an industry and prepare single line diagram of electric distribution system.
2. Perform a study of energy conservation in lighting system.
3. Perform a study of energy conservation in electromechanical system.
4. Perform economic analysis of energy system management of any one (lighting or motoring system)
5. Group presentation

References:

1. Utilization of Electric power & Electric Traction , J.B. Gupta
2. Installation commissioning & maintenance of electrical equipment, Tarlok Singh
3. A course on “Principles and Practices of Energy Conservation System, prepared for ‘Office of Energy Efficiency Services/Ministry of Industry, S.L. Nakarmi, IOE
4. General aspects of Energy Management and Energy Audit volume-I, Bureau of Energy Efficiency, Ministry of power, Govt of India.

Project II

EG 3213 EE

Total: 6 hour /week

Year: III **Lecture: hours/week**

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

Practical: 6 hours/week

Lab: hours/week

Course Description:

Students are required to take up a project work related to the topic described in the course content. Students shall submit a formal project report and give a presentation at the end of semester.

Course Objective:

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

1. Develop the self-capability of students to design, analyze, fabricate and testing of electrical system and devices.

Course content:

Students are required to take up a project work as prescribed by the department. The project work would be related to:

1. Electrical machines
2. Power electronics
3. Electronics
4. Measurement and instrumentation
5. Electrical installation design and estimating
6. Control and protection
7. Any other topics related to electrical engineering.
   The project work shall involve the followings:
   - Selection of relevant topic
   - Selection of design criteria
   - Methodology
   - Design calculation
   - Assemble or fabricate the device
   - Testing
   - Report writing
   - Evaluation by internal and external examiner

Note: A group of four students shall select a project. Student may propose their own project work but it shall be approved by the department or student may choose a project offered by the department. Each project work shall be supervised by a faculty of the department.

Power System Operation and Maintenance

EG 3214 EE

Total: 6 hour /week

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

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

Practical: hours/week

Lab: 3 hours/week

Course Description:

This course deals with the operation of small hydroelectric power plant, diesel power plant and substation equipment. It also deals with high voltage testing, fault location of cables and maintenance of power plant.

Course Objectives:

After completion of this course the student will be

- familiarize with operation of small hydro power plants, substations and diesel power plants.
- perform routine inspection and simple maintenance of small hydro power plant and diesel power plant land H.V. testing, cable fault locating.

Course content:

Unit1. Introduction [8]

1.1. Generation of Electrical energy in small hydro power plant and diesel power plant.

1.2. Substation, supply system, transmission and distribution system, system interconnection.

1.3. Causes of deterioration of power plant (moisture, contamination, corrosion, mechanical stress, electrical faults, system surges, overheating).

1.4. Need of regular of maintenance, types of maintenance: routine, preventive and breakdown maintenance. Factor determining the types of maintenance, maintenance planning and record keeping.

1.5. Listing routine maintenance task- daily, weekly, fortnightly, monthly, quarterly, yearly, number of inspections per period, charts.

Unit2. Operation of Small Hydro Power Plant [4]

2.1 Small hydro-electric power schemes, review of main civil, hydraulic, mechanical and electrical components of typical small hydro power plant.

2.2 Duties of the operator in charge of a small hydro electric power plant. Typical operational activities in normal and emergency (abnormal) conditions.

2.3 Technical details and operating characteristics of electronic load controller. Operation of mechanical tripping devices and their effects.

2.4 Technical details of generator, voltage and frequency control. earthing and protective system.

2.5 Synchronizing scheme, plant operation in isolated, parallel and interconnected.

Unit3. Routine Maintenance and Inspection of Small Hydro-electric Power plant [8]

3.1 Principle of preventive maintenance, routine maintenance and inspection, plant record keeping.

3.2 Typical routine maintenance and inspection for a small hydro power scheme

- Civil work and pipe line

- Turbine and hydraulic equipment
- Generator and electrical equipment

3.3 Lifting and moving heavy equipment. Safe working load and handling of equipment

3.4 Inspection and maintenance of lifting and moving devices and record keeping.

3.5 Electrical equipment insulating oil: - characteristics and application cause of deterioration and failure of electrical equipment. Testing, reconditioning and handling of insulating oil.

Unit4. Operation of substation Equipment [8]

4.1. Working with high voltage equipment operational rules and safety regulations, Definitions: Official In charge, Authorized Person, Working Party, High voltage Zone, Working clearance etc.

4.2. Inspection and explanation of sub-station system, system components and methods of operation, Protection system of substation, tripping and alarm sequences

4.3. Receiving and transmitting operational messages by telephone or radio, recorder messages, reporting.

4.4. Preparation of switching programmes for maintenance

- To work on main transformers and isolators
- To work on feeders and cables

4.5. Operating principle of voltage regulating relay, on-load tap changer on main transformer, capacitor banks and reactors.

4.6. Log book keeping of electrical parameters.

Unit5. High Voltage Testing and Fault Location [9]

5.1. Pressure testing of H.V. equipment after maintenance, objectives, and tables of test voltage for main equipment.

5.2. High voltage cable test set: description and specification, explanation of components and control panel, method of operation.

5.3. High voltage testing safety rules, test controller and isolation of equipment.

5.4. Types of faults on H.V. cables causes of faults, fault type diagnosis procedures, cable records/data, and routine inspection.

5.5. Fault location related to fault types, principles of operation.

5.6. Detail procedure for application of the Murray Loop Test for cable fault location.

Unit6. Operation and Maintenance of Diesel Power Plant [8]

6.1. Main assembly of plant: Diesel Engine, alternator, transmission, voltage regulator, fuel tank, switchgear, measuring instruments.

6.2. Operation of diesel power plant.

6.3. General maintenance: changing engine oil, oil filter, cleaning air filter. Valve adjustments, coolant changing, battery and starter motor servicing, adjustment of fuel pump and injectors.

6.4. Inspection and maintenance schedules.

Practical Exercise: [45]

1. Visit nearby hydro power plant and observe operation of its various components starting from intake to tailrace
2. Observe substation in detail and prepare its SLD, including its components, bus bar, incoming and outgoing feeders, LA, switch gears, protecting schemes, and transformer.
3. Observe operation of hydraulic system and turbine.

4. Manually operate the Air Circuit Breaker, switches, switches, switch fuses, with switch board dead, replaces fuses, open, isolate and put the ACB into service.
5. Follow up operation procedure to run generator up to rated speed. Load the generator
    - isolated mode
    - synchronized to the grid
6. Visit local NEA substation to note:
    - Operator's duties and log book-keeping
    - Layout of equipment- indoor and outdoor.
    - Provision for safety to public and NEA Staff.
7. Take readings of all quantities shown on substation daily log sheet. Record any defects or irregularities.
8. 11kV OCB: Open; isolate earth feeder and bus bars. Check the operation of interlock and indicators, fit test plugs, check local and remote control, rack out OCB, lock-off orifices, and isolate PT.
9. 11kV switch fuse: open, isolate, earth cable, fit test plug. Change fuse, check fuse trip operation, Lock-off
10. Observe the switching programs
    - on main transformer
    - on feeders and cables
11. Raise and lower the substation voltage using the main transformer OLTC gear. Check operation of all controls, remote and local, manual and auto indications.
12. Move heavy equipment using rollers, pinch bars, and chain blocks.
13. Lift and move heavy equipment using a traveling gantry crane, wire rope slings, and nylon web slings.

References:

1. Electrical Wiring Fundamentals, Foley
2. Electrical Installation Estimating & Costing, J. B. Gupta
3. Practices and Procedure of Industrial Electrical Design, L. B. Roe
4. Substations Design and Equipment, P.V. Gupta
5. Art and Science of Utilization of Electrical Energy, H. Pratap
6. Hand Book of Electrical Engineering, S.L. Bhatia.

Electrical Repair and Maintenance II

EG 3215 EE

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

Course Description:

This course deals with the procedure of repair, testing, rewinding of transformers, motor starters, Armatures.

Course objectives:

On completion of this course the students will be able to:
1. Diagnose the fault of transformer and motor.
2. Dismantle, repair. Assemble and test the transformer and motor.
3. Rewind transformer coils, stator coil and armature of motors.
4. Perform repair as per trouble shooting of AC motors, DC motors, and small generators.

Course contents:

Unit1. Repair and maintenance of existing transformer [12]
- 1.1 Open short circuit and body leakage test of two winding, multi winding taped winding and trace the fault.
- 1.2 Study the finding and consult instructor.
- 1.3 Dismantle the core and coils
- 1.4 Take data of each coil – size of wire and number of turns – compare with the enamel wire data table.
- 1.5 Clean and assemble (Former) Bobbin
- 1.6 Rewind coils of appropriate size, material, number of turns and fix tag on beginning and ends
- 1.7 Assemble core and coils together
- 1.8 Test – continuity and body leakage, coil to coil leakage test
- 1.9 Varnes the transformer and dry it, assemble body
- 1.10 Connect the proper load and run for load test.

Unit2. Rewinding a new transformer [8]
- 2.1 Find out required power input voltage and output voltage- frequency and core size
- 2.2 Calculate the size and number of turns of primary and secondary coils
- 2.3 Prepare bobbin
- 2.4 wind coil
- 2.5 Assemble core
- 2.6 Test continuity
- 2.7 Varnes and dry
- 2.8 Connect supply and load for 1hr

Unit3. Maintenance and Repair of motors [12]
- 3.1 Find out problem from customer Visual inspection for loose parts loose connection, broken parts, burn outs, jams.
- 3.1 Check continuity and leakage

3.2 No load test and load test

3.3 Dismantle universal motor of drill machine, hand saw machine, hand qriender clean and inspect armature, field coil, commutator, bearings shape carbon brush, assemble and test run.

3.4 Dismantle single phase capacitor start induction motor, clean and inspect squirrel cage rotor, test stator windings, capacitor centrifugal switches, distinguish starting windings and running winding. Grease the bearing assembles and test run.

3.5 Dismantle a 3 phase induction motor, clear and inspect squirrel cage rotor, test state rewinding, find type of winding- change of grease bearings – Assemble and test run.

Unit4. Rewinding – stator of motor [16]

4.1. Capacitor start motor, running and startng winding, capacitor centrifugal switch.

4.2. Name plate data – power output voltage, frequency, connection, rpmot, full load, phase, number full load current insulation type, manufacture model no.

4.3. No of poles: Pitch of coil – no of slots that each coil spans

4.4. No of turn in each coil

- Size of wire in each winding
- Kind of connection (series- parallel)
- Position of windings in relation to other windings

4.5. Type of winding (hand, form skein)

4.6. Slot insulation both size and kind

- Number of slots
- Stripping the stator
- Magnet wires (enamel wire)
- Slots insulation – insulation class, insulation material, size cuffed ends

4.7. Rewinding- hand rewinding, form winding, skein winding

4.8. Connection of winding – single voltage, double voltage series parallel recognize the connection

4.9. Splicing and taping leads

4.10. Testing new winding

4.11. Backing and varnishing

Unit5. Rewinding of Armature [12]

5.1 Data taking and stripping armature

5.2 Insulating core

5.3 Making coils in the slots

5.5 Connection the coils to the commutator

5.6 Testing

5.7 Turning the commutator in lathe

5.8 Backing and varnishing

5.9 Lap winding wake winding

5.10 Armature with one coil, two coil and three coil per slots

5.11 Commutator pitch and soldering the commutator

5.12 Banding the Armature

5.13 Balancing the Armature

5.14 Dismantle armature from drill machine or vacuum machine take data and strip the winding, insulate the slots, make coils or wound it step by step. Balance test and varnish it.

References:

1. Electrical Motor repair, Robert Rosenberg
2. Electrical trade theory, CIMI Madras
3. Manufacturer’s catalogue and repair manual.
4. Industrial electrician, N. Vinogradov Moscow
5. Practical ac and dc motor rewinding, K.B. Bhatia
6. Handbook of Electrical motor control system,US Eswar.

Industrial Attachment

EG 3216 EE

Total: 6 hour /week

Year: III **Lecture: hours/week**

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

Practical: 6 hours/week

Lab: hours/week

Course Description:

The students shall be deputed to various electric sub-station, motor design and maintenance workshop, transformer manufacturing industry and maintenance workshop, circuit breaker manufacturing industry and maintenance workshop, electric power stations on a full time basis for duration of 90 hours. At the end of industrial attachment the student shall submit a report conforming to a standardized format along with daily diary.

Industrial attachment shall consist of learning skill aspect and methods in design operation, diagnosis, maintenance and repair of machines and equipment used in respective field. For the first two days the students shall observe the operation of industry or plant. During the next remaining time he/she shall work as operator/supervisor/mechanist and at the same time he/she shall be engaged in preparing the report and presentation.

The report shall consist of the following factors:

1. Profile of the industry/plant/workshop and layout diagram of respective.
2. Organizational structure and administrative set-up of industry or plant
3. Daily dairy maintenance
4. Basic feature of industry or plant
5. Report on selected technological aspect
6. Suggestions for improvement of selected aspect of the problem.

Course Objective:

Objective of the course is to develop skill oriental knowledge and to familiarize with real industrial system and organization.

Entrepreneurship Development

EG3201 MG

Total: 5 hour /week

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

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

Practical: 2 hours/week

Lab: hours/week

Course description:

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

Course objectives:

After completion of this course students will be able to:

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
5. Manage small business

Course content:

THEORY

Unit 1: Introduction to business & entrepreneurship [9]

- 1.1 Overview of entrepreneur and entrepreneurship
- 1.2 Wage employment, self- employment and business
- 1.3 Synopsis of types and forms of enterprises
- 1.4 Attitudes, characteristics & skills required to be an entrepreneur
- 1.5 Myths about entrepreneurs
- 1.6 Overview of SME in Nepal

Unit 2: Exploring and developing entrepreneurial competencies [10]

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

Unit 3: Business identification and selection [4]

- 3.1 Sources and method of finding business idea(s)

3.2 Selection of viable business ideas

3.3 Legal provisions for SMEs in Nepal

Unit 4: Business plan formulation **[17]**

4.1 Needs and importance of business plan

4.2 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

4.3 Business operation plan

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

4.4 Organizational and human resource plan

- Legal status of business
- Management structure
- Required human resource and cost
- Roles and responsibility of staff

4.5 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

4.6 Business plan appraisal

- Return on investment
- Breakeven analysis
- Risk factors

Unit 5: Small business management **[5]**

5.1 Concept of small business management

5.2 Market and marketing mix

5.3 Basic account keeping

PRACTICAL

Unit 1: Overview of business & entrepreneurship [2]

1. Collect business information through interaction with successful entrepreneur

Unit 2: Exploring and developing entrepreneurial competencies [2]

1. Generate innovative business ideas

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

1. Analyze business ideas using SWOT method

Unit 4: Business plan formulation [22]

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]

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

Text books:

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.
2. Khanna S.S., Entrepreneurship Development, S. Chand & Co. New Delhi
3. David H. Holt, Entrepreneurship: New Venture Creation, Prentice Hall India
4. Mohanty Sangram Keshari, Fundamentals of Entrepreneurship, Prentice Hall India

Transmission and Distribution of Electrical Power

EG3219 EE

Total: 4 hour /week

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

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

Practical: hours/week

Lab: hours/week

Course Description:

The course deals with the transmission and distribution of electrical power & energy.

Course Objectives:

After completing this course the students will be able to:

1. Gain knowledge about the transmission and distribution operation and its components
2. Understand the characteristics of interconnected power system
3. Know the basic concepts of voltage control and compensation techniques

Course contents:

Unit 1: Introduction [8]

1.1 Role of Transmission and distribution as the components of power system
1.2 Typical A.C. Transmission system, standard voltage levels
1.3 Distinction between transmission and distribution system
1.4 Single phase and poly transmissions
1.5 Advantage of three phase
1.6 Concept of line and phase quantities of three phase system
1.7 Advantage of interconnected transmission network (grid system)

Unit 2: Transmission line components [12]

2.1 Overhead line vs. underground cable
2.2 Components of overhead transmission lines
- Conductors : material, stranding and bundling of conductor
- Supports: various types of poles and tower as supporting structure
- Insulators their types and applications
- Other components like; jumper, anti-climbing devices, danger plate, and stay wires etc.

2.3 Mechanical and electrical considerations
- Conductor spacing and clearance criterion
- Sag tension computation

2.4 Underground cables
- Types of HV underground cables
- Construction of cables
- Solid, oil and gas as filling material

Unit 3: Transmission line performance [8]

Transmission Line parameters: Basic concept of Resistance, inductance and capacitance calculation

3.1 Concept of single line diagram

3.2 Classification of transmission line: Short, medium and long TLs

3.2.1 Short TL: Sending and receiving end voltage, equivalent single line diagram, efficiency, phasor diagram

3.2.2 Medium TL: Sending and receiving end voltage, equivalent single line diagram (T-pi), efficiency, phasor diagram

3.3 Ferranti effect

Unit 4: Distribution system [7]

Distribution system as proximity to consumers

4.1 Radial , loop and ring main feeders

4.2 Voltage drop and power losses in radial and loop feeders

4.3 Guidelines for rural and urban distribution

4.4 Single phase and three phase distribution

4.5 Underground cables for distribution

- Seathing and armoring
- Cable breakdown
- Effect of moisture and temperature

Unit 5: Voltage Control [6]

Necessity of voltage control, voltage fluctuation and associated problems

5.1 Method for voltage control

- Excitation control of alternator
- Tap changing transformer
- Synchronous condenser
- Static compensating devices

Unit 6: Interconnected system [4]

6.1 Advantage of interconnection

6.2 Effects on voltage and frequency fluctuation with interconnected system

6.3 Flexibility in real and reactive power dispatching

6.4 Knowledge of complexity with interconnected system

References:

1. M.L. Soni, P.V. Gupta, U.S. Bhatnagar & A Chakrabarti, “A text Book on Power System Engineering”, Dhanpat Rai & Co., India
2. A.S. Pabla, “Electric Power Distribution”, Tata McGraw-Hill Publishing Company Ltd, India
3. J.J. Burke, “Power Distribution Engineering Fundamentals & Applications”, Marcel Dekker, Inc., New York.

Micro Hydro Power

EG3218 EE

(Elective)

Total: 5 hour /week

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

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

Practical: 2 hours/week

Lab: hours/week

Course Description:

This course deals with the Micro Hydro Power (MHP) plant. The main focus of this course is the constructional details and functions of various components of a MHP plant and management, operation and maintenance aspect of MHP plant.

Course Objective:

After completion of this course, student will be able to explain the basic constructional details, function and operation of various components of a MHP plan such as – Civil construction components, electro-mechanical components, protection system, and distribution system.
The students also will be familiar with the basic concept of survey, design, management, operation and maintenance of MHP plant.

Course content:

Unit 1. Introduction [4]

1.1 Classification of hydro power plant by capacity
1.2 Features of Micro Hydro Power (MHP) plant
1.3 Role of MHP plant for rural development
1.4 Historical background and current status of MHP in Nepal

Unit 2. Basic Concept and Civil Construction Works of MHP Plant [6]

2.1 Basic layout of a MHP plant
2.2 Principle of power generation - Definition of head and discharge, Power equation.
2.3 Components of MHP Plant, their constructional details and functions – Weir and intake, Canal, Desilting basin and spillway, Forebay, Penstock, Power house, Tailrace.

Unit 3. Electro-mechanical component of MHP Plant [13]

3.1 Turbines and valves – Types of turbine and their working principle, turbines for MHP plants, types of valve used in MHP plant.
3.2 Synchronous generator–Basic construction and working principle, Excitation system.
3.3 Induction generator - Basic construction and working principle, requirement of excitation capacitor.
3.4 Coupling of turbine and generator - Direct coupling, Belt drive, Flywheel.
3.5 Speed Governing – Hydraulic mechanical governor, Electronic Load Controller (ELC) – Basic principle, types of ELC – AC voltage controller based ELC, DC chopper based ELC, Discrete resistance type ELC.

3.6 Voltage control – AVR for synchronous generator, VAR compensator (Thyristor Switched Capacitor and Fixed Capacitor Thyristor Control Reactor) for induction generator

Unit 4. Survey of MHP Plant and Basic Design Concept [6]

4.1 Basic concept of site selection for MHP Plant
4.2 Mesurement of discharge at site – Bucket method, Velocity area method, Weir method, Salt dilution method.
4.3 Mesurement of head at site- Using clinometer, Using a water-filled tube, Using altimeter
4.4 Power Calculation, selection and sizing of turbine and generator

Unit 5. Protection System for MHP Plant [6]

5.1 Over speed protection
5.2 Over-load and short-circuit protection for generator
5.3 Over voltage and under voltage tripping system
5.4 Earthing for generator neutral and body
5.5 Protection of generator and ELC from lightening strike
5.6 Single-line diagram of control panel with protection devices

Unit 6. Distribution System [4]

6.1 Basic layout of distribution system
6.2 Calculation of conductor size for distribution line
6.3 Poles and insulators for distribution line
6.4 Consumer's connection system

Unit 7. Management, Operation and Maintenance of MHP Plant [6]

7.1 Individual ownership management
7.2 Community ownership based management
7.3 Plant operator – starting up procedure, shutdown procedure, training of operator.
7.4 Regular maintenance of procedure for intake system, canal, desilting basin and spillway, forebay, penstock, turbine, valve, generator.

Practical Exercises: [30]

Exercise No.1: Experimental study on synchronous generator at Lab,

- Study of excitation and voltage build-up at no-load
- Operation with purely resistive load
- Operation with inductive load and effect on terminal voltage

Exercise No.2: Experimental study on Electronic load controller at Lab.
Exercise No.3: Field study on an existing MHP plant.
Exercise No.4: Practice on field measurement – Measurement of flow, Head measurement, Calculation of power, section of turbine and generator.

References:

1) Adam Harvey, "Micro-Hydro Design Manual – A guide to small-scale water power generation", published by Intermediate Technology Publication, 1993
4) Manual for survey and layout design of private micro-hydro power plants, published by ICIMOD, Kathmandu, Nepal, 1999
5) Maintenance and Repair Manual for private micro-hydro power plants, published by ICIMOD, Kathmandu, Nepal, 1999
6) Operation and Management Manual for private micro-hydro power plants, published by ICIMOD, Kathmandu, Nepal, 1999

Instrumentation & Transducers

EG3218 EE

(Elective)

Total: 5 hour /week

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

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

Practical: 2 hours/week

Lab: hours/week

Course Description:

This course introduces the basic instrumentation techniques and sensors & actuators.

Course Objective:

After completing this course the students will be able to:
1. learn operating characteristics & operating principle of different transducers
2. understand the use of sensors and actuators and their applications in real-world instrumentation

Course content:

Unit 1: Basic concepts **[8]**

1.1 Transducers, Sensors and Actuators
1.2 Basic requirements of a Transducer
1.3 Classification of Transducers
1.4 Selection of Transducers
1.5 Specification, Sensitivity and Accuracy
1.6 Resolution & Range

Unit 2: Measurement of Position and speed **[10]**

2.1 Potentiometers
- Operating principle
- DC potentiometers
- AC potentiometers

2.2 LVDT construction & operating principle
2.3 RVDT construction & operating principle
2.4 Capacitive Transducers
2.5 Hall effect application in displacement measurement
2.6 Tacho-generator
- DC Tacho-generator
- AC Tacho-generator
- Digital Counter principle

2.7 Linear velocity measuring concept

Unit 3: Measurement of Torque, Force & Pressure **[8]**

3.1 Torque measurements
- Strainguage principle
- inductive transducers
- Electronic technique

3.2 Piezoelectric Transducers

- Material
- Construction
- Operating principles

3.3 Applications of Piezoelectric Transducers
3.4 Acellerometers

Unit 4: Measurement of temperature [6]

4.1 Resistance Temperature detector
- Principle
- Construction
- Applications

4.2 Thermistor
- Principle
- Construction
- Applications

4.3 Thermocuple
- Principle
- Construction
- Applications

Unit 5: Miscellaneous Transducers [9]

5.1 Photoconductive cells
5.2 Vacuum measurements
5.3 Pneumatic displacement detectors
5.4 Flow measurements
5.5 Measurements of sound

Unit 6: Signal conditioning circuits [4]

6.1 Operational Amplifier
6.2 Application of Opm in instrumentation

Laboratory Exercises: [30]

1. To study the resistance transducers for angular or linear position Applications
2. To study the construction and characteristics of strain gauge transducer.
3. To study the construction and characteristics of a capacitive transducers.
4. To study the construction and characteristics of thermocouple
5. To study the characteristics of a Hall effect transducers
6. To study the characteristics of a Buzzer
7. To study the characteristics of a Differential Amplifier

Suggestions for instruction:

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

References:

1. J.B. Gupta, "A course in Electronic and Electrical Measurements and Instrumentation", S.K. Kataria & Sons, India, 1999
2. A.K. Mahalanabis, "Introductory System Engineering" Wiley eastern Limited, India

Electric Drives

EG3218 EE

(Elective)

Total: 5 hour /week

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

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

Practical: 2 hours/week

Lab: hours/week

Course Description:

This course covers the power electronics devices and schemes such as rectifier, chopper, inverter, ac voltage controller applied to electric circuits.

Course Objective:

After completion of this course, student will be able to explain the basic constructional details and operation of power electronic devices- diode, power transistor, thyristor, GTO, Triac, MOSFET, IGBT, operation of rectifier, chopper, inverter and ac voltage controller.

Course content:

Unit 1. Introduction [2]

1.1 Basic concept of electric drives- definition, components of electric drives (drive-motor, control circuits), various actions in drive system (starting, speed control, braking)

1.2 Classification of electric drive –Group drive, Individual derive, Multi-motor derive

1.3 Classification of control scheme – Manual control, Semi-automatic control, automatic control

Unit 2 DC motor drives [20]

2.1 Speed- torque characteristic of dc shunt generator

2.2 Four-quadrant operation of dc shunt motor

2.3 Speed control of dc shunt motor

- Factors affecting the speed of dc shunt motor
- Constant torque mode of speed control (Armature control)
- Constant power mode of speed control (Field control)
- Armature control method with single-phase half-controlled bridge rectifier
- Armature control method with single-phase full-controlled bridge rectifier
- Field control method with single-phase half-controlled bridge rectifier
- Closed loop control system for constant speed operation
- Armature control method with step-down chopper

2.4 DC motor starter

- Necessity of starter
- Conventional three-point starter with manual control
- Starter using voltage sensing relays
- Starter using current sensing relays
- Starter using time delay relay

2.5 Speed control DC series motor

- Armature control method with single-phase half-controlled bridge rectifier

- Field diverter method with chopper controlled diverter resistance.

Braking of dc motor – plugging, dynamic braking and re-generative braking.

Unit 3 AC motor drives **[14]**

3.1. Speed- torque characteristic of three-phase induction motor

3.2. Speed control of three-phase induction motor

- Factors affecting the speed of three-phase induction motor
- Stator voltage control method using inverter fed stator
- Frequency control method using variable frequency inverter
- Constant Volt-Hertz method
- Rotor rheostat using chopper control
- Static-Kramer drive

3.3. Induction motor starter

- Necessity of starter
- DOL starter using contactor with provisions for overload protection and speed reversal.
- Auto transformer starter using contactor with overload protection
- Star-Delta starter using contactor with overload protection

3.4. Braking of induction motor – plugging, dynamic braking and re-generative braking.

3.5. Synchronous motor drives

- Constant volt-Hz method of speed control using variable voltage and variable frequency (VVVF) inverter
- Self-controlled synchronous motor drive using load commutated thyristor inverter.

Unit 4. Drives for traction and industrial applications **[9]**

4.1 Requirements of electric traction system

4.2 AC series motor as traction motor

4.3 DC series motor as traction motor

4.4 Drive system for electric train – speed/time curve, power supply system, driving motor

4.5 Drive system for trolley bus – power supply system and driving motor

4.6 Drive system for paper mill

4.7 Drive system for rolling mill

4.8 Drive system for power lathe

4.9 Drive system for electric vehicle with four-quadrant chopper

Practical Exercises: **[30]**

Exercise No.1:
Experimental study on speed control of dc shunt motor using armature control method and field control method with single-phase half-controlled bridge rectifier.

Exercise No.2:
Experimental study on speed control of dc series motor using armature control method with single-phase half-controlled bridge rectifier.

Exercise No.3:
Experimental study on speed control of three-phase induction motor using variable applied to stator winding at constant load torque.

Exercise No.4:
Experimental study on speed control of three-phase induction motor using variable frequency inverter at constant load torque.

Exercise No.5:
Experimental study on speed control of three-phase induction motor using constant Volt-Hz method at constant load torque.

Exercise No.6:
Experimental study on speed control of three-phase slip-ring induction motor using rotor rheostat at constant load torque.

Exercise No.7:
Study of any one of the drive system (described in chapter-5) at the real site and write a technical report on the drive system.
[note different groups of student shall study different sites.]

References:

1. N.K. De and P.K. Sen, “Electric drives”, published by Prentice Hall of India, 2002.
2. H. Pratap, “Art and science of utilization of electrical energy” published by Dhanpat Rai and Co. India, 2001.
3. A Chakrabarti, "Fundamentals of Power Electronic and Drives” Dhanpat Rai and Co., 2002.

Renewable Energy Technology

EG3218 EE

(Elective)

Total: 5 hour /week

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

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

Practical: 2 hours/week

Lab: hours/week

Course Description:

This course deals with fundamentals of different renewable energy resources and their role in sustainable development.

Course Objectives:

After completing this course the students will be able to:

1. Identify the different renewable energy resources and their importance.
2. Understand the basic principles behind renewable energy sources like hydro, solar, wind and biomass.
3. Compare the prospects of renewable energy resources

Course content:

Unit 1 Introduction [6]

1.1 World energy scenario

1.2 Energy crisis

1.3 Renewable energy resources

- Solar energy
- Hydro electricity
- Biomass
- Wind energy
- Geothermal energy
- Tidal energy
- Wave energy

Unit 2 Solar Energy [12]

2.1 Solar radiation

- Electromagnetic spectrum
- Prediction of solar radiation

2.2 Solar thermal energy

- Domestic hot water system
- Solar dryer
- Solar distillation
- Solar ponds
- Swimming pool heating
- Concentrating collectors
- Flat plate collectors

2.3 Solar-electricity

- Fundamental principle of photovoltaic conversion
- Types of photovoltaic cells (mono-crystalline, poly-crystalline, thin film or amorphous cells)
- Solar module, energy storage battery, charge controller

- Solar home system and solar water pumping

Unit 3 Hydro-electricity [10]

3.1 Water head, flow and power from water

3.2 Types of hydropower plants
- Large hydro, medium hydro, small hydro, micro hydro, peltric set

3.3 Micro-hydro power
- Feasibility study and evaluation of potential of hydro power
- Demand survey and calculation of micro-hydro size
- Hydraulic structures
- Electromechanical equipment
  - turbine
  - generator
  - governor
  - automatic voltage regulator
  - electronic load controller
  - ancillary equipments

Unit 4 Biomass [10]

4.1 Biomass as a fuel
- Direct combustion
- Gasification
- Pyrolysis
- Anaerobic digestion – Biogas

4.2 Role of biogas in Nepal

4.3 Components of Biogas system
- Biogas constituents
- Biodigester
- Biogas inputs (feeds)
- Digestion
- Slurry
- Use of Biogas (cooking, lighting etc)

4.4 Presentation Package: Microsoft PowerPoint

Unit 5 Wind Energy [7]

5.1 Power from the winds

5.2 Wind turbines
- Horizontal axis turbines
- Vertical axis turbines

5.3 Electricity generation from wind turbines

5.4 Wind farm

Practical Exercises [30]

1. Measurement of solar radiation
2. Solar Home System: Solar cells and connection, charge controller and storage battery
3. Use of solar heaters, solar ovens, solar dryers
4. Study of Micro-hydro systems/peltric set with electronic load controller
5. Study of Biogas system
6. Study of wind turbine, induction generator and generation controller

References:

1. Renewable Energy, Power for a sustainable future by Godfrey Boyle, Oxford University Press.

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