CURRICULUM

DIPLOMA

Electrical & Electronics Engineering

(Three year program-semester system)

Council for Technical Education and Vocational Training

Curriculum Development Division

Sanothimi, Bhaktapur

2013

Table of Contents

1. Introduction:

The fusion of Electrical and Electronics Engineering is an emerging field in the engineering and technology sector. Many people in the developed countries, developing countries and under developed countries have been given emphasis for the broader application of electrical and electronics technology. This sector has been helping the world for the overall development and it has been creating wage and self employment opportunities both in public and private sectors.

This curriculum is designed with the purpose of producing middle level technical human resources equipped with knowledge and skills related to Electrical and Electronics 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 and Electronics Engineering.

2. Curriculum title:

Diploma in Electrical and Electronics Engineering (DEEE)

3. Programme objectives:

This curriculum has following objectives to:

1. Produce middle level competent technical human resources fused with Electrical and Electronics engineering skills;
2. Prepare such electrical and electronic technicians who are able to work in the local industrial settings of the country;
3. Prepare such electrical and electronic workforce who will demonstrate positive attitude and respect for the profession and socio-cultural values;
4. Help in meeting the demand of electrical and electronics technician required for the public and private hospitals of Nepal;
5. Reduce the dependence on employing such technicians from foreign countries; and
6. Create self employment opportunities.

4. Programme description:

This course is based on the job required to perform by an Electrical and Electronic Technician at different related industries and organizations in Nepal.

Therefore, this curriculum is designed to provide knowledge and skills focusing on Electrical and Electronics Engineering related to the occupation. There are six semesters in total within the period of three years. The first year courses are offered focusing on foundational and core subjects of engineering; the second year courses are focused on basic disciplinary subjects of Electrical and Electronics Engineering. Similarly, the third year comprises of the disciplinary subjects including provision of elective subjects of both Electrical and Electronics Engineering discipline. Moreover, the third year insists on the application of learned skills and knowledge through the Industry Based Project as infusion model of subjects.

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

The content of individual subjects prescribed in the curriculum are incorporated in the light of "must know and must do" principle of knowledge and skills for this level.

5. Duration:

The total duration of this curricular program is three years. Each year consists of two semesters of six months each.

6. Target group:

Individuals, who have passed SLC or equivalent with English, Science, and Mathematics or Technical SLC (TSLC) course in Electrical and Electronics Engineering.

7. Group size:

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

8. Target location:

The target location will be all over Nepal.

9. Entry qualification:

Entry qualification of the applicant for diploma in Electrical and Electronics Engineering programme should be SLC pass or equivalent or Technical SLC (TSLC) in related subject. S/he should have English, Science, and Compulsory Mathematics in SLC or as per provisions mentioned on CTEVT admission guidelines.

10. Entry criteria:

- Should submit SLC or equivalent certificate
- Should pass entrance examination as administered by CTEVT

11. Selection:

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

12. Medium of instruction:

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

13. Pattern of attendance:

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

14. Teacher and student ratio:

- For theory: As per the nature of the course.

- For practical / demonstration: 1:12.
- For bench work: 1:8.
- 75 % of the technical teachers must be full timer.

15. Teachers and demonstrators:

- The disciplinary subjects' related teachers should be a bachelor's degree holder in the related area with three years experience in the related field.
- The demonstrators should be bachelor's degree holder in the related area with two years experiences in training activities.
- The foundational subjects' related teachers (refer to course codes SH and MG) should be master's degree holder in the related area.

16. Instructional media and materials:

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

- ***Printed Media Materials*** (Assignment sheets, Case studies, Handouts, Information sheets, Individual training packets, 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.).

17. Teaching learning methodologies:

The methods of teachings for this curricular program will be a combination of several approaches. Such as Illustrated Lecture, Tutorial, Group Discussion, Demonstration, Simulation, Guided practice, 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

18. Approach of education:

There will be inductive and deductive approaches of education

19. Examination and marking scheme:

- The subject teacher will internally assess 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 wise final examination will be allocated for theoretical components of a subject.
- The final semester examinations of all theory components will be administered 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 needs.
- Student who fails in the internal assessment will not be allowed to sit in the semester final examination and will also be not allowed continuing the following semester.

20. Provision of back paper:

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

21. 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.

22. Pass marks:

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

23. 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:

Marks division:

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

24. Certification and degree awards:

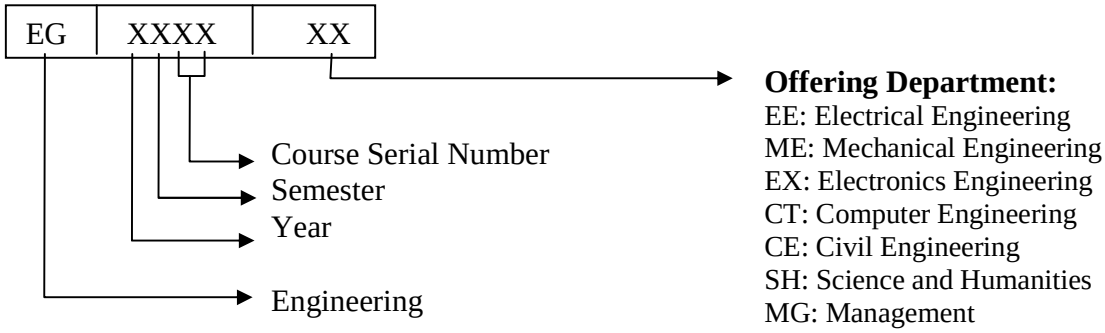
- Students who have passed all the components of all subjects of all six semesters are considered to have successfully completed the course.
- Students who have successfully completed the course will be awarded with a degree of **Diploma in Electrical and Electronics Engineering**.

25. Curriculum and credits:

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

26. Subjects Codes

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



27. Provision of specialization:

There will be no provision of specializing but some subjects are offered here with provision of the elective; viz. Micro Hydro, Instrumentation and Transducers, Electric Drive, Renewable Energy Technology, Principle of Energy Conservation, PLC Design and Advanced Micro Processor & Interfacing

28. Career path:

The graduates will be eligible for the position equivalent to non-gazetted 1st class (technical) as Electrical and Electronics 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 provisioned in the related council act (if any).

29. Curriculum Structure

Diploma in Electrical and Electronics Engineering

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	Continuous Assessment
2	EG 1102 SH	Communication English	2				2	10	40	1.5				50	
3	EG 1103 SH	Engineering Mathematics I	4	1			5	20	80	3				100	
4	EG 1104 SH	Engineering Physics I	3	1		2	6	20	60	3	10	10	1.5	100	
5	EG 1105 SH	Engineering Chemistry I	3	1		2	6	20	60	3	10	10	1.5	100	
6	EG 1106 ME	Engineering Drawing I			4		4				60	40	4	100	
7	EG 1111 ME	Applied Mechanics	3			2	5	20	60	3	10	10	1.5	100	
8	EG 1112 EE	Workshop Practice I	1		9		10				120	80	6	200	
		Total	**18**	**3**	**13**	**6**	**40**	**100**	**340**		**210**	**150**		**800**	

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				100	Continuous Assessment
2	EG 1202 SH	Engineering Physics II	3	1		2	6	20	60	3	10	10	1.5	100	
3	EG 1203 SH	Engineering Chemistry II	3	1		2	6	20	60	3	10	10	1.5	100	
4	EG 1211 CT	Computer Application	2		2		4	10	40	1.5	30	20	3	100	
5	EG 1212 EE	Safety Rules and Regulations	2				2	10	40	1.5				50	
6	EG 1213 EE	Workshop Practice II	1		6		7				90	60	6	150	
7	EG 1214 EE	Engineering Drawing II			4		4				60	40	4	100	
8	EG 1215 EE	Principles of Electrical Engineering	4			3	7	20	80	3	30	20	3	150	
		Total	**18**	**3**	**12**	**7**	**40**	**100**	**380**		**220**	**150**		**850**	

Diploma in Electrical and Electronics Engineering

Year : II **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 2111 CT	Computer Programming	2		2		4	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 EX	Digital logic	3			3	6	20	80	3	30	20	3	150	
4	EG 2114 EE	Electrical and Electronics Engineering Material	4				4	20	80	3				100	
5	EG 2115 EE	Electric Circuit Theory	3	1		3	7	20	80	3	30	20	3	150	Continuous Assessment
6	EG 2116 EE	Electrical Installation I			7		7				60	40	4	100	
7	EG 2118 EE	Electrical and Electronics Engineering Drawing			4		4				60	40	4	100	
8	EG 2107 ME	Elements of Engineering Economics	2				2	10	40	1.5				50	
		Total	**17**	**1**	**13**	**9**	**40**	**100**	**400**		**240**	**160**		**900**	

Year : II **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 2206 SH	Social Studies	2				2	10	40	1.5				50	
2	EG 2211 EE	Computer Aided Drawing	2		2		4	10	40	1.5	30	20	3	100	
3	EG 2203 EX	Introduction to Microprocessors	3		3		6	20	80	3	30	20	3	150	
4	EG 2213 EX	Basic Programmable Logic Control (PLC)	3			3	6	20	80	3	30	20	3	150	
5	EG 2215 EE	Electrical Machines 1	3	1		2	6	20	60	3	10	10	3	100	Continuous Assessment
6	EG 2216 EE	Electrical Measurements and Measuring Instruments	3	1		2	6	20	60	3	10	10	3	100	
7	EG 2217 EE	Transmission and Distribution of Electrical Power	3	1			4	20	80	3				100	
8	EG 2218 EE	Repair and Maintenance of Winded Machine			6		6				90	60	6	150	
		Total	**19**	**3**	**11**	**7**	**40**	**100**	**360**		**200**	**140**		**850**	

Diploma in Electrical and Electronics Engineering

Year : III **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 3112 EE	Switch Gear and Protection	3	1		3	7	20	80	3	30	20	3	150	Continuous Assessment
2	EG 3113 EE	Power Electronics	3			2	5	20	60	3	10	10	3	100	
3	EG 3114 EE	Electrical Machines II	3	1		3	7	20	80	3	30	20	3	150	
4	EG 3105 EX	Product Design & Development			3		3				30	20	3	50	
5	EG 3106 EX	Integrated Digital Electronics	3	1		3	7	20	80	3	30	20	3	150	
6	EG 3107 EX	Repair and Maintenance of Electrical and Electronics Appliances			5		5				60	40	4	100	
7	EG 3109 CT	PC Organization	3	1	2		6	20	80	3	30	20	3	150	
		Total	**15**	**4**	**10**	**11**	**40**	**100**	**380**		**200**	**170**		**850**	

Year : III **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 3201 EX	Microprocessor System Design	3	1		3	7	20	80	3	30	20	3	150	Continuous Assessment
2	EG 3207 EX	Fundamentals of Automatic Control	3			3	6	20	80	3	30	20	3	150	
3	EG 3208 EX	Design, Estimating & Costing of Electrical & Electronics Installation	3		2		5	20	60	3	20			100	
4	EG 3209 EX	Industry Based Major Project			8		8				120	80	6	200	
5	EG 3211 ME	Organization and Management	4				4	20	80	3				100	
6	EG 3201 MG	Entrepreneurship Development	3		2		5	20	60	3	10	10	3	100	
7		**Elective (One of the followings)**	3		2		5	20	60	3	10	10	3	100	
	EG 3218 EE	a) Micro Hydro													
	EG 3218 EE	b) Instrumentation & Transducers													
	EG 3218 EE	c) Electric Drives													
	EG 3218 EE	d) Renewable Energy Technology													
	EG 3218 EE	e) Principle of Energy Conservation													
	EG 3210 EX	f) Programmable Logic Control (PLC) Design													
	EG 3210 EX	g)Advanced Microprocessor & Interfacing Systems													
		Total	**19**	**1**	**14**	**6**	**40**	**120**	**420**		**220**	**140**		**900**	

First Year
(First and Second Semesters)

First Semester
Subjects:

1. **EG 1101 SH Communication Nepali**
2. **EG 1102 SH Communication English**
3. **EG 1103 SH Engineering Mathematics I**
4. **EG 1104 SH Engineering Physics I**
5. **EG 1105 SH Engineering Chemistry I**
6. **EG 1106 ME Engineering Drawing I**
7. **EG 1111 ME Applied Mechanics**
8. **EG 1112 EE Workshop Practice I**

कम्युनिकेसन नेपाली

ई.जी. ११०१ एस.एच.

वर्ष : प्रथम **जम्मा: २ घण्टा/ हप्ता**
सेमेष्टर : प्रथम **प्रवचन: २ घण्टा/ हप्ता**
पूर्णांक : ५०

कोर्षको परिचय

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

कोर्षको उद्देश्य :

यस पाठ्यांशको अध्ययनबाट विद्यार्थीहरूले निम्नलिखित भाषिक क्षमता विकास गर्न 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 कोर्श (कालिगढ तालिम) : एक परिचय : इ.अ.सं. पश्चिमाञ्चल क्याम्पस पोखरा ।
- भूकम्पबाट सुरक्षित रहन गर्नु पूर्व तयारी: भूकम्प प्रविधि राष्ट्रिय समाज नेपाल ।
- इन्जिनियरिङ नेपाली: लालानाथ सुवेदी ।
- सिंचाई प्रविधि ज्ञान : भोजराज रेग्मी, त्रि. वि. पाठ्यक्रम विकास केन्द्र

सिकाई सामग्रीहरू

- त्रि. वि. पाठ्यक्रम विकास केन्द्र, अनिवार्य नेपाली शिक्षण निर्देशन, काठमाण्डौं
- लालानाथ सुवेदी, इन्जिनीयरिङ नेपाली विद्यार्थी पुस्तक भण्डार, भोटाहिटी, काठमाण्डौं ।
- लालानाथ सुवेदी, नेपाली व्याकरण, बोध/रचना (सम्बन्धित अंश मात्र) विद्यार्थी पुस्तक भण्डार, भोटाहिटी, काठमाण्डौं ।
- गोरखापत्र, कान्तिपुर आदि पत्रिका सम्पादकीय, टिप्पणी र लेखहरू ।

- प्रशिक्षकहरूले आफ्नो पुस्तक तयार गर्न वा बजारमा पाइने सामग्री छानेर पढाउन सक्ने, तर परीक्षा महाशाखालाई यसको पूर्व जानकारी दिनुपर्ने

Communication English

EG 1102 SH

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

Course Description:

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

Course Objectives:

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

Course Contents:

Unit 1. English sound and basic structures: [2]

1.1. Define with examples:
- 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 Pronounciation, Cambridge University Press, New edition
10. …….. Link English, Central Department of English, Tribhuvan University

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

Engineering Mathematics I

EG 1103 SH

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

Course Description:

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

Course Objectives:

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

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

Course Contents:

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

1.1. Review of trigonometric ratios:
- Basic trigonometric formulae
- Identities and conditional identities.

1.2. Trigonometric equations:
- Periodicity of trigonometric functions
- General solutions of the following equations:
  - Sin x = k , cos x = k and Tan x = k and using trigonometric equations.

1.3. Inverse circular functions:
- Domain and their graphs
- Formulae involving inverse circular functions
- Simple identities and equations involving circular functions

1.4. Properties of triangles:
- The sin law
- The cosine law
- The projection law
- The half angle formulae
- The area of a triangle
- The encircles and ex-circles of a triangle

Coordinate Geometry: [12]

2.1 Straight lines:

- The three standard forms of equations of a line.
- The linear equation: $ax + by + c = 0$.
- Any line through the intersection of two lines.
- Concurrency of lines.

2.2 Pair of straight lines:

- Angle between two lines
- Bisectors of angles between two lines
- Pair of lines
- Homogeneous equation of second degree
- General equation of second degree representing two lines
- Angle between a pair of lines
- Bisectors of the angles for a line pair
- Lines joining the origin to the points of intersection of a curve and a line

2.3. Circle:

- Standard equation
- General form
- Tangents and normal

2.4. Parabola:

- Standard equation
- Tangents and normal

Unit 2. **Algebra: [12]**

3.1. Progressions:

- A.P., G.P. and H.P.

3.2. Permutations and combinations

3.3. The binomial theorem for any index

3.4. Series:

- Exponential & logarithmic

3.4. Equations:

- Quadratic & polynomial

Unit 3. **Set relation and function: [8]**

4.1 Idea of set, set notations, set operations,

4.2. Venn diagram,

4.3. The set of real members and its subsets.

4.4. The absolute value of a real number.

4.5. Functions- algebraic and transcendental.

4.6. Graphs of simple function.

Unit 4. **Calculus: [16]**

5.1. Limit of community.

5.2. Derivatives from definition of simple functions like:

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

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

5.4. Integration, Rules for finding integrals.
5.5. Standard integrals and their uses.
5.6. Definite integrals- definition and evaluation.
5.7. Definite integral as limit of sum.

Learning materials:

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

Engineering Physics I

EG 1104 SH

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

EG 1105 SH

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

Course Description:

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

Course Objectives:

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

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

Course Content:

Unit: 1: Language of chemistry: [4]

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

1.2 Formula:
- Definition
- Significance (qualitative and quantitative)
- Concept of valency in terms of combining capacity with H_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 1106 ME

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

Course description

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

Course objectives

After completing this course the students will be able to

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

Course Contents

Unit 1: Introduction [4 Hours]

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

Unit 2: Technical Lettering [4 Hours]

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

Unit 3: Geometrical Construction [12 Hours]

3.1 Construction on straight lines and angles

Bisection and trisection of a straight line, Bisection and trisection of an angle, To draw perpendicular lines, To draw parallel lines, To divide a straight line into any number of equal parts, To divide a straight line proportionately, To draw an angle equal to given angle

3.2 Construction of polygons

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

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

3.4 Construction on circular arcs and circles

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

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

3.6 Construction of standard curves

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

3.7 Exercise on construction of standard curves [Sheet 5]

Unit 4: Dimensioning [4 Hours]

4.1 Dimensioning terms and notations

4.2 Techniques of dimensioning: Size and location dimensioning

4.3 Placement of dimensions: Aligned and Unidirectional system

4.4 Rules for dimensioning and conventions

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

Unit 5: Projection of Points, Lines and Planes [8 Hours]

5.1 Principle of projection

5.2 Principle planes of projections, four quadrants

5.3 Projection of point

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

5.4 Projection of line

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

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

5.6 Projection of plane

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

5.7 True Length of an Oblique Line

5.8 True shape of an Oblique Plane

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

Unit 6: Projection of Geometrical Solids [4 Hours]

6.1 Types of Solids: Polyhedra and Solids of revolution

6.2 Projection of geometrical solids: Prism, Cylinder, Pyramid and Cone

6.3 Projection of points on the surfaces solids

6.4 Exercise on projection of cylinder, prism, cone and pyramid; Projection of points on the surfaces of these solids [Sheet 9]

Unit 7: Orthographic Projection [20 Hours]

7.1 Principle of Orthographic Projection

7.2 Systems of Orthographic Projection: First Angle and Third Angle

7.3 Making an Orthographic Drawing

7.4 Analysis in Three Views

7.5 Exercise on orthographic projection of rectangular objects with horizontal and vertical plane surfaces [Sheet 10]

7.6 Exercise on orthographic projection of rectangular objects with inclined plane surfaces [Sheet 11]

7.7 Exercise on orthographic projection of objects with cylindrical surfaces [Sheet 12 &13]
7.8 Exercise on orthographic projection and dimensioning [Sheet 14]

Unit 8 Freehand Sketching [4 Hours]

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

References:

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

Applied Mechanics

EG 1111 ME

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

Course description

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

Course objectives

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 Hours]**

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 Hours]**

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 Hours]**

3.1 Introduction to the concept of equilibrium
3.2 Conditititions of equilibrium in two- and three dimensions
3.3 Body constraints and free body diagrams

Unit 4. Distributed forces **[6 Hours]**

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 Hours]**

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 Hours]**

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 Hours]**

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

Laboratory **[2x7=14 Hours]**

List of laboratory experiments

1 Verification of parallelogram law and triangle law of forces
2 Verification of polygon law of forces
3 Verification of principle of moments
4 Determination of coefficient of friction (μ) between wood, steel, copper and glass (horizontal and vertical)
5 Determination of moment of inertia by flywheel
6 Determination of the support reaction of simply supported beams with concentrated loads at one or more points
7 Identification of composition and resolution of forces by vector method

References:

1 Beer F.P & Johnston ER: Mechanics for Engineers, 8th Edition, Mc Graw Hill.
2 Malhotra, M.M, Subramanian, R., Gahlot RathorP.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,

Workshop Practice I

EG 1112 EE

Total: 10 hours /week
Year: I **Lecture: 1 hours/week**
Semester: I **Tutorial: hours/week**
Practical: 9 hours/week
Labs: hours/week

Course description

This course deals with identify, select, use hand tools, power tool, measuring equipment and practice the process of filing, chiseling, sawing, drilling, reaming, threading, riveting, soldering, bending, folding, welding, brazing, forging and foundry work

Course objectives

On completion of 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. Use hand tools and power tools for the marking, measuring and cutting the metal in shape.
4. Understand foundry process
5. Joining the metal by different process
6. Maintenance and care the measuring instrument, hand tools and power tools
7. Use arc, gas welding equipment, use for gas and heat treatment process.

Course Contents

Unit 1. Safety rules in the workshop [1 Hour]

1.1. Causes of accident and prevention
1.2. Safety environment
1.3. Use the protective cloths and equipment
1.4. Arrange the workshop, hand tools.

Unit 2. Laying tools [2 Hours]

2.1 Layout tools
- Identify the scriber, punch, divider, surface plate, v-block and vernier eight gauge.
- Select the tools for the line and point on the surface.
- Handle the layout tools, care and maintenance.

2.2 Hammer/hammering
- Identify the ball, cross, straight, claws and soft hammers and size of them.
- Select the hammers for the driving, chipping, punching, puling nails riveting and fitting.
- Holding handles and replace handle. Be cure when the stroking by hammer.

2.3: Wrenches
- Identify the single, double pipe and the adjustable wrenches and size of them.
- Wrench holding and processes of tightening and opening the elements and parts.

2.4: Work holding device
- Identify the bench, machine, pipe and chain vices.
- Select the device and uses.
- After use clean and maintenance the vices, protect voice jaws and work pieces.

Unit 3. Cutting tools [2 Hours]

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

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

3.3: Files and filling
- Identify the parts, shapes, sizes, cuts of the files.
- Select the file for the shaping different types of the metal and surface finis accuracy +-0.2mm.
- Method of the holding, balancing and the direction of the filing.
- Clean the stores and files.

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

Unit 4. Measuring instrument [2 Hours]

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

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

4.3: The rules of the measuring and using te measuring instrument.

Unit 5. Power Tools [2 Hours]

5.1 Drill machines
- Identify the hand drills machines, bench, gang, colon, and radial drill machine.
- Select the correct types of the machine.
- The correct method of the using the drilling machine.
- Select the correct speed and the feed for different size of the drill and the metal.

5.2: Drill machines
- Drill and drilling
- Identify the different kinds of drill size, purpose and angle.
- Select the work and the drill machine of the of the drill holes of acceptable standards.
- Operates all the types of drill machines and function of coolant.
- Operate the machines safely and use safety equipments.

Unit 6. Reamer and Thread [2 Hours]

6.1: Reamer and reaming
- Types of the reamers, hand, tape and adjustable reamers.
- Select the holding device, reamer, drill speed.
- The method of the reaming on the metal.

6.2: Thread and threading
- Name of the taps, dies, handle, kinds of the thread, size, angle, main part of the thread and uses.
- The method of the producing the thread by the taps and dies, lathe machine.

Unit 7. 7: Bend and bending [1 Hour]

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

- Select the folding, radius bending and rolling.
- The method of bending the metal bar, flat and plate.

Unit 8. Rivet and riveting [1Hour]

8.1: Identify the rivets, size, head, metal, riveting sets punches.

- Calculate the length, diameter of rivet and head.
- Procedure of the riveting and the joints mistakes.

Unit 9. Solder and soldering [1 Hour]

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

- Select the source of heat and temperature.
- The process of cleaning and the joining work metal.
- Care and the prevent accident, safely uses of the equipments.

Unit 10. The sheet metal work [6 Hours]

10.1: Hand tool metal

- Identify the types of the sheet metal, mild steel, galvanized steel, copper, brass, aluminum familiar with sizes and thickness of the sheet metals.
- Measure the sheet with the guage and instruments.

10.2: Marking tools

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

10.3: Power tools

- Identify the bending, rollers, folders, and edge forming, sawing, crimping, spot welding and polishing parts.
- Understand, select, adjust, controls and to operate the power tools, cut the sheet for final shape or the forming.

10.4: Development sheet

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

10.5: Sheet metal joining

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

10.6: Safety

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

Unit 11. Introduction to are welding [2 Hours]

11.1: Introduction to are welding

11.2: Arc column theory

11.3: Power sources for arc welding

11.4: Safety precautions in arc welding

11.5: Arc welding machines: types, uses and care

11.6: Problems in welding machines: troubles, causes and remedies.
11.7: Arc welding machine accessories and operators' accessories.
11.8: Arc welding electrode: classification, application and uses

Unit 12. Introduction to oxyacetylene (Gas) welding: [2 Hours]

12.1: Oxy-acetylene welding principle. Oxy-acetylene welding
12.2: Advantages and application of oxy-acetylene welding.
12.3: Safety precaution in oxy-acetylene welding
Personnel safety, fire prevention, care of cylinders, hoses, acetylene generators, lighting of welding torch

Unit 13. Brazing: [2 Hours]

13.1: Brazing principle, application and advantages
13.2: Brazing equipment and materials.
13.3: Brazing procedures
Requirement for a successful brazing, Brazing operation, suitable joint design brazing.

Unit 14. Forging [2 Hours]

14.1 Introduction to forging
14.2: Introduction to hand forging, its application and advantages, safety in forging practice.
14.3: Hand forging tools: nomenclature, application and care.
14.4: Forging operation: bending, cutting down, setting down, swaging, squeezing upsetting, punching and drifting, forge welding.
14.5: Heat treatment of forged materials:
Introduction to heat treatment, annealing, hardening, tempering

Unit 15. Foundry: [2 Hours]

15.1: Introduction to foundry practice
15.2: Development, advantages and uses of casting
15.3: Safety in foundry practice
15.4: Sand casting
15.5: Pattern making
15.6: Material for pattern
15.7: Consideration of draft and shrinking of metal
15.8: Sand molding hand tools
15.9: Sand molding process
15.10: Core making
15.11: Melting furnace:- construction and uses
15.12: Cupola, introduction and crucible furnace
15.13: Safety clothing, melting of metal, pouring temperature and superheat, the ladle, pouring the melted metal into the mold, cleaning the casting.

Practical

S.N.	Task practical	Time: 150 hrs	Remark key point
1	Marking : straight, curve, dot	5 hrs	
2	Measuring: rules, vernier caliper, gauge	10 hrs	
3	Hammering by ball, cross, soft straight pin	5 hrs	
4	Sawing by hand saw power	8 hrs	
5	Filling with single , double and rasp cut	25 hrs	
6	Chiseling by the flat, cross, concave, power chisel	5 hrs	
7	Reamering: Hand and adjustable	2 hrs	
8	Threading: Tap and dies	3 hrs	
9	Scrapping: Flat and curve on the metal surface	2 hrs	
10	Riveting: Riveting sets pup riveter	5 hrs	
11	Soft soldering: Solder, heat joint metal	5 hrs	
12	Shearing: Snip, press folds	5 hrs	
13	Bending by pliers, range, hand, bar, fork and power tools	5 hrs	
14	Holding: Bend, machine pipe and the devices	5 hrs	
15	Power tools operating: Drill, folding, rolling, radius bending, spot welding, grinding, beading, creping, edge forming, hacksaw machines	15 hrs	
16	Drilling: Counter sink, counter boring, reaming, thread cutting	5 hrs	
17	Sheet metal working: Hands pipe bend plot, blow horn, groove and seaming	5 hrs	
18	Developing: Patterns, templates, for the sheet boxes, book stand, scoop funnel, pipe and the machine guards	5 hrs	

References:

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

Second Semester
Subjects:

EG1201 SH	**Engineering Mathematics II**
EG1202 SH	**Engineering Physics II**
EG1203 SH	**Engineering Chemistry II**
EG1211 CT	**Computer Application**
EG1212 EE	**Safety Rules and Regulations**
EG1213 EE	**Workshop Practice II**
EG1214 EE	**Engineering Drawing II**
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 Publicartion House, Dillibazar, Kathmandu
2. A Text book of Statistics – B.C. Bajracharya
3. Elementary Statistics – H. C. Saxena
4. Statistical Methods – Mrigendralal Singh
5. Engineering Mathematics I, Hari Nandan Nath, Parishowar Acharya, Vudhyarthi Publisher and distributors, Bhotahity, Kathmandu
6. References to be selected by the related lecturer(s) from among the texts available in the market that meet the content needs of this subject.
7. The related institute may develop its own textbook and approve from the related authority so as to have a prescribed textbook of this subject

Engineering Physics II

EG 1202 SH

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 of Huygen's principle.
- Polarization and un polarized lights, polarization by reflection(Brewster's law)

Unit 3. Properties of matter: [10]

3.1 Elasticity:

- Elasticity, Hook's law, Young's modules, Bulk modulus
- Elasticity of shear.

3.2 Surface tension:

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

3.3 Viscosity:

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

Unit 4. Modern physics: [10]

4.1 Atomic physics:

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

4.2 Semiconductors:

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

4.3 Nuclear physics:

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

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

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

Learning materials:

Text books:

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

Text book for laboratory work:

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

Other learning materials:

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

Engineering Chemistry II

EG 1203 SH

Total: 6 hour /week

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

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

Practical: hours/week

Lab: 2 hours/week

Course Description:

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

Course Objectives:

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

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

Course Content:

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

1.1 Water:
- Source of water
- Hard and soft water
- Removal of temporary and permanent hardness of water
- Water treatment of domestic and industrial purpose

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

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

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

1.5 Hydrochloric acid:

- Lab preparation
- Properties and uses

1.6 Hydrogen Sulphide:
- Lab preparation
- Properties and uses

1.7 Sulphuric acid:
- Manufacture by contact process)
- Properties and uses

1.8 Carbon and its compounds:
- Allotropes of carbon (reference of diamond & graphite & their structure).
- Oxides of carbon (Ref. carbon dioxide & carbon mono oxide as pollutants)- general idea only

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

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

2.2 Alkali metals:
- General characteristics of Alkali metals
- Properties & uses of sodium

2.3 Alkaline earth metals:
- General characteristics of the Alkaline earth metals
- Properties & uses of calcium

2.4 Aluminum:
- Properties and uses

2.5 Coinage metals:
- General properties of coinage metals
- Properties and uses of cupper

2.6 Zinc:
- Properties & uses

2.7 Iron:
- Properties & uses

2.8 Lead:
- Properties & uses

2.9 Alloys:
- Definition
- Purpose of making alloys
- Types of alloys

Unit: 3: Organic compounds and synthetic materials: [10]

3.1. Organic compounds
- Organic compounds:
  - Historical background, classification, and nomenclature
  - Functional groups and homologous series
- Saturated hydrocarbon: Properties of Methane

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

3.2. **Synthetic materials:**

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

Engineering Chemistry Practical II:

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

Textbooks:

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

Computer Application

EG 1211 CT

Total: 4 hour /week
Year: I **Lecture: 2 hours/week**
Semester: II **Tutorial: hours/week**
Practical: 2 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** Hours**]**

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

Unit 2 Hardware Components **[6** Hours**]**

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

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

Unit 3 Introduction to Operating System Software **[6 Hours]**

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

Unit 4 Application Packages [8 Hours]

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

4.4 Concept of Database management system
4.5 Database management package: Microsoft Access
4.6 Presentation Package: Microsoft PowerPoint

Unit 5 Utility Programs [2 Hours]

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

Unit 6 Computer Networking and Data Communication [4 Hours]

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 (30 Hours)

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

9. Project Work (2 sessions)
   The students will be assigned (individually or in group) a project work based on Microsoft Excel or Access. The students are required to prepare a short report in MS Word and prepare a short presentation in PowerPoint.

Textbooks:

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

Reference books:

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

Safety Rules and Regulations

EG 1212 EE

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 Contents

Unit 1: Safe use of Electrical components [6 Hours]
- 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 Hours]
- 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 Hours]
- 3.1 Connecting a non current carrying parts of electrical equipment to ground
- 3.2 Concept of 3-pin plug for high rating equipments
- 3.3 Touch and step potential
- 3.4 Various types of electrodes used for earthing
- 3.5 Earthing mat
- 3.6 Concepts of instruments used for earth resistance measurement

Unit 4: Fire hazards and fire fighting techniques **[8 Hours]**

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

Workshop Practice II

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 selection, use of basic tools, measuring equipment and wiring accessories for incandescent as well as fluorescent lighting using different control methods

Course objectives

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

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

Course Contents

Unit 1: **[8 Hours]**

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: **[8 Hours]**

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 Hours]**

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: **[8 Hours]**

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: **[8 Hours]**

L: Introduction of mutual, gang call system.

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

Unit 6: **[8 Hours]**

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: **[8 Hours]**

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: **[8 Hours]**

L: Methods of addition, renovation of lighting work.

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

Unit 9: **[8 Hours]**

L: Behaviour of lamps in series and parallel connection

P: Installation of two lamps controlled by one switch.

Unit 10: **[8 Hours]**

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: **[8 Hours]**

L: Method of lamp controlled from multi places

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

Unit 12: **[8 Hours]**

L: Introduction of flourescent lamp.

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

Unit 13: **[8 Hours]**

L: Introduction of ring circuit.

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

Unit 14: **[8 Hours]**

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: **[8 Hours]**

L: Introduction of capacitor connection with tube set

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

References:

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

Engineering Drawing II

EG 1214 EE

Total: 4 hour /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 (mainly on electro-mechanical parts).

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 Contents

Unit 1: Sectional Views [28 Hours]

1.1 Use of sectional views
1.2 Cutting plane line and hatching lines
1.3 Types of Section: Full section and Half Section
1.4 Exercises on Full Section [Sheet 1]
1.5 Exercises on Half Section [*Sheet 2]*
1.6 Exercise of full section of squirrel cage induction rotor with cooling fan [*Sheet 3]*
1.7 Exercise of full section of single phase induction startor with & without winding [*Sheet 4]*
1.8 Exercise of full section of sheded pole motor and slip ring motor [*Sheet 5]*
1.9 Exercise of half section of salient pole alternator [*Sheet 6]*
1.10 Exercise of half section of three phase transformer [*Sheet 7]*
1.11 Exercise of full / half section of pen stoke with pelton turbine[*Sheet 8]*

Unit 2: Pictorial Projection: Isometric Drawing [8 Hours]

2.1 Introduction to Axonometric projection
2.2 Isometric projection and isometric drawing
2.3 Procedure of Making an Isometric Drawing
2.4 Non isometric Lines and Non isometric surfaces
2.5 Box and coordinate construction method
2.6 Angles in isometric
2.7 Circles and circular arcs in isometric

2.8 Orientation of object in isometric drawing
2.9 Exercise on isometric drawing of objects with horizontal and vertical planes [*Sheet 8]*
2.10 Exercise on isometric drawing of objects with cylindrical surfaces and cylindrical holes [*Sheet 9*]

Unit 3: Oblique Drawing [4 Hours]

3.1 Oblique projection and Oblique drawing
3.2 Procedure of Making an Oblique Drawing
3.3 Rules for Placing Object in Oblique
3.4 Angles, Circles and Circular Arcs in Oblique
3.5 Cavalier and Cabinet Projection
3.6 Exercise on oblique drawing of objects with plane and curved surfaces [Sheet 10]

Unit 4: Surface Development [8 Hours]

4.1 General concepts and practical considerations
4.2 Development of Right solids: Cylinder, Prism, Cone and Pyramid
4.3 Development of Oblique solids: Cylinder, Prism, Cone and Pyramid
4.4 Development of Truncated solids
4.5 Exercise on development of truncated right prism and cylinder [Sheet 11]
4.6 Exercise on development of oblique solids [Sheet 12]

Unit 5: Intersection of solids [8 Hours]

5.1 Lines of intersection of geometric surfaces
5.2 Intersection of two cylinders
5.3 Intersection of two prisms
5.4 Intersection of a prism and a cylinder
5.5 Intersection of a prism and a pyramid
5.6 Intersection of a prism and a cone
5.7 Intersection of a cylinder and a cone
5.8 Intersection of a cylinder and a pyramid
5.9 Exercise on intersection of two cylinders, intersection of a prism and a pyramid, intersection of a prism and a cone [*Sheet 13*]
5.10 Exercise on intersection of a cylinder and a cone, intersection of a cylinder and a yramid [Sheet 14]

Unit 6: Pattern Making [8 Hours]

6.1 Pattern of three dimensional solids
6.2 Pattern of geometrical solids
6.3 Pattern of intersecting solids
6.4 Exercise on patterns of any two solid objects from Sheet 1 and 2 [*Sheet 15*]

References:

1. Luzadder, W.J., Fundamental of Engineering Drawing, Prentice-Hall of India Pvt-Ltd., New Delhi, Latest edition.
2. Bhatt N. D. and PanchalV.M., Engineering Drawing, Charotar Publishing House, 2001.
3. Gill P.S, Engineering Drawing, S. K. Kataraia & Sons, New Delhi, 2004/2005
4. Surjit Singh- General Electrical Drawing – S.K. Kataria and sons

Principles of Electrical Engineering

EG 1215 EE

Total: 7 hour /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. Explain the electromagnetic phenomena and its applications.

Course Contents

Unit 1: Basic Concept of Electricity **[10 Hours]**
- 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
- 1.8. Electric power and energy

Unit 2: Electric Circuit Fundamentals **[12 Hours]**
- 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 Hours]**
- 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 Hours]

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 Hours]

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 [6 Hours]

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 Exercise [30 Hours]

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
(Third and Fourth Semesters)

Third Semester

Subjects:

EG 2111 CT	**Computer Programming**
EG 2112 EX	**Basic Electronics**
EG 2113 EX	**Digital logic**
EG 2114 EE	**Electrical and Electronic Engineering Material**
EG 2115 EE	**Electric Circuit Theory**
EG 2116 EE	**Electrical Installation I**
EG 2118 EE	**Electrical and Electronic Engineering Drawing EG**
EG 2107 ME	**Elements of Engineering Economics**

Computer Programming

EG 2111 CT

Total: 4 hour /week
Year: II **Lecture: 2 hours/week**
Semester: I **Tutorial: hours/week**
Practical: 2 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 Contents

Unit 1. Programming Fundamentals [4 Hours]

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 Hours]

2.1 C language basics
2.2 Data type
2.3 C operators
2.4 Input/Output statements
2.5 Built-in functions and inclusion of header files.

Unit 3. Control statements and loops [8 Hours]

3.1 Conditional operators
3.2 if, if – else, switch statements
3.3 for loop
3.4 while, do – while loops
3.5 Nested loops

Unit 4. Arrays and strings [4 Hours]

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 Hours]

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 Hours]

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 Hours]

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 [30 Hours]

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)

Textbooks:

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

Reference books:

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

Basic Electronics

EG 2112 EX

Total: 6 hour /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 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 linear circuits.

Course objectives

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 Contents

Unit 1. Introduction : [1 Hour]

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 Hours]

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 Hours]

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 Hours]

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

Unit 5. Semiconductor diode [4 Hours]

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 Hours]

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 Hours]

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 over heating.

Unit 8. RC coupled small signal common emitter amplifier [3 Hours]

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 Hours]

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

Laboratory Experiments [45 Hours]

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.

References:

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

Digital Logic

EG 2113 EX

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

Course description

This course deals with the study and design of devices/equipment that are based on digital techniques.

Course objectives

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

1. Learn design methods for combinational logic circuit,
2. Verify truth tables of basic gates universal gates
3. learn design concert of sequential logic circuits
4. Design problem based / predefined logic based circuits

Course Contents

Unit 1. Introduction **[2 Hours]**

1.1 Analog Signal and Digital Signal
1.2 Advantages of Digital over Analog Signals
1.3 Representation of Digital Signal
1.4 Applications of Digital Signal

Unit 2. Number Systems and Codes **[3 Hours]**

2.1 Two State Devices
2.2 Decimal Number System
2.3 Binary Number System
2.4 Octal Number System
2.5 Hexadecimal Number System
2.6 Conversions among Different Number Systems
2.7 Fractions Conversion
2.8 BCD Code
2.9 Gray Code
2.10 Alphanumeric Code
- ASCII Code
- EBCDIC Code

Unit 3. Arithmetic Logic Operations **[6 Hours]**

3.1 Binary Arithmetic
- Binary Addition
- Binary Subtraction
- Binary Multiplication
- Binary Division

3.2 9's and 10's Complement Method
- 9's Complement Subtraction
- 10's Complement Subtraction

3.3 1's Complement and 2's Complement Method
- 1's Complement Subtraction
- 2's Complement Subtractio

Unit 4. Logic Gates [7 Hours]

4.1 Basic Gates: AND, OR, NOT
4.2 Universal Gates: NAND, NOR
4.3 Exclusive Gates: XOR, XNOR
4.4 Logic Equations
4.5 Truth Tables
4.6 The Universal Properties of the NAND Gates
4.7 The Universal Properties of the NOR Gates
4.8 Pulse Operation in Logic Gates
4.9 Combination of Logic Gates
4.10 Building Logic Circuits from Logic Equations
4.11 Forming Logic Equations from Logic Circuits

Unit 5. Boolean Functions and Logic Simplification [7 Hours]

5.1 Boolean Algebra and its Properties/Laws
5.2 Boolean Expression in Logic Gates
5.3 Simplification of Boolean Expressions
5.4 DeMorgan's Theorems
5.5 Karnaugh Map
- K-Map Simplification for Two Input Variables
- K-Map Simplification for Three Input Variables
- K-Map Simplification for Four Input Variables

5.6 Sum of Product (SOP) Simplification
5.7 Product of Sums (POS) Simplification
5.8 Maps with *Don't Care* Conditions

Unit 6. Combinational Logic Circuits [9 Hours]

6.1 Adders
- Half Adder
- Full Adder
- Parallel n-Bit Adders

6.2 Subtractors
- Half Subtractors
- Full Subtractors
- Parallel n-Bit Subtractors

6.3 Encoders
- Decimal to Binary Encoder
- Decimal to BCD Encoder
- ASCII Encoder
- Encoder IC Packages

6.4 Decoders
- Binary to Decimal Decoder
- Four Bit Binary Decoder
- BCD to Decimal Decoder
- Seven Segment Display Decoder
- Decoder IC Packages

6.5 Multiplexers
- Data Transmissions
- 4-to-1 Multiplexer
- 8-to-1 Multiplexer

- Multiplexer IC Packages

6.6 Demultiplexers

- Demultiplexer and Decoder Relations
- 1-to-4 Demultiplexer
- 1-to- 16 Demultiplexer
- Demultiplexer in IC Packages

Unit 7. Sequential Logic Circuits [9 Hours]

7.1 Latch and Flip-Flops

- RS Flip-Flop and its Truth Table
- D Flip-Flop and its Truth Table
- JK Flip-Flop and its Truth Table
- T Flip-Flop and its Truth Table
- Master-Slave Flip-Flops
- Applications of Flip-Flop

7.2 Shift-Registers

- Flip-flop as a One-bit Memory Device
- Right/Left Shift Registers
- Serial-in Serial-out (SISO) Shift Register
- Serial-in Parallel-out (SIPO)Shift Register
- Parallel-in Serial-out (PISO)Shift Register
- Parallel-in Parallel-out (PIPO)Shift Register
- Applications of Shift Registers

7.3 Counters

- Synchronous Counters
- Ripple Counters
- M- Modulus Counters
- Decade Counters
- Ring Counters
- Applications of Counters

Unit 8. Digital Displays [3 Hours]

8.1 LED Display
8.2 LCD Diplay
8.3 Gas Display
8.4 7-Segment Display
8.5 Alphanumerical Display
8.6 Digital Clock Display Design

Laboratory **(45 Hours)**

1. Experiments on logic operation and verify with truth tables of basic gates: AND, OR, NOT, NAND, NOR
2. Verify the universal properties of the NAND gate and NOR gate.
3. Experiments on logic operation and verify with truth tables of basic gates: XOR, XNOR Gates.
4. Building logic circuits from logic equations
5. Realize the pulse operation in different logic gates
6. Realize and verify truth tables applying DeMorgan's Theorems
7. Realize and verify truth tables of binary half adder/Subtractor and full adder/Subtractor
8. Realizing the function of decimal to 3-4 bit binary binary encoder
9. Realizing the function of 4 bit binary binary decoder
10. Realizing the function of 4-to-1 multiplexer and 1-to-4 demultiplexer circuits.
11. Realizing the function of latches and flip-flops, RS,D,JK,T flip-flops
12. Realizing the function shift-registers: SISO, SIPO, PISO and PIPO
13. Realizing the function ripple counters
14. Realizing the function synchronous counters
15. Realizing and designing of seven-segment display-decoder logic circuit

References:

1. Principle of Digital Electronics- P. Malvino
2. Digital Fundamentals- T. Flyod
3. Logic Circuits- M.Mano

Electrical and Electronics Engineering Material

EG 2114 EE

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 imparts knowledge on the properties of Magnetic, Resistor, Dielectric and Semiconductor materials from the peripherals of electrical engines.

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. Understand dielectric, Dielectric, Resistor alloys

Course Contents

Unit 1. Magnetic material [24 Hours]

1.1 Classification based on ferrous material and non-ferrous material
1.2 Use and their characteristics
1.3 B-H characteristics
1.4 Electrical characteristic
1.5 Forms of steels
1.6 Hysteresis loop, eddy current losses
1.7 Magnetic dipole moment
1.8 Magnetising field or magnetic field intensity
1.9 Magnetic permeability and susceptibility
1.10 Domain structure
1.11 Corrosion of ferrous materials, causes, effects and methods of prevention
1.12 Electrical characteristics and typical application of commonly used non-ferrous materials and their alloy (copper, aluminium, brass, bronze, silver, gold)
1.13 Carbon as an electrical material, its product (brushes) and application
1.14 Forms of non-ferrous material
1.15 Chemical/corrosion characteristics of some commonly used non-ferrous metals

Unit 2. Resistor alloys [4 Hours]

2.1 Description of commonly used resistors, alloys of Nickel, Iron, Chromium, Aluminium, their mechanical and electrical characteristics and industrial application

Unit 3. Dielectric materials [18 Hours]

3.1. Definition of dielectric, macroscopic approach
3.2. Polarization, Dielectric constant, Electric Dipole moment, Electronic polarization, Ionic polarization
3.3. Dielectric losses, frequency and temperature effects
3.4. Dielectric breakdown
3.5. Dielectric breakdown in gases
3.6. Dielectric breakdown in liquids

3.7. Dielectric breakdown in solids
3.8. Ferro electricity and Piezo-electricity
3.9. Properties of some dielectric materials
3.10. Insulating materials
3.11. Identification of insulating materials in general uses and their characteristics
3.12. 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 Hours]

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
4.9. Fermi level

References:

1. Electrical engine mater by 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:

1. Understand the basic circuit theorems and their application for analysis of DC networks
2. Gain the fundamental knowledge of AC circuits and analysis of AC networks
3. Understand the 3 phase AC systems and their application

Course Contents

Unit 1: DC Network Theorems and Circuit Analysis [12 Hours]

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 Hours]

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 [12 Hours]

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 embalanced load in three phase system, current through the neutral.
3.5 Star delta or delta star conversion.
3.6 Related numerical problems.

Practical [45 Hours]

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

Electrical Installation I

EG 2116 EE

Total: 7 hour /week
Year: II **Lecture: hours/week**
Semester: I **Tutorial: hours/week**
Practical: 7 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 Contents

Unit 1. PVC Conduit wiring preferably in Cubical [14 Hours]

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 out put. 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 [7 Hours]

2.1 Introduction of different types of light fixtures – their comparison and application (incandencent 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 incandencent 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 [7 Hours]

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 Hours]

4.1 Preparation of connection diagram and description of MCB, DB, and kWh meter, power circuit – Nos. of socket, light circuit, nos 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 Hours]

5.1 Purpose of earthing, Earth loop impedence, 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, recomended ohm, correction.

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

Unit 6. Wiring Project in Cubical [7 Hours]

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 flouresent lamps, celling dome, wall bracket, call bell, power sockets, dimmer, regulator

Unit 7. Installation Testing [7 Hours]

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

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

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

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 Hours]

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

Unit 10. Use of DOL starter for 3 phase motor

10.1 Connect and start 3 ph. Squarrel cage induction motor (up to 3HP) using drum type ON/OFF switch and HRC/MCB fuses (use conduit wiring system)

10.2 Function, position of switch, motor coils,**Y** connection, Δ connection, name plate, Direction

Unit 11. Use of reversible starter for three phase motor [7 Hours]

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

Unit 12. Star/Delta starting of 3 phase motors. [7 Hours]

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

Unit 13. Connection of meter and indicator [7 Hours]

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

Unit 14. Observation visit [7 Hours]

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

References:

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

Electrical & Electronics Engineering Drawing

EG 2118 EE

Total: 4 hour /week

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

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

Practical: 4 hours/week

Lab: hours/week

Course description

This course deals with ISO standard symbols of electrical/electronic and digital components, simple electrical and electronics circuits and block diagram of some domestic consumable electronics equipment as well as with lighting, D.C. motor, D.C. generator, motor winding diagrams distribution diagrams

Course objectives

On completion of this course the students will able to:

1. Understand describe and use electrical and electronic symbols.
2. Draw basic electrical/electronic symbols (standard / freehand)
3. Draw free hand sketches of components, equipments and electrical/electronic circuits.
4. Interpret the circuit diagrams and block diagrams.
5. Prepare the layout and wiring diagrams for buildings and equipment.
6. Prepare schematic diagrams from wiring diagrams.

Course Contents

1 Basic symbols used in electrical and electronics circuits diagrams: **[4 Hours]**

1.1 Introduction to subject, size of drawing sheet, type of diagrams, drawing symbols fuses, relays, switches, circuit-breakers, motors, generators, transformers, earthings, lamps, tube lights etc.

2 Basic symbols used in electronic circuits : **[3 Hours]**

2.1 Active components as semiconductor devices (transistors PNP/NPN, diodes, SCR, MOSFET, CMOS, JFET, FET, thyristers.

2.2 Digital electronic devices such as gates(AND,OR,NOT, NAND, NOR, XOR, XNOR, Flip-Flpos)

3 Passive components such as Resistors, capacitors, Inductors, Variable resisters and capacitors. **[3 Hours]**

4 Draw simple, two way and intermediate switches connection for building lighting and impulse relay and timer for street lighting **[4 Hours]**

5 Circuit diagram of simple measuring instruments. **[10 Hours]**

5.1. Multi-range voltmeter

5.2. Multi-range ammeter

5.3. Multi-range ohmmeter

5.4. Conversion of galvanometer to

- Voltmeter
- Ammeter

6. Draw connection diagram of DC generator and its control circuit
a) Separately excited b) Series c) Shunt d) Compound wound **[4 Hours]**

7. Draw connection diagram of DC rotor and its control circuit
   a) Series b) Shunt c) Compound wound **[4 Hours]**
8. Draw connection and diagram of capacitor start, capacitor run and capacitor start and Run single phase motor. **[4 Hours]**
9. Draw detail panel board fabrication diagram of 250 Amp incoming MCCB – **[4 Hours]**
   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
10. Draw connection diagrams for 3-phase, 5 hp380v delta connected squirrel age induction motor controlled by a star/delta rotary switch and fuses. **[4 Hours]**
11. 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 Hours]**
12. 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 brake **[4 Hours]**
13 Draw wiring and connection diagram of substation with incoming and outgoing 11Kv OCBS, its control and differential protection. **[4 Hours]**
14. Draw block diagram of basic computer and computer monitor. **[4 Hours]**

References:

1. Electrical circuit and machines – E.C Lister
2. Practices and procedures of Industrial Electrical design – L.B. Roe
3. Electrical engineering design manual – M.G.Say
4. General Electrical Drawing – Surjit Singh
5. Electrical Motor repair – Robort Rosenberg

Elements of Engineering Economics

EG 2107 ME

Total: 2 hour /week

Year: II **Lecture: 2 hours/week**

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

Practical: hours/week

Lab: hours/week

Course description

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

Course objectives

After completing this course the students will be able to

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

Course Contents

Unit 1: Introduction to Engineering Economics [2 Hours]

1.1 Role of engineering/technical manpower in organization

1.2 Types of engineering economic decision

Unit 2: Brief understanding of Financial Statements [4 Hours]

2.1 Familiarization with balance sheets, income statement and cash-flow statement components

2.2 Calculation of financial ratios and their familiarization

2.3 Related numerical problems on 2.1 and 2.2

Unit 3: Cost and Revenue [2 Hours]

3.1 The elements of cost

3.2 Direct cost, Indirect cost and Overhead cost allocation

3.3 Job and Process costing

3.4 Revenue and its types

3.5 Related numerical problems on 3.2 and 3.3

Unit 4: Time value of Money, Interest Rate and Depreciation concept [4 Hours]

4.1 Time value of Money

4.2 Simple and compound interest rates, effective interest, and continuous compound interest

4.3 Depreciation methods, straight line, declining balance method

4.4 Related numerical problems on 4.2 and 4.3

Unit 5: Types of cash Flows and their Formulas [4 Hours]

5.1 Types of cash flows and its significance

5.2 Single cash flow formulas

5.3 Uneven cash flow series

5.4 Equal cash flow series

5.5 Linear gradient series

5.6 Geometric gradient series

5.7 Related numerical problems on 5.2, 5.3, 5.4, 5.5 and 5.6

Unit 6: Economic Equivalence of projects [2 Hours]

6.1 Definition and simple calculations

6.2 General observation about equivalence calculations

6.3 Related numerical problems on 6.1

Unit 7: Project Evaluation Techniques [8 Hours]

7.1 Initial Project screening methods

- Payback period
- Benefits and flaws of payback period method

7.2 Net Present Value (NPV) analysis

- Net Present Value criterion
- The meaning of Net Present Value

7.3 Future Value and Annual Equivalent analysis

7.4 Internal Rate of Return (IRR) analysis

7.5 Comparing revenue and service projects, projects with different analysis period and project live

7.6 Related numerical problems on 7.1, 7.2, 7.3, 7.4 and 7.5

Unit 8: Benefit and Cost Analysis [3 Hours]

8.1 Calculation of Benefits and Costs

8.2 Definition on Benefit-Cost (B/V) ratio

8.3 Relation between B/C ratio and NPV

8.4 Related numerical problems on 8.1

Unit 9: Project Risk [3 Hours]

9.1 Definition of project risk

9.2 Sensitivity analysis

9.3 Breakeven analysis

9.4 Scenario analysis

9.5 Related numerical problems on 9.2, 9.3 and 9.4

Suggestions for instructions:

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

References:

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

Fourth Semester

Subjects:

EG 2206 SH	**Social Studies**
EG 2211 EE	**Computer Aided Drawing**
EG 2203 EX	**Introduction to Microprocessors**
EG 2213 EX	**Basic Programmable Logic Control (PLC)**
EG 2215 EE	**Electrical Machines I**
EG 2216 EE	**Electrical Measurements and Measuring Instruments**
EG 2217 EE	**Transmission and Distribution of Electrical Power**
EG 2218 EE	**Repair and Maintenance of Winded Machine**

सामाजिक अध्ययन

ई.जी. २२०६ एस.एच.

वर्ष : दोस्रो
सेमेष्टर : दोस्रो

जम्मा : २ घण्टा/ हप्ता
प्रवचन : २ घण्टा/ हप्ता
विशेष : घण्टा/ हप्ता
प्रयोगात्मक : घण्टा/ हप्ता
प्रयोगशाला : घण्टा/ हप्ता

पाठ्यक्रमको परिचय :

सामाजिक अध्ययन विषयको पाठ्यक्रमको मूल उद्देश्य नेपालको वस्तुस्थिति विशेषतः भौगोलिक जानकारी संक्षेपमा दिई प्राविधिक विद्यार्थीहरूलाई नेपालका विविध पक्षबाट परिचित गराउनु हो । सामाजिक अध्ययनको पाठ्यक्रम डिप्लोमा इन्जिनियरिङ तहमा पढ्ने विद्यार्थीहरूका लागि इतिहास, संस्कृति, भूगोल, अर्थशास्त्र, राजनीतिशास्त्र, समाजशास्त्र, मानवशास्त्र, जनसंख्या शिक्षा, वातावरण शिक्षा आदिका विषयवस्तुलाई एकीकृत गरी निर्माण गरिएको छ ।

पाठ्यक्रमको उद्देश्य :

यस पाठ्यक्रमको अध्ययनपछि मध्यम स्तरीय प्राविधिक विद्यार्थीहरू निम्नलिखित विषयमा सक्षम हुनेछन् :

क) विश्वमानचित्रमा नेपालको परिचय दिन ।
ख) नेपाल शब्दको उत्पत्तिबारे जानकारी दिन ।
ग) सामाजिक विज्ञान-मानव र समाजको सामान्य जानकारी दिन ।
घ) नेपालको आर्थिक व्यवस्थाको विशेषताहरूसहित कृषि, व्यापार, उद्योग, यातायात, सञ्चारको सामान्य परिचय दिन ।
ङ) नेपालको छिमेकी तथा मित्रराष्ट्र भारत र चीनसँगको सम्बन्धको छोटकरीमा परिचय तथा असंलग्न परराष्ट्र नीति, संयुक्त राष्ट्रसंघ, सार्कबारे छोटकरीमा जानकारी गराउन ।
च) नेपालको शासन व्यवस्थाका प्रमुख अङ्गहरू र संविधान, विकेन्द्रीकरणको सामान्य परिचय दिन ।
छ) सामाजिक तथा सांस्कृतिक परिवर्तनसम्बन्धी जानकारी दिन ।
ज) वातावरण, सामाजिक सेवा र सामुदायिक विकास, सामाजिक अनुसन्धान, जनसंख्या शिक्षासम्बन्धी सामान्य जानकारी दिन ।

एकाइ	पाठ्यांश विवरण	पाठ घण्टा
१.	**सामाजिक अध्ययन तथा सामाजिक विज्ञानको परिचय**	४
	क) सामाजिक अध्ययनको अर्थ, क्षेत्र, महत्व	२
	ख) सामाजिक अध्ययनको सामाजिक विज्ञानसँग सम्बन्ध	
	ग) सामाजिक अध्ययनको अन्य विषयसित सम्बन्ध	
	घ) सामाजिक अध्ययन र सामाजिक विज्ञानबीच भिन्नता	
	ङ) समाजशास्त्र र ग्रामीण समाजशास्त्रको परिचय	१
	च) समाजशास्त्रको प्रकृति र वैज्ञानिक पद्धति	
	छ) सामाजिक विज्ञान र भौतिक विज्ञानबीचको अन्तर	
	ज) विज्ञान र इन्जिनियरिङ	१
	झ) विज्ञान र प्रविधि	
	ञ) विज्ञान र धर्म	
	ट) विज्ञान र समाज	
२.	**मानव र समाज**	२
	क) समाज, संस्कृति र व्यक्तित्व, बानी, परम्परा र फेसन	१
	ख) जाति, भाषा, धर्म, पेसा, रहनसहन र चाडपर्व	१
	ग) समाजमा महिलाहरूको स्थिति	
३.	**सामाजिक तथा सांस्कृतिक परिवर्तन**	४

	क) सामाजिक तथा सांस्कृतिक परिवर्तनका अर्थ	१
	ख) सामाजिक तथा सांस्कृतिक परिवर्तनका सिद्धान्तहरू	
	ग) सामाजिक परिवर्तनको विशेषताहरू	१
	घ) सामाजिक र सांस्कृतिक परिवर्तनका कारक तत्वहरू	
	ङ) औद्योगिकीकरण र सामाजिक परिवर्तन	१
	च) ग्रामीण सामाजिक जनजीवनमा प्रविधिको प्रभाव	
	छ) औद्योगिक र ग्रामीण समाजका विशेषताहरू	१
	ज) सहरीकरण	
४.	वातावरण र पर्यावरण	**१**
	क) वातावरण र पर्यावरणको अर्थ	
	ख) वातावरण संरक्षणको आवश्यकता र महत्व	
५.	**सामाजिक सेवा र सामुदायिक विकास**	**२.५**
	क) सामुदायिक विकास परियोजनाको अर्थ र उद्देश्य	१
	ख) सामुदायिक विकास कार्यक्रम	
	ग) जनसहभागिता र सामुदायिक विकास	०.५
	घ) सामाजिक सेवाको अर्थ, क्षेत्र र उद्देश्य	१
	ङ) सामाजिक कार्यकर्ताको अर्थ, प्रकार, गुण र भूमिका	
६.	**सामाजिक अनुसन्धान**	**२**
	क) परिभाषा, प्रकृति, उद्देश्य र प्रकार	०.५
	ख) सामाजिक अनुसन्धानका प्रेरकताहरू	१.५
	ग) सामाजिक अनुसन्धानका प्रमुख चरण	
	घ) सामाजिक अनुसन्धान प्रतिवेदन तयार गर्ने ढाँचा	
७.	**हाम्रा स्रोतहरू**	**२**
	क) मानवशक्ति	१
	ख) जलस्रोत	
	ग) भूमि	
	घ) वनसम्पदा	०.५
	ङ) खनिजशक्ति	
	च) सौर्यशक्ति	०.५
	छ) वायुशक्ति	
८.	नेपाल शब्दको उत्पत्ति	**१**
९.	विश्वमानचित्रमा नेपाल	**१**
१०.	**आर्थिक अवस्था**	**२**
	क) कृषि, व्यापार, उद्योग, यातायात र सञ्चारको महत्व	१
	ख) आर्थिक व्यवस्थाका विशेषताहरू	१
	कृषिजन्य अर्थव्यवस्था, मिश्रित अर्थव्यवस्था, साझा अर्थव्यवस्था, योजनाबद्ध विकास	
११.	**परराष्ट्र नीति**	**३**
	क) नेपालको असंलग्न परराष्ट्र नीतिको अर्थ	१
	ख) नेपालको परराष्ट्र नीतिका विशेषताहरू	
	ग) नेपाल भारत सम्बन्ध	०.५
	घ) नेपाल चीन सम्बन्ध	०.५
	ङ) संयुक्त राष्ट्रसंघ र नेपाल	१
	च) सार्क र नेपाल	
१२.	**शासन व्यवस्था**	**३.५**
	क) व्यवस्थापिका	०.५
	ख) कार्यपालिका	०.५
	ग) न्यायपालिका	०.५
	घ) संविधान, संविधानसभा, अन्तरिम संविधानको छोटो परिचय	१
	ङ) नेपाल अधिराज्यको संविधान २०४७ को विशेषताहरू	०.५

	च) विकेन्द्रीकरण, महत्व, आवश्यकता र विशेषताहरू	०.५
१३.	**जनसंख्या शिक्षा**	**२**
	क) जनसंख्या शिक्षाको परिचय	१
	ख) जनसंख्या शिक्षाको उद्देश्यहरू	
	ग) जनसंख्या वृद्धि र नियन्त्रण	१

पाठ्यपुस्तक

१. सामाजिक अध्ययन, सिद्धीश्वरमान श्रेष्ठ, डा. राजेन्द्रप्रसाद अधिकारी, सावित्री श्रेष्ठ, अक्षलोक, प्रकाशन, काठमाडौँ ।

सन्दर्भ पुस्तक

१. नेपाल अधिराज्यको संविधान २०४७, कानुन, न्याय तथा संसदीय व्यवस्था मन्त्रालय, कानुन किताब व्यवस्था समिति, काठमाडौँ, २०४७ ।
२. नेपाल अधिराज्यको संविधान २०४७ : एक टिप्पणी, खिमलाल देवकोटा, निरन्तर प्रकाशन, काठमाडौँ, २०५८ ।
३. नेपाल परिचय, सिद्धीश्वरमान श्रेष्ठ, प्रा. श्यामकृष्ण जोशी, सावित्री श्रेष्ठ, अक्षलोक प्रकाशन, काठमाडौँ, २०६५/०६९ ।
३. नेपालको अन्तरिम संविधान २०६३ ।
४. नेपालको सरकार र प्रशासन, सिद्धीश्वरमान श्रेष्ठ, अक्षलोक प्रकाशन, काठमाडौँ, २०५० ।
५. नेपाली बृहत् शब्दकोष, नेपाल राजकीय प्रज्ञा-प्रतिष्ठान, काठमाडौँ, २०५२ ।
६. नेपाली महिला र जनआन्दोलन २०६३, सावित्री श्रेष्ठ, अक्षलोक प्रकाशन, २०६३ ।
७. प्रश्नोत्तर नेपाल परिचय, सावित्री श्रेष्ठ, सिद्धीश्वरमान श्रेष्ठ, निरन्तर प्रकाशन, काठमाडौँ, २०५०, २०५८ (तेस्रो संस्करण) ।
८. वातावरण शिक्षा स्रोत सङ्गालो, राष्ट्रिय संरक्षण कार्यनीति कार्यान्वयन आयोजना, काठमाडौँ, २०५० ।
९. महत्वपूर्ण राजनीतिक शब्दज्ञान, सिद्धीश्वरमान श्रेष्ठ, अक्षलोक प्रकाशन, काठमाडौँ, २०५५, २०५८, २०६६ ।
१०. मुद्रा, बैङ्किङ, राजस्व, अन्तर्राष्ट्रिय व्यापार तथा नेपालको अर्थव्यवस्था, महेश्वरमान श्रेष्ठ, रत्न पुस्तक भण्डार, काठमाडौँ, २०५१ ।
११. राजनीतिशास्त्रको परिचय, सिद्धीश्वरमान श्रेष्ठ, निरन्तर प्रकाशन, काठमाडौँ, २०५०, २०५८ (दोस्रो संस्करण) ।
१२. सामाजिक अनुसन्धान प्रविधि, प्रभाकर लाल दास, श्री जय नारायण, सप्तरी, २०५४ ।
१३. सामाजिक अध्ययन (हेल्थ साइन्स), सिद्धीश्वरमान श्रेष्ठ, सावित्री श्रेष्ठ, अक्षलोक प्रकाशन, काठमाडौँ, २०६७ ।

Computer Aided Drawing

EG 2211 EE

Total: 4 hour /week
Year: II **Lecture: 2 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 Contents

Unit 1: Introduction [4 Hours]

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 [12 Hours]

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 **[12 Hours]**

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 **[6 Hours]**

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

Unit 5: Display commands **[2 Hours]**

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

Unit 6: Inquiry Commands **[4 Hours]**

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 **[4 Hours]**

7.1 HATCH and BHATCH commands
7.2 Creating Isometric drawing

Unit 8: Grouping in AutoCAD **[4 Hours]**

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

Unit 9: Working with text in AutoCAD **[2 Hours]**

9.1 TEXT, MTEXT, DTEXT commands

9.2 Justifying text and text fonts

9.3 STYLE command

Unit 10: Dimensioning in AutoCAD **[2 Hours]**

10.1 Dimensioning commands

10.2 Dimension styles and dimension setup

10.3 Dimension scale

Unit 11: Layout Drawing **[4 Hours]**

11.1 Use of AutoCAD Design center

11.2 Layout drawing using standard symbols

Unit 12: Plotting drawings **[4 Hours]**

12.1 Layout management

12.2 Device information, pen parameters, paper size and orientation

12.3 Scale, rotation and origin

Practical **[30 Hours]**

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*]

References:

1. G. Omura; Mastering AutoCAD, Latest Edition

Introduction to Microprocessors

EG 2203 EX

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

Course description

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

Course objectives

After completing this course the students will be able to

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

Course Contents

Unit1. Introduction to Microprocessor [8 Hours]

1.1. History of computer development
1.2. Analog and digital computer
1.3. Microprocessor, microcomputer, microcontroller
1.4. Stored program concept and von-Neumann's architecture
1.5. General architecture of a microcomputer system showing control buses
1.6. History of x86 microprocessors
1.7. Block diagram of a typical microprocessor and microcontroller
1.8. Programming languages
1.9. Instruction set of microprocessors
1.10. Introduction to Simple as Possible (SAP1,SAP2,SAP3) computers

Unit2. Microprocessor architecture and the instruction set [8 Hours]

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

Unit3. Assembly language programming for 8085 [9 Hours]

3.1. Introduction to assembly language and assemblers
3.2. Simple assembly language programs
3.3. Programs using loops, counters, delays
3.4. Table processing
3.5. Subroutine and stack
3.6. Code conversion ASCII/BCD/Binary

Unit4. Interfacing I/O and memory devices [10 Hours]

4.1. 8085 machine cycles and bus timing
- Fetch and execute cycles
- Memory read/write machine cycle
- I/O read/write machine cycle

4.2. Address Decoding
- Unique and non-unique address decoding
- Address decoding for I/O and memory devices

4.3. Interfacing I/O devices
- Interfacing Input Devices
- Interfacing Output Devices
- Address decoding using block decoders
- Interfacing Memory-mapped I/O

4.4. Memory Interfacing
- Memory structure and its requirement
- RAM and ROM chips
- Address decoding using NAND and block decoders

4.5. Direct memory access

Unit5. 8085 Interrupt processing [6 Hours]

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

Unit6. Introduction to general purpose programmable peripheral devices [4 Hours]

6.1. 8255 Programmable Peripheral Interface
6.2. 8254(8253) Programmable Interval Timer
6.3. 8259 Programmable Interrupt Controller
6.4. 8251 USART

Practical [45 Hours]

The practical exercise shall cover the low level program from simple programs for data transfer to complex programs for table processing

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

References:

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

Basic Programmable Logic Control (Basic PLC)

EG 2213 EX

Year: II
Semester: II

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

Course description

This course is designed to provide a generalized approach in Programmable Logic Control system. Students will be equipped with the knowledge in designing the memory sub-system, selecting peripheral devices and standards in a PLC control system. In addition, students will learn about PLC and its application.

Course objectives

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

1. Understand the structure of a PLC, and its various components
2. Understand the use and application of PLC
3. Learn design methods for combinational logic circuit,
4. Understanding the PLC input / output system.

Course Contents

Chapter 1 Introduction to Programmable Controllers [4 Hours]

1-1 Definition
1-2 A Historical Background
1-3 Principles of Operation
1-4 PLCs Versus Other Types of Controls
1-5 PLC Product Application Ranges
1-6 Ladder Diagrams and the PLC
1-7 Advantages of PLCs

Chapter 2 Number Systems and Codes [2 Hours]

2-1 Number Systems
2-2 Number Conversions
2-3 One's and Two's Complement
2-4 Binary Codes
2-5 Register Word Formats

Chapter 3 Logic Concepts [2 Hours]

3-1 The Binary Concept
3-2 Logic Functions
3-3 Principles of Boolean Algebra and Logic
3-4 PLC Circuits and Logic Contact Symbology

Chapter 4 The Memory System and I/O Interaction [8 Hours]

4-1 Memory Overview
4-2 Memory Types
4-3 Memory Structure and Capacity
4-4 Memory Organization and I/O Interaction
4-5 Configuring the PLC Memory—I/O Addressing
4-6 Summary of Memory, Scanning, and I/O Interaction
4-7 Memory Considerations

Chapter 5 The Discrete Input/ Output System **[9 Hours]**

5-1 Introduction to Discrete I/O Systems
5-2 I/O Rack Enclosures and Table Mapping
5-3 Remote I/O Systems
5-4 PLC Instructions for Discrete Inputs
5-5 Types of Discrete Inputs
5-6 PLC Instructions for Discrete Outputs
5-7 Discrete Outputs
5-8 Discrete Bypass/Control Stations
5-9 Interpreting I/O Specifications
5-10 Summary of Discrete I/O

Chapter 6 The Analog Input/ Output System **[10 Hours]**

6-1 Overview of Analog Input Signals
6-2 Instructions for Analog Input Modules
6-3 Analog Input Data Representation
6-4 Analog Input Data Handling
6-5 Analog Input Connections
6-6 Overview of Analog Output Signals
6-7 Instructions for Analog Output Modules
6-8 Analog Output Data Representation
6-9 Analog Output Data Handling
6-10 Analog Output Connections
6-11 Analog Output Bypass/Control Stations.

Chapter 7 Special Function I/O and Serial Communication Interfacing **[10 Hours]**

7-1 Introduction to Special I/O Modules
7-2 Special Discrete Interfaces
7-3 Special Analog, Temperature, and PID Interfaces
7-4 Positioning Interfaces
7-5 ASCII, Computer, and Network Interfaces
7-6 Fuzzy Logic Interfaces
7-7 Peripheral Interfacing

Laboratory **[45 Hours]**

- Recycled oil tank
- Counter function block
- Timer function block
- D.C. motor simple control.

References:

1. Programmable Controllers
   (Theoryand Implementation)
   By L. A. Bryan and E. A. Bryan
2. Programmable-Logic-Controllers-Fourth Edition
   Author: W. Bolton
3. Programmable Logic Controllers: An Emphasis on Design and application
   Author: Kelvin T. Ericson
4. Programmable Logic Controller by Frank Petruzella

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 objectives

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 Contents

Unit 1. Single Phase Transformer : [14 Hours]

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 Capacity of transformer – Definition, factors affecting the capacity of transformer.
1.9 Testing of transformer – Polarity test, No-load test, Short-circuit test.
1.10 Auto transformer – Operating principle and application.
1.11 Parallel operation

Unit 2. Three Phase Transformer : [8 Hours]

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, Buchloz's relay, tap-changer.
2.5 Study of name plate specification of transformer.

Unit 3. DC Generator : [14 Hours]

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

Unit 4. DC Motor : [12 Hours]

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

Practical Exercises : [30 Hours]

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.

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

EG 2216 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 Contents

Unit 1. Electrical Measuring Instrument. [8 Hours]
- 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 Hours]
- 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 Hours]
- 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 [4 Hours]
- 4.1 Shunts and Multipliers – use and characteristics.
- 4.2 Multi-range meters – ammeter, voltmeter, ohmmeter and multimeter.

Unit 5. Potentiometer [4 Hours]

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 Hours]

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 Hours]

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 Hours]

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 Hours]

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

Practical Exercise:

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.

References:

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.

Transmission and Distribution of Electrical Power

EG 2217 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 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 10. Unit 1: Introduction [7 Hours]

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 Hours]

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 Hours]**

3.1 General evaluation of transmission line efficiency and regulations

3.2 Transmission Line parameters:

- Basic concept of Resitance, inductance and capacitance calculation
- Skin and proximity effect
- Concept of single line diagram

3.3 Classification of transmission line as Short , medium and long lines and associated assumptions

3.4 T and pi model of medium length transmission line

3.5 Concept of distributed parameter model

3.6 Phasor diagrams

Unit 4: Distribution system **[8 Hours]**

4.1 Distribution system as proximity to consumers

4.2 Radial , loop and ring main feeders

4.3 Voltage drop and power losses in radial and loop feeders

4.4 Guidelines for rural and urban distribution

4.5 Single phase and three phase distribution

4.6 Underground cables for distribution

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

Unit 5: Voltage Control **[6 Hours]**

5.1 Necessity of voltage control, voltage fluctuation and associated problems

5.2 Method for voltage control

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

Unit 6: Interconnected system **[4 Hours]**

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. Bhtnagar & A Chkrabarti, "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.

Repair and Maintenance of Winded Machine

EG 2218 EE

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

Course description

This course will provide skill and knowledge to repair and maintenance of electrical motor and equipment (Both single phase and three phases). It also gives testing and detail guidelines of power circuits and control circuits. It also provides skill and knowledge to repair transformers and voltage regulators

Course objectives

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

1. Test and identify the fault of Electrical machine and equipment.
2. Repair and replace the faulty part
3. Reform and supervise repair work
4. Read and develop circuit diagram

Course Contents

Unit 1 **Single phase A.C. Motor** **[16 Hours]**

1.1 Introduction single phase motor
1.2 Types single phase motor
1.3 Identify parts of single phase motor
1.4 Trace the data of winding.
1.5 Dismantle cover where required.
1.6 Remove coils
1.7 Rewind the coils
1.8 Reassemble the parts of motor
1.9 Test the motor.

Unit 2 **Polyphase Motor** **[18 Hours]**

1.1 Introduction poly phase motor
1.2 Types poly phase motor
1.3 Identify partsof poly phase motor
1.4 Trace the data of winding.
1.5 Dismantle cover where required.
1.6 Remove coils
1.7 Rewind the coils
1.8 Reassemble the parts of motor
1.9 Test the motor

Unit3 **D.C.Motor** **[20 Hours]**

1.1 Introduction.
1.2 Identify parts of D.C. motor.
1.3 Trace the data of winding.
1.4 Dismantle cover where required.
1.5 Remove coils

1.6 Rewind the coils
1.7 Reassemble the parts of motor
1.8 Test the motor.

Unit 4 **Single Phase Transformer** **[18 Hours]**

4.1 Introduction
4.2 Identify parts of Transformer.
4.3 Calculate the winding of transformer
4.4 Calculate the measurement of bobbin
4.5 Remove coils.
4.6 Test the Transformer.

Unit 5 **Voltage Regulator** **[18 Hours]**

5.1 Concept of voltage regulation
5.2 Component use in voltage regulation.
5.3 Circuit of voltage regulation.
5.4 ICs use in voltage regulation.
5.5 Dismantle of voltage regulator.
5.6 Assemble of voltage regulator.
5.7 Test the Voltage regulator.

References:

1) I.J. Nagrath and D.P. Kothari, "Electric Machines", Tata McGraw-Hill publication.
2) J.B. Gupta, "Theory and performance of Electrical Machines" S.K. Kataria& Sons, India, 2004.
3) Electronic Devices and Circuits – TF Bogart

Third Year
(Fifth and Sixth Semesters)

Fifth Semester

Subjects:

EG 3112 EE	**Switch Gear and Protection**
EG 3113 EE	**Power Electronics**
EG 3114 EE	**Electrical Machines II**
EG 3105 EX	**Product Design & Development**
EG 3106 EX	**Integrated Digital Electronics**
EG 3107 EX	**Repair and Maintenance of Electrical and Electronics Appliances**
EG 3109 CT	**PC Organization**

Switch Gear and Protection

EG 3112 EE

Year: III
Semester: I

Total: 7 hour /week
Lecture: 3 hours/week
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

Course Contents

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

1.1 Nominal ratings and abnormal conditions of electrical equipments
1.2 Short-circuit and their harmful effects
1.3 Open circuit and their consequences
1.4 Requirements of protection system
1.5 Characteristics of protecting devices
1.6 Example of protection against short circuit

Unit 2: Short Circuit Faults [8 Hours]

2.1 Possible reason behind short circuiting
2.2 Concept of short circuit fault current and fault MVA
2.3 Short circuit in a generators
- Types of short circuit fault
- Possibility of occurrence and sensitivity based on magnitude
- Calculation of 3-phase symmetrical faults on unloaded generators
- Faults in generator windings

2.4 Short circuit in a transmission and distribution feeder
- Types of short circuit fault
- Possibility of occurrence and sensitivity based on magnitude
- Calculation of simple 3-phase symmetrical faults

2.5 Short circuit in a transformers
2.6 Short circuit in a bus bar and their sensitivity

Unit 3: Protection system components [10 Hours]

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

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

Unit 4: Relays [8 Hours]

4.1 Operating principle

4.2 Realy 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 Buchhols relay construction and characteristics

Unit 5: Protection scheme [8 Hours]

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 Buchhols relay for transformer protection alarm and tripping circuits

Unit 6: Circuit breakers [8 Hours]

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 Hours]**

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 PT and make polarity test
5. Identify the fault location in a arbitrary underground cable
6. Obtain the time current characteristics of an induction disc relay
7. Test an induction disc relay for earth fault protection
8. Check connection sensitive earth fault protection scheme.
9. Check connections on a biased differential protection scheme
10. Test Buchhloz's relay for alarm and trip operation
11. Test an air circuit breaker for calibration
12. 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 objectives

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. Enable to operate rectifier, chopper, inverter and ac voltage controller.

Course Contents

Unit 1. Power Electronics Devices [8 Hours]

- 1.1 Power diode – Construction, Characteristic and ratings.
- 1.2 Power Transistor - Construction, Characteristic, use as power switch, base drive circuits.
- 1.3 Thyristor – Construction, Characteristics, Turn on mechanism, Turn-on process wih gate signal, thyristor firing circuit.
- 1.4 GTO - Construction, Characteristics, Turn on mechanism and turn off mechanism.
- 1.5 TRIAC – Construction and Characteristics.
- 1.6 MOSFET - Construction and Characteristics.
- 1.7 IGBT - Construction and Characteristics.

Unit 2. Rectifier [10 Hours]

- 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 two thyristors and two diodes with resistive load.
- 2.3 Single-phase full converter with four thyristors with highly inductive load- rectifier and inversion mode of operation.
- 2.4 Single-phase controlled rectifer for speed control of dc motor.
- 2.5 Three-phase single phase rectifier with three numbers of diode.
- 2.6 Three-phase bridge rectifier with six numbers of diode.

Unit 3. DC Chopper [6 Hours]

- 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 [8 Hours]

4.1 Single phase square wave inverter – Circuit diagram, operating principle, rms value of output voltage, operation with resistive load and inductive 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 and inductive load.

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

Unit 5. AC voltage controller [6 Hours]

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

Exercise No.1 :

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.2:

Fabrication full-wave single-phase controlled rectifier with thyristors and its firing circuit. Observe its output voltage waveforms with resistive load.

Exercise No.3 :

Fabrication of dc chopper using power transistor and its base drive circuit. Observe its output voltage waveforms with resistive and inductive load.

Exercise No.4 :

Fabrication of single-phase ac voltage controller and its firing circuit. Observe its output voltage waveforms with resistive load.

References:

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

Unit 2. Three Phase Induction Motor [18 **Hours**]

1.1 Constructional details – Yoke, stator, stator windings, 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 3. Single Phase AC Motors : [8 Hours]

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 4. Three-phase Synchronous Generator [14 Hours]

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 Synchronous generator connected to infinite bus, effect of excitation.

3.6 Parallel operation and synchronization.

Unit 5. Synchronous Motor [10 Hours]

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 Hours]

Expt. No.1: Determine the load characteristics and voltage regulation of dc series generator.

Expt. No.2 : Experimental study of on dc shunt motor.

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

Expt. No.3 : Experimental study on speed control of dc shunt generator.

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

Expt. No.4 : 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.5 : 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.6 : Experimental study on induction motor testing.

- Perform no-load test and blocked rotor test and evaluate the equivalent circuit parameters.

Expt. No.7 : 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.8 : Experimental study on single phase shaded pole ac motor.

- Connect and start a shaded pole ac motor and obtain its characteristics.

Expt. No.9 : Experimental study on single phase ac series motor.

- Connect and start a single-phase ac series motor and obtain its characteristics.

Expt. No.10 : 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.11 : 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.12 : 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.

Product Design and Development

EG 3105 EX

Total: 3 hour /week

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

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

Lab: 3 hours/week

Course description

This course deals with Product Design and Development, Specification, Quality in Design, Product Family Design, and Design for product life cycle, Application of computer technologies in product design and Process Selection and Development.

Course objectives

After completing this course the students will be able to:

1. Develop the competence with a set of tools and methods for product design and development.
2. Understand the processes involved in creating a new product or modifying an existing product.
3. Sensitize the role of multiple functions in creating a new product (e.g., marketing, finance, industrial design, engineering, production)
4. Sensitize the importance of system, process, and information integration in product development
5. Develop the ability to coordinate multiple, interdisciplinary tasks in order to achieve a common objective of launching a new product.

Learning objectives

Upon completion of the course, students will be able to:

1. Describe the systematic concept of development process
2. Determine customer needs by using the Quality Function Deployment process
3. Identify product features through gathering product information, decomposing product, identifying product features, and conducting product benchmarking study
4. Establish target specification to satisfy customer needs
5. Generate concepts to address the customer needs
6. Select the most promising concepts for further consideration
7. Test the concepts and set the final specifications
8. Define product architecture
9. Outline a product launch plan

Course Contents

Unit 1. An Introduction to Product Design and Development [12 Hours]

1.1 Introduction
1.2 Significance of product design
1.3 Generic development process
1.4 Concept development
1.5 Market-pull
1.6 Technology-push
1.7 Product development organization
1.8 Functional and project organization
1.9 Platform product
1.10 Process incentive product
1.11 Customized product
1.12 Engineering design methods
- Sequential engineering design
- Concurrent engineering design

Unit 2. Product Specification [6 Hours]

2.1 Introduction
2.2 Concept development process
2.3 Product specification
2.4 Product specification process
2.5 Matrix
2.6 Technical incentive products
2.7 Technical model
2.8 Cost model
2.9 Quality function development

Unit 3. Quality in Design [4 Hours]

3.1 Quality function deployment for product planning
3.2 Robust design

Unit 4. Product Family Design [10 Hours]

4.1 Mass customization
4.2 Platform Definition and Approaches
4.3 Platform Leveraging Strategies
4.4 Module- and Scale-based Product Family
4.5 Interpretations
4.5 Advantages / Disadvantages
4.6 Formulations of product modules
4.7 Product portfolios architecture:
- Methods and Tools (Object-Process-Methodology (OPM)
- Design Structure Matrix (DSM))
- Product Architecture Framework
- System Architecture Framework

4.8 Roles and Responsibilities of the Product/System Architect

Unit 5. Design for product life cycle [4 Hours]

5.1 Design for manufacture and assembly
5.2 Design for service
5.3 Design for environment

Unit 6. Application of computer technologies in product design [3 Hours]

6.1 Introduction to computer-aided design and computer-aided analysis

Unit 7. Process Selection and Development [6 Hours]

7.1 Process taxonomy
7.2 Product attribute
7.3 Selection of manufacturing processes by progressive elimination
7.4 Computer-aided process selection
7.5 Part print analysis
7.6 Baseline dimensioning
7.7 Tolerance stacking
7.8 Determination of datum surfaces
7.9 Development of process plan

Textbooks and Readings:

Ulrich, K.T. and Eppinger, S.D., *Product Design and Development, 3rd ed*, McGraw-Hill, 2004 (ISBN 0-07-247146-8)
Product Design and Development, K.T. Ulrich et al., McGraw-Hill, 2000.
Product Design: Fundamentals and Methods, K. Otto and K. Wood, Prentice Hall, 2001.
Product Design and Manufacture, J. Lindbeck, Prentice Hall, 1995.

Integrated Digital Electronics

EG 3106 EX

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

Course description

This course is focused to study, design, applicutic of digital devices that based on various logic families as well as design of PLA, RAM, ROM etc.

Course objectives

After completing this course the students will be able to:

1. Study various logic families,
2. Design different logic concept.

Course Contents

Unit 1. Introduction **[3 Hours]**

1.1 Digital Signal versus Analog Signal
1.2 Combinational Logic Circuits versus Sequential Logic Circuits
1.3 BJT as a Switching Device
1.4 MOSFET as a Switching Device
1.5 Tri State Device

Unit 2. Multivibrators **[6 Hours]**

2.1 Astable Multivibrator
2.2 Monostable Multivibrator
2.3 Bistable Multivibrator
2.4 Transistorized Pulse-Generator
2.5 Pulse-Generator Using Timer IC 555
2.6 Applications of Multivibrators

Unit 3. Logic Families **[6 Hours]**

3.1 Classification of Logic Families
3.2 Specifications / Characteristics of Logic Families
- Power Dissipations
- Propagation Delay
- Noise Margins
- Operating Temperature
- Power Supply Requirements
- Fan Out
- Fan In

3.3 Voltage Transfer Characteristic Curve
3.4 Logic Level Diagram

Unit 4. Bipolar Logic Families **[6 Hours]**

4.1. Diode-Diode Logic (DDL)
4.2. Resistor-Transistor Logic (RTL)
4.3. Diode-Transistor Logic (DTL)

4.4. Transistor-Transistor Logic (TTL)
- Standard TTL
- High-Speed TTL
- Low-Power TTL
- Schottky TTL

4.5. Integrated- Injection Logic (I2L)

Unit 5. MOS Logic Families [6 Hours]

5.1 Switching Characteristics of MOSFET
5.2 NMOS Logic Gates
5.3 CMOS Logic Gates
5.4 Transmission Gates

Unit 6. Semiconductor Memories [9 Hours]

6.1 Bipolar Memories
- RAM, SRAM Cell
- ROM
- PROM

6.2 MOS Memories
- RAM, SRAM Cell, DRAM Cell
- ROM
- PROM
- EPROM, UVEPROM, EEPROM

6.3 Comparison of Memories
- Density
- Access Time
- Cost
- Complexity
- Availability

Unit 7. Integrated Circuit Technology [9 Hours]

7.1 Short History of Integrated Circuits (IC) Development
7.2 Types of Integrated Circuits
7.3 Integrated Components: Resistors, Capacitors, Diodes and Transistors
7.4 Manufacturing Process of Monolithic ICs
- Epitaxial Growth
- Oxidation
- Masking
- Photo Etching
- Metallization
- Probing
- Testing
- Packaging

7.5 IC Specifications
7.6 Analogue and Digital IC Packages

Experiments: **[45 Hours]**

1. Realizing a BJT as a switching device
2. Construct and realize the transistorized astable multivibrator as a pulse generator
3. Study and realizing monostable multivibrator
4. Pulse generator implementing timer IC 555.
5. Realization and verification of Diode-Diode Logic (DDL) and Resistor-Transistor Logic (RTL)
6. Realization and verification of simplified and modified two-input Diode-Transistor Logic (DTL)
7. Realization and verify the logic specifications of Transistor-Transistor Logic (TTL) 74 series ICs
8. Realizing a flip-flop as one bit memory device/RAM memory

References:

1. Principle of Digital Electronics- P. Malvino
2. Digital Fundamentals- T. Flyod
3. Logic Circuits- M. Mano

Repair and Maintenance of Electrical and Electronics Appliances

EG 3107 EX

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

Course description

This course deals with the procedures of testing, repairing and maintenance of essential domestic electrical and electronic appliances.

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. Introduction to maintenance principles [3 Hours]

1.1 Preventive and corrective maintenance
1.2 Introduction to fault diagnosis techniques, using basic flow chart

Unit 2. Assembling of DC low voltage power supply unit with Transistor Series Voltage regulator with over load and short circuit protection and testing of the parameters[18 Hours]

2.1. Continuity and insulation resistance test
2.2. Voltage measurements: Main input voltage, DC, unregulated voltage, regulated output voltage
2.3. Load regulation characteristics
2.4. Line regulation characteristics
2.5. Ripple voltage (Factor)
2.6. Current limit

Unit 3. Basic Analogue Multimeter [12 Hours]

3.1. Circuit tracing and identification of the components and accessories with reference to circuit diagram

Unit 4. AM/FM Radio Receiver [12 Hours]

4.1 Examine mechanical layout, dismantling and re-assembling procedure
4.2 Operation check (performance check)
4.3 Tracing and identification of the components with reference to circuit diagram
4.4 Trouble hooting practice: Signal tracing and signal injection method, DC voltage measurement, alignment and tuning of the IF and Oscillator circuit

Unit 5. Electric Iron [4 Hours]

5.1. Ordinary electric iron and automatic electric iron ON/OFF switch indicator, heating element and plug-leads

5.2. Visual inspection, continuity test, disassembling and assembling procedure and final test

Unit 6. Heater [4 Hours]

6.1. Ordinary - immersion ON/OFF switch, heat control, two rod heater

6.2. Visual and continuity test, body leakage test, disassembling and assembling procedure and final test

Unit 7. Rice Cooker [4 Hours]

7.1. Thermal fuse, magnetic switch, bi-metallic thermostatic switch ON/OFF switch indicator, cooking element and warmer element

7.2. Visual inspection, disassembling and assembling procedure and final test

Unit.8 Grinder, Mixture and Dryer [4 Hours]

8.1. Armature winding, field winding, capacitor suppression, limit switch, carbon brush, holders and carbon heating element

8.2. Visual inspection, continuity test, body leakage test, disassembling and assembling procedure and final test

Unit 9. Volt - guard [4 Hours]

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

Unit 10. Battery- charger [4 Hours]

10.1. Transformer, electronic circuit, rectifiers-filter control and float and boost charge in indicator

10.2. Continuity test, leakage test, disassembling and assembling procedure and final test

Unit 11. Optical disc player and optical data storage device [6 Hours]

11.1. Safety precautions and demonstration of principle of operation

11.2. Consideration when troubleshooting

11.3. Discussion and demonstration of laser disk problems

References:

1. Electrical motor repair - Robert Rosenberg
2. Electrical trade theory - CIMI Madras
3. Manufacturer's catalogue and repair manual

PC Organization

EG 3109 CT

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

Course description

This course deals with the basic Computer organization; Register, Arithmetic-Logic Unit, and Control Unit, Arithmetic Processors, Memory Organization, Machine instructions; Addressing modes and Input/output organization.

Course objectives

After completing this course the student will be able to:

1. Understand the basic concepts of the central processing unit
2. Simulate different arithmetic processes
3. Understand the principles behind the memory system and I/O organization
4. Design the Control Unit

Course Contents

Unit 1. Introduction [4 Hours]

- 1.1 History of Computation
- 1.2 Overview of basic digital building blocks
- 1.3 Basic structure of a digital computer
- 1.4 Trends

Unit 2. Milestones in Computer Architecture [4 Hours]

- 2.1. The Zeroth Generation-Mechanical Computers (1642-1945)
- 2.2. The First Generation-Vacuum Tubes (1945-1955)
- 2.3. The Second Generation-Transistors (1955-1965)
- 2.4. The Third Generation-Integrated Circuits (1965-1980)
- 2.5. The Fourth Generation-Very Large Scale Integration (1980-?)

Unit 3. Central Processing Unit [8 Hours]

- 3.1. Hardwired and Micro programmed
- 3.2. Arithmetic Logic Unit
- 3.3. Instruction Execution
- 3.4. Addressing Modes
  - Immediate Addressing
  - Direct Addressing
  - Register Addressing
  - Register Indirect Addressing
  - Indexed Addressing
  - Based-Indexed Addressing
  - Stack Addressing

Unit 4. Data Transfer and Manipulation, Program Control

- 4.1 RISC versus CISC

Unit 5. Arithmetic Processor Design [9 Hours]

5.1. Addition and Subtraction algorithms
5.2. Multiplication and Division algorithm
5.3. Logical Operation
5.4. Processor Configuration
5.5. Design Of Control Unit

Unit 6. Memory System [10 Hours]

6.1 Characteristics of Memory System
6.2 Primary Memory
- Bits
- Memory Addresses
- Byte Ordering
- Error-Correcting Codes
- Cache Memory
- Memory Packaging and Types

6.3 Secondary Memory
- Memory Hierarchies
- Magnetic Disks
- Floppy Disks
- IDE Disks
- SCSI Disks
- RAID
- CD-ROMs
- CD-Recordables
- CD-Rewritables
- DVD

Unit 7. Input/Output Organization [6 Hours]

7.1 Peripheral devices
7.2 Buses and Controller
7.3 Basic I/O Interfaces
7.4 I/O Technique
7.5 I/O Processor

Unit 8. Design Issues for Parallel Computers [4 Hours]

8.1. Communication Models
8.2. Interconnection Networks
8.3. Performance
8.4. Software

References:

1. M. Mano, "Computer System Architecture"
2. A Tanenbaum," Structured Computer Organization"
3. M. Morris Mano, Charles R. Kime, " Logic and Computer Design Fundamentals"
4. William Stalling, " Computer Organization and Architecture"
5. Peter Abel, IBM PC Assembly Language and Programming 3rd Edition, Prentice Hall

Sixth Semester

Subjects:

EG 3201 EX Microprocessor System Design
EG 3207 EX Fundamentals of Automatic Control
EG 3208 EX Design, Estimating & Costing of Electrical & Electronics Installation
EG 3209 EX Industry Based Major Project
EG 3211 ME Organization and Management
EG 3201 MG Entrepreneurship Development

Elective (One of the followings)
EG 3218 EE a) Micro Hydro
EG 3218 EE b) Instrumentation & Transducers
EG 3218 EE c) Electric Drives
EG 3218 EE d) Renewable Energy Technology
EG 3218 EE e) Principle of Energy Conservation
EG 3210 EX F) Programmable Logic Control (PLC) Design
EG 3210 EX G) Advanced Microprocessor & Interfacing Systems

Microprocessors System Design

EG 3201 EX

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

Course description

This course is designed to provide a generalized approach in microprocessor-based system design. Students will be equipped with the knowledge in designing the memory sub-system, selecting peripheral devices and the bus standards in a microprocessor-based system. In addition, students will learn about microcontroller and its application.

Course objectives

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

1. Understand the structure of a microprocessor based system, and its various components
2. Analyse and select appropriate bus standards for interfacing peripheral devices
3. Select the appropriate processing unit, memory, interfacing and communication technique, interrupt mechanism
4. Know microcontroller and its use in embedded systems

Course Contents

Unit 1. Introduction [4 Hours]

1.1. Review of 8-bit microprocessor
- Structure
- Registers and stacks
- External interface

1.2. Review of assembly language programming

Unit 2. Internal operation of microprocessor [4 Hours]

2.1 Register transfer logic (RTL)
2.2 Timing diagrams

Unit 3. Memory [6 Hours]

3.1. Read only memory (ROM), PROM, EPROM, PLAs
3.2. Static/Dynamic random access memory (RAM)
3.3. Static memory timing waveforms
3.4. Address decoding (unique and non-unique)

Unit 4. Input/Output [6 Hours]

4.1. Parallel I/O
4.2. Serial communication
- Asynchronous and synchronous
- RS-232 signal definitions and levels
- RS-422A and Rs-423A

4.3. Introduction to Direct Memory Access (DMA) controller

Unit 5. Timer and Interrupts [7 Hours]

5.1. Programmable timer/counter 8254
5.2. Interrupt and its processing concept
5.3. Interrupt hardware –priority encoder
5.4. Programmable interrupt controller

Unit 6. Microcomputer Buses [4 Hours]

6.1 The system bus and bus interface
6.2 Introduction to standard bus: ISA, PCI, IDE, SCSI, PCMCIA, USB

Unit 7. Peripherals [4 Hours]

7.1 Keyboards
7.2 CRT controllers
7.3 Printers
7.4 Secondary memory

Unit 8. Microcontroller Fundamentals and Design [25 Hours]

8.1 Microcontroller and its applications
8.2 8 Bit microcontroller – 8051 pin-out and electrical characteristics
8.3 Interfacing techniques with I/O and memory devices
8.4 Special functions – interrupts, timers
8.5 8051 assembly programming, emulators
8.6 Application program model and design

Practical [45 Hours]

The practical exercise shall cover the basic understanding of microprocessor based system such as address decoding for memory and I/O, parallel I/O, serial communication, hardware interrupts, software interrupts, and programming with microcontroller.

References:

1. 8085 Microprocessor programming and interfacing, by Ramesh S. Gaonkar
2. Microprocessors and Interfacing, by Douglas V. Hall
3. The 8051 microcontroller, by Kenneth Ayala

Fundamentals of Automatic Control

EG 3207 EX

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

Course description

This course deals with the introduction of control system, lap lace transform, mathematical modeling of dynamic systems, transient –response analysis, basic control, actions and response, root-locus analysis and design, frequency response analysis, and design.

Course objectives

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

1 Provide basic idea of automatic control system

Course Contents

Unit1. Introduction: [2 Hours]

1.1. Introduction, Examples of control system, Closed-loop control and open-loop control, Design of control systems

Unit2. The Laplace Transform: [4 Hours]

2.1. Introduction, Complex variables and complex functions, Laplace transformation, Laplace transform theorem, Inverse Laplace transformation, Partial fraction expansion, Solving general linear, time-invariant, differential equations, Example problems and solutions.

Unit3. Mathematical Modeling of Dynamic Systems: [8 Hours]

3.1. Introduction, Transfer function and impulse-response function, Block diagrams, Modeling in state space, State-space representation of dynamic systems, Mechanical systems, Electrical systems.

Unit4. Transient-Response Analysis: [4 Hours]

4.1. Introduction, First-order system, Examples

Unit5. Basic Control Actions and Response of Control Systems: [7 Hours]

5.1. Introduction, Basic control actions, Effects of integral and derivative control actions on system performance, Electronic controllers, Phase lead and phase lag in sinusoidal response, Steady-state errors in unity-feedback control system, Example problem and solutions

Unit6. Root-Locus Analysis: [6 Hours]

6.1. Introduction, Root-locus plots, Summary of general rules for constructing root loci, Root-locus plots with MATLAB, Special cases

Unit7. Control Systems Design by the Root-Locus Method: [5 Hours]

7.1. Introduction, Preliminary design considerations, Lead compensation, Lag compensation, Simple example, problems and solutions

Unit8. Frequency-Response Analysis: [5 Hours]

8.1. Introduction, Bode diagrams, Plotting Bode diagrams with MATLAB, Polar plots, Log-magnitude versus phase plots, Nyquist stability criterion, Stability analysis, Example problems and solutions.

Unit9. Control Systems Design by Frequency Response: [4 Hours]

9.1. Introduction, Lead compensation, Lag compensation, Simple example, problems and solutions

Laboratory [45 Hours]

1. The laboratory exercises should cover all the features mentioned above.

References:

1 Katsuhiko Ogata, "*Modern Control Engineering*", Prentice-Hall of India Private Limited, 2002.

Design, Estimating and Costing of Electrical and Electronic Installation

EG 3208 EX

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 general principles of light and power circuit design, design of illumination scheme overhead, design of electrical installation in buildings and develops skill on construction, testing of operation and fault diagnosis in electronic circuits

Course objectives

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 basic functional blocks, principles of operation of electronic equipment.
4. Assist and carry out the installation and commissioning of electronic equipment.

Course Contents

Unit 1. General Principles [6 Hours]
- 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 of Illumination Scheme [6 Hours]
- 2.1 Introduction.
- 2.2 Terminology in illumination
- 2.3 Laws of illumination
- 2.4 Various types of light sources
- 2.5 Practical lighting schemes
  - Lighting arrangement
  - Illumination for different occupancies
  - Selection of luminaries.
- 2.6 Factory lighting.
- 2.7 Street lighting
- 2.8 Methods of calculation

Unit 3. Design Consideration of Electrical Installation in buildings. [10 Hours]
- 3.1 Electric supply system: single phase two wire and three phase four wire system
- 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 installing EPABX unit [15 Hours]

4.1 Examine the equipment and peripherals.
4.2 Installation practice referring installation manual.
4.3 Programming of user's fetchers and testing of operation of the system.

Unit 5. Estimating and costing of radio receiving system [8 Hours]

5.1 Introduction to radio receiving system.
5.2 Types of radio receiving system (AM and FM)
5.3 TV receiver
5.4 Frequency management.
5.5 Component use in receiving system.

Practical Exercise [30 Hours]

1. Draw the electrical symbols and standards
2. Layout the system distribution of electricity
3. Layout the various system of wiring
4. Draw the single line and connection diagrams of electric light and power circuit
5. Design and cost estimation of electrical installation for residential, commercial and industrial (small) buildings.
6. Design and cost estimation of radio receiving system
   6.1 FM receiver
   6.2 AM receiver
   6.3 TV receiver

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.
7. B. Grob and Charles E. Herndon, "Basic Television and Video Systems", McGraw-Hill.

Industry Based Major Project

EG 3209 EX

Total: 8 hour /week

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

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

Practical: 8 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 ,Radio transmission station, T.V. Transmission station, Telecommunication exchange center, Base Trans receiver station etc. At the end of industrial attachment the student shall submit a report conforming to a standardized format along with daily diary.

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

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, communication system, signal and system Or any other topics related to electrical and electronics engineering approved by the department

The report shall consist of the following factors:

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

Organization and Management

EG 3211 ME

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

Course description

This course deals with the fundamental concepts of organization and management, production management, motivation and leadership, marketing, materials management, engineering economics and capital management required for supervisors and first line managers engaged in industrial enterprises.

Course objectives

After completing the course the student will be able to:

1. Describe the concept of management and its processes
2. Explain the basic concepts of organization
3. Explain the production management and its functional sub-systems
4. Apply the concepts of motivation and leadership
5. Demonstrate the understanding of marketing
6. Demonstrate understanding of materials management
7. Apply the principles of engineering economics and capital management

Course Contents

Unit 1: Management **[8 Hours]**

- 1.1 Definitions of management
- 1.2 Characteristics of management
- 1.3 Need and importance of management
- 1.4 Levels of management: top level, middle level & lower level management.
- 1.5 Functions of management: planning, organizing, leading, controlling, etc.
- 1.6 Managerial skills: technical skills, conceptual skills and human relation skills
- 1.8 Evolution of management theories: classical theories of management (scientific management theory, administrative management theory and bureaucratic model), behavioral science theory and modern management theories (contingency approach to management and system approach to an organization)

Unit2 Organization **[8 Hours]**

- 2.1 Definitions of Organization
- 2.2 Industry as an organization
- 2.3 Basic characteristics of organization
- 2.4 Necessity of organization
- 2.5 Different types of organizations based on their products and services
- 2.6 Formal and informal organization
- 2.7 Types of organization structure: line organization, line & staff organization, functional organization
- 2.8 Organization chart
- 2.9 Types of ownership: individual ownership, partnership, joint stock company and public corporation.

Unit 3 Production Management [10 Hours]

3.1 Definition of production management
3.2 Functional sub-systems of an industrial organization: research and development, production (manufacturing), marketing, purchasing, finance, personnel management and industrial relations.
3.3 Levels of decisions: strategic, tactical and operational decisions
3.4 System concept of production function
3.5 Plant location, plant layout and material handling
3.6 Types of production system: job production, batch production, mass production
3.7 Productivity and its improvement techniques
3.8 Time and motion study
3.9 Maintenance of production/service facilities including material handling equipment
3.10 Production planning and control (PPC): definition of production, planning and control
3.11 Functions of PPC: planning phase, action phase, control phase
3.12 Inspection and quality control: concept, objectives and importance

Unit 4 Motivation and Leadership [6 Hours]

4.1 Definitions of motivation
4.2 Theories of motivation: Maslow's need theory, Herzberg's two factor theory and McGregor's theory X and theory Y
4.3 Definitions of leadership
4.4 Leadership theories: trait approach, behavioral approach and contingency approach to leadership.

Unit 5 Marketing of Products or Services [9 Hours]

5.1 Definitions of market and marketing
5.2 Modern concepts of marketing: customer orientation and customer satisfaction
5.3 Functions of marketing: buying, selling, transport, storage, standardization & grading, financing, risk bearing, market information
5.4 Concept of marketing mix: product, price, place, promotion
5.5 Understanding consumer behavior
5.6 Understanding the concept of distribution channels
5.7 Sales promotion
5.8 Advertising
5.9 Pricing of goods or services
5.10 Role of bottom level management in marketing process

Unit 6 Materials management and inventory control [9 Hours]

6.1 Definition of materials management
6.2 Functions of material management: material planning, store/stock control, purchasing, receiving and issue of materials, simplification/standardizing/coding of materials, transportation and handling, value engineering and value analysis, disposal of scrap, surplus and obsolete materials.
6.3 Store management: meaning, objectives, function of store
6.4 Definition of inventory control
6.5 Inventory level
6.6 Economic lot size
6.7 Duties and responsibilities of store keeper

Unit7 Engineering Economics and Capital Management [10 Hours]

7.1 Engineering economics: introduction
7.2 Importance of manufacturing industry in the economy of the country
7.3 Estimating and costing
7.4 Classification of costs
7.5 Capital Management
7.6 Basic concept of assets and liability
7.7 Fixed capital and selection of machine and tools
7.8 Working capital and calculation
7.9 Accounting: objectives and importance of accounting, debit and credit, journal and ledger, profit and loss account, balance sheet

References:

1. Ahuja, K.K. (1994). Industrial Management. CBS Publishers and Distributors, India.
2. Mahajan, M. (2002). Industrial engineering and production management (2nd ed.). Dhanpat Rai and Co. (P) Ltd., Delhi.
3. Panneerselvam, R. (2005). Production and Operations management (2nd ed.). Prentice-Hall of India, Private Limited, Delhi.
4. Verma, A.P. (2002). Industrial Engineering. S. K. Kataria & Sons, Delhi.

Entrepreneurship Development

EG 3201 MG

Total: 5 hrs /w
Lecture: 3 hrs/w
Tutorial: hrs/w
Practical: 2 hrs/w
Lab: hrs/w

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 Contents

THEORY

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

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

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

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

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

1. Sources and method of finding business idea(s)
2. Selection of viable business ideas
3. Legal provisions for MSMEs in Nepal

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

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

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

1. Concept of small business management
2. Market and marketing mix
3. Basic account keeping

PRACTICAL

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

1. Collect business information through interaction with successful entrepreneur

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

1. Generate innovative business ideas

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

1. Analyze business ideas using SWOT method

Unit 4: Business plan formulation [22 Hours]

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

Unit 5: Small business management [2 Hours]

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

पाठ्यपुस्तक :

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

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

Reference book:

Entrepreneur's Handbook, Technonet Asia, 1981.

Micro Hydro Power

EG 3218 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 objectives

After completion of this course, student will be able to:
1. 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
2. Sensitize with the basic concept of survey, design, management, operation and maintenance of MHP plant

Course Contents

Unit 1. Introduction [**3 Hours**]
- 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 Hours]
- 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 [10 Hours]
- 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 Hours]

4.1 Basic concept of site selection for MHP Plant
4.2 Measurement of discharge at site – Bucket method, Velocity area method, Weir method, Salt dilution method.
4.3 Measurement 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 Hours]

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 Hours]

1.1 Basic layout of distribution system
1.2 Calculation of conductor size for distribution line
1.3 Poles and insulators for distribution line
1.4 Consumer's connection system

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

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 Hours]

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

- Study of 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
2. Manual for survey and layout design of private micro-hydro power plants, published by ICIMOD, Kathmandu, Nepal, 1999
3. Maintenance and Repair Manual for for private micro-hydro power plants, published by ICIMOD, Kathmandu, Nepal, 1999
4. Operation and Management Manual for for private micro-hydro power plants, published by ICIMOD, Kathmandu, Nepal, 1999

Instrumentation & Transducers

EG 3218 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 objectives

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 Contents

Unit 1: Basic concepts **[8 Hours]**
- 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 Hours]**
- 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 measurment
- 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 Hours]**
- 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 Hours]

4.1 Resistance Temperature detector
- Principle
- Construction
- Applications

4.2 Thermistor
- Principle
- Construction
- Applications

4.3 Thermocuple
- Principle
- Construction
- Applications

Unit 5: Miscellaneous Transducers [8 Hours]

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 Hours]

6.1 Operational Amplifier
6.2 Application of Opm in instrumentation

Laboratory Exercises: [30 Hours]

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 Limitted, India

Electric Drives

EG 3218 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 objectives

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, operation of rectifier, chopper, inverter and ac voltage controller.

Course Contents

Unit 1. Introduction **[2 Hours]**

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 Hours]**

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.

2.6. Braking of dc motor – plugging, dynamic braking and re-generative braking.

Unit 3 AC motor drives [14 Hours]

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 [8 Hours]

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 Hours]

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 Printice 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

EG 3218 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 biomas.
3. Compare the prospects of renewable energy resources

Course Contents

Unit 1 Introduction **[6 Hours]**

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 Hours]**

2.1. Solar radiation
2.2. Electromagnetic spectrum
2.3. Prediction of solar radiation
2.4. Solar thermal energy
2.5. Domestic hot water system
2.6. Solar dryer
2.7. Solar distillation
2.8. Solar ponds
2.9. Swimming pool heating
2.10. Concentrating collectors
2.11. Flat plate collectors
2.12. Solar-electricity
2.13. Fundamental principle of photovoltaic conversion
2.14. Types of photovoltaic cells (mono-crystalline, poly-crystalline, thin film or amorphous cells)

2.15. Solar module, energy storage battery, charge controller
2.16. Solar home system and solar water pumping

Unit 3 Hydro-electricity [10 Hours]

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 equipments
  - turbine
  - generator
  - governer
  - automatic voltage regulator
  - electronic load controller
  - ancillary equipments

Unit 4 Biomass [10 Hours]

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 [8 Hours]

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 Hours]

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.

Principle of Energy Conservation

EG 3218 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 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 [2 Hours]

1.1 Electrical energy in Nepal.
- The growth of consumption.
- The cost of new power plant
- Electricity Price
- Electrical energy conservation: The national prospective.

Unit 2 Electrical Energy Survey [4 Hours]

2.1 Understanding the electricity bill
- Electricity tariffs
- Analysis of electric bill
- Collecting historical data.

2.2 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 3 Plant Electrical Distribution System [8 Hours]

3.1 Typical system bus design:
- Simple radial single bus system
- Double bus system
- Sectionalized and special bus system

3.2 Voltage Levels and Wiring System

3.3 Conductor Size
- Energy losses in conductor
- Optimum conductor size

3.4 Transformer
- Transformer losses
- Transformer selection

3.5 Design of new plant distribution system

Unit 4 Power Factor [6 Hours]

4.1 Power factor fundamentals
4.2 Causes of low power factor
4.3 Leading and lagging power factor and kVAr flow
4.4 Effects of low power factor and benefits of its improvement
- System capacity
- Capital cost for new system
- Distribution system loss

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

Unit 5 Load Management [6 Hours]

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

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

5.3 Methods of demand control
- Manual demand control (load shedding and monitering)
- Automatic demand control

Unit 6 Electric Motors [4 Hours]

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

6.2 Standard motor efficiencies.
6.3 Factor affecting electric motor efficiency
- Motor size
- Motor load
- Motor selection and sizing
- Motor maintenance
- Motor rewinding

6.4 High efficiency motors.

Unit 7 Lighting **[6 Hours]**

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

7.2 Ballasts

7.3 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 8 Process Equipment **[8 Hours]**

8.1 Energy saving in process equipment
- Turn off idle equipment
- Operate equipment at design loading

8.2 Compressor
- Minimize flow rate of compressed air
- Minimum operating pressure of compressor air system

8.3 Pumps
- Reducing friction losses
- Reducing the flow

8.4 Adjustable speed systems
- Mechanical system: pulley system, fluid drives, gear drives and other mechanical adjustable speed systems
- Electrical and electronic system: multi-speed motors, pole amplitude modulated motors, electronic adjustable speed drives, energy saving by adjustable speed drive.

Practical **[30 Hours]**

1. Familiarization of industry (plant)
2. Draw a single line diagram of electric distribution system for any one of visited plant
3. A case study of energy conservation by load management
4. A case study of energy conservation by power factor improvement
5. A case study of energy conservation in electric motor.
6. A case study of energy conservation in lighting system

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 Sevices/Ministry of Industry by S.L. Nakarmi. IOE

Programmable Logic Control (PLC) Design

EG 3210 EX
(Elective)

Total: 5 hour /week
Year: III **Lecture: 3 hours/week**
Semester: II **Tutorial: 0 hours/week**
Practical:
Lab: 2 hours/week

Course description

This course is designed to teach students the fundamental concepts, methods of analysis, and design of programmable logic controllers and systems.

Course objectives

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

1. Design a PLC system, component, or process to meet a set of specifications.
2. Design, conduct, and interpret a validation test of a PLC system.
3. Gain an understanding of the role of PLCs in safety critical systems.
4. Gain proficiency with a PLC simulation software package, and utilize this software package to solve problems on a wide-range of PLC problems.

Course Contents

Unit 1 Programmable Logic Controller (PLC) Review **[3 Hours]**
- 1-1 Overview
- 1-2 PLC and Control System Components

Unit 2 Relay Logic Diagrams **[2 Hours]**
- 2-1 Logic diagram symbols and terminology
- 2-2 Proper logic diagram formatting

Unit 3 PLC Programming **[3 Hours]**
- 3-1 Introduction to PLC programming
- 3-2 Programming Logic Gate Functions

Unit 4 PLC Timer Functions **[2 Hours]**
- 4-1 Retentive timers
- 4-2 Nonretentive timers
- 4-3 Timer applications

Unit 5 PLC Counter Functions **[2 Hours]**
- 5-1 Basic counter functions □
- 5-2 Counter applications
- 5-3 Introduction to Special I/O Modules

Unit 6 PLC Math Functions **[3 Hours]**
- 6-1 Addition, Subtraction, Multiplication, Division
- 6-2 Square root, Scaling, Absolute value, X to the power of Y
- 6-3 Natural Logarithm, Base 10 logarithm
- 6-4 Sine, Cosine, Tangent, ArcSine, ArcTan, ArcCos

Unit 7 PLC Logic Functions **[4 Hours]**

7-1 Bit functions
7-2 Shift and rotate functions

Unit 8 Other PLC Functions **[5 Hours]**

8-1 PLC Compare, Jump, and MCR Functions
8-2 PLC Subroutine Functions
8-3 PLC Sequencer Functions

Unit 9 PLC Interrupts **[2 Hours]**

9-1 The principle and the structure of interrupt function
9-2 Application of interrupt service routine
9-3 Interrupt source, label and priority
9-4 Interrupt configuration and examples of interrupt routing

Unit 10 Process Control **[5 Hours]**

10-1 Features of PLC based process control
10-2 Point of Loop Controller
10-3 Internal mechanism of Loop Controller
10-4 Outline of Procedures to build PLC-based Process Control System

Unit 11 PLC Networks **[6 Hours]**

11-1 Serial networks (RS-232, RS-485)
11-2 TCP/IP networks

Unit 12 PLC Applications and Case Studies **[8 Hours]**

12-1 large scale PLC system design
12-2 Human-machine interface

Laboratory **(30 Hours)**

The practical exercise shall cover all the PLC programming exercises related to above topics.

References:

1. M. Rabiee, Programmable Logic Controllers: Hardware and Programming, Goodheart-Willcox, 2002.
2. M. Rabiee, Programmable Logic Controllers: Hardware and Programming Laboratory Manual, Goodheart-Willcox, 2002**.**

Advanced Microprocessor and Interfacing Systems

EG 3210 EX
(Elective)

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

Course description

This course deals with advanced features of microprocessor, basic low level microprocessor programming, interfacing and basic programmable devices.

Course objectives

After completing this course the students will be able to:

1. Understand the working principle of a computer
2. Understand the working principle of microprocessor
3. Explain the process or writing and executing low level language

Course Contents

Unit1. Review of 8-bit microprocessor [2 Hours]

1.1. Microprocessor architecture and the instruction set
1.2. Addressing modes
1.3. Assembly language programs

Unit2. Introduction to 16-bit Microprocessor [3 Hours]

2.1 History of x86 microprocessors
2.2 Internal architecture of 8086 microprocessor
2.3 Instruction and instruction format
2.4 Addressing modes

Unit3. Assembly language programming for 8086 [12 Hours]

2.5 Assembly language: Process of assembling, linking and executing
2.6 Assemblers: One pass assemblers, Two pass Assemblers, One and Half pass assemblers, Macro
2.7 Statements: Instruction, Directives, Conventional segment directives, simplified segment directives
2.8 DOS interrupts and its functions
2.9 Advanced Keyboard and Video processing

Unit4. Interfacing I/O and memory devices [7 Hours]

2.10 Unique and non-unique address decoding
2.11 Types of address decoding: Discrete Component, Decoders, FPGA
2.12 Interfacing Memory units and Input Output devices
2.13 BUS and bus architecture: ISA, PCI, USB and their signals
2.14 Parallel ports and application
2.15 Direct memory access

Unit5. Interrupt and Interrupt processing [4 Hours]

5.1 Types of Interrupt: Software, Hardware and their handling
5.2 Interrupt and interrupt processing
5.3 Interrupt Vector table and its implementation
5.4 Interrupt Driven I/O

Unit6. Introduction to higher bit Processor [5 Hours]

Unit7. Introduction Intel based processor: x86 , Pentium, Xeon, Itanium

5.5 Introduction to AMD, Cyrix processor
5.6 Introduction to Math co-processor

Unit8. General purpose programmable peripheral devices [12 Hours]

8.1 8255 Programmable Peripheral Interface: Internal Architecture, modes of operation, interfacing with different modes, Bit set reset mode, simple Input output mode, handshaking mode and applications
8.2 8254(8253) Programmable Interval Timer: Internal Architecture, modes of operation and applications
8.3 8259 Programmable Interrupt Controller: Internal Architecture, Initialization Command Words, Operational Command Word One, Interrupt Sequence, cascade connection and applications
8.4 8251 USART: Internal Architecture, Initialization and application

Laboratory [30 Hours]

The practical exercise shall cover the Assembly language program from the simple programs for data transfer to complex programs as interrupt service routine

1. Basics of debug program and its instruction
2. Programs that uses simple input and output processing
3. Programs that uses arithmetic instructions and table processing
4. Programs that uses logical instructions and string processing
5. Programs video screen processing
6. Programs with Advanced video processing
7. Programs involving macro and sub-routine
8. Programs that interrupt service routine Type 0: Divide by zero
9. Familiarization with 8255
10. Simple input output on 8255
11. Familiarization with Parallel port
12. Interfacing 7-segment display with parallel port

References:

1. Peter Able, "IBM PC assembly language programming"
2. Douglas V. Hall, "Microprocessors and Interfacing: Programming and Hardware"
3. Hans-Peter Messmer, "The Indispensable PC Hardware Book"

Experts involved in Curriculum Development

CTEVT would like to extend its heartfelt thanks to the following experts who contributed in the process of developing and revising the curriculum of **Diploma in Electrical and Electronics Engineering.**

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