

CURRICULUM DIPLOMA

Electrical & Electronics Engineering (Three year program-semester system)



**Council for Technical Education and Vocational
Training**

Curriculum Development Division

Sanothimi, Bhaktapur

2013

Revision 2019

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Introduction

The fusion of Electrical and Electronics Engineering is an emerging field in the engineering sector. Many people in the developed countries, developing countries and under developed countries have 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.

There are six semesters in total within the period of three years. The first year courses are offered focusing on foundational subjects such as; Physics, Chemistry, Mathematics and languages like Nepali and English diffusion model of curricular program are applicable in the field of Electrical and Electronics 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. In this course the students practices on the application of learned skills and knowledge through the Industry Based Project as infusion model of subjects. It makes provision of projects as well as elective subjects in the specific areas of Electrical and Electronics Engineering. This curriculum will guide to its implementers to produce competent and highly employable middle level technical workforces in the field of Electrical and Electronics sectors.

Rational

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

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

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

Curriculum Title

Diploma in Electrical and Electronics Engineering (DEExE)

Aim

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

Program Objectives

This curriculum has following objectives to:

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 national and international manufacturing industries.
3. Prepare such electrical and electronic workforce who will demonstrate positive attitude and respect for the profession and socio-cultural values.
4. Reduce the dependence on foreign technicians.
5. Create self employment opportunities.

Group Size

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

Entry Criteria

- SLC Pass or SEE with minimum C grade in Compulsory Mathematics & Science and D+ in English.
- TSLC in Electrical or Electronics Engineering with minimum 67%.
- Should pass entrance examination as administered by CTEVT.

Duration

The total duration of this curricular program is three academic years. The program is based on semester system. Moreover, one semester consists up to 15 weeks and one academic week consists up to 40 hours excluding evaluation period.

Medium of Instruction

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

Pattern of Attendance

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

Teachers and Students Ratio

The ratio between teachers and students must be:

- Overall ratio of teacher and student must be 1:12 (at the institution level)
- 1:48 for theory and tutorial classes
- 1:12 for practical/demonstration
- 1:8 for bench work
- 75 % of the technical teachers should be full timer

Qualification of Teachers and Instructors

- The program coordinator should be a master's degree holder in the related area.
- The disciplinary subject related teacher and demonstrators should be a bachelor's degree holder in the related area.

- The foundational subjects' related teachers (refer to course codes SH and MG) should be master's degree holder in the related area.

Instructional Media and Materials

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

- **Printed Media Materials** (Assignment sheets, Hand-outs, Information sheets, Individual training packets, Procedure sheets, Performance Check lists, Textbooks etc.).
- **Non-projected Media Materials** (Display, Flip chart, Poster, Writing board etc.).
- **Projected Media Materials** (Opaque projections, Overhead transparencies, Slides etc.).
- **Audio-Visual Materials** (Audiotapes, Films, Slide-tape programs, Videodiscs, Videotapes etc.).
- **Computer-Based Instructional Materials** (Computer-based training, Interactive video etc.)

Teaching Learning Methodologies

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

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

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

Mode of Education

There will be inductive and deductive modes of education.

Examination and Marking Scheme

a. Internal assessment

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

b. Final examination

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

c. Requirement for final practical examination

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

d. Final practicum evaluation will be based on:

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

e. Pass marks:

- The students must secure minimum 40% marks in theory and 40% marks in practical. Moreover, the students must secure minimum pass marks in the internal assessment and in the semester final examination of each subject to pass the subject.

Provision of Back Paper

There will be the provision of back paper but a student must pass all the subjects of all semester within six years from the enrollment date; however there should be provision of chance exam for final semester students as per CTEVT rules.

Disciplinary and Ethical Requirements

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

Grading System

The following grading system will be adopted:

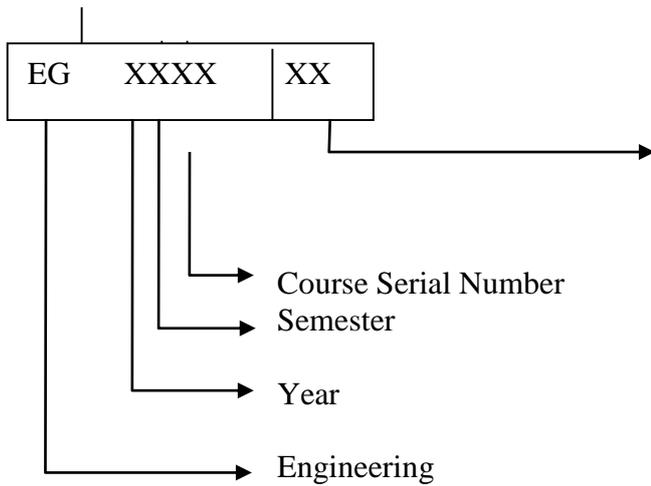
- Distinction: 80% and above
- First division: 65% to below 80%
- Second division: 50 % to below 65%
- Pass division: Pass marks to Below 50%

Certification and Degree Awards

- Students who have passed all the components of all subjects of all 6 semester are considered to have successfully completed the program.
- Students who have successfully completed the program will be awarded with a degree of "**Diploma in Electrical and Electronics Engineering**".

Subjects Codes

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



Offering Departments:

MX: Mechatronics Engineering

AR: Architecture

AE: Automobile Engineering

EE: Electrical Engineering

ME: Mechanical Engineering

EX: Electronics Engineering

CT: Computer Engineering

CE: Civil Engineering

SH: Science and Humanities

MG: Management

Provision of Specialization:

There will be no provision of specializing but some subjects are offered here with provision of the elective; viz. Hydro Power, Radio/Television and Broadcasting System, Renewable Energy Technology, Electrical Energy Management, Fiber Optic Communication, Wireless Communication.

Career Opportunity

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

Question Patterns for Written Exam

The question patterns for written exam are suggested as follows;

A. For subject with full marks 80

S. N.	Type of questions	No of questions	Weightage marks	Full marks	Time distribution	Optional questions
1	Long	3	8	24	54 minutes	1
2	Short	8	4	32	72 minutes	2
3	Very short	12	2	24	54 minutes	2
	Total	23		80	180 minutes	

B. For subject with full marks 60

S. N.	Type of questions	No of questions	Weightage marks	Full marks	Time distribution	Optional questions
1	Long	3	6	18	54 minutes	1
2	Short	8	3	24	72 minutes	2
3	Very short	9	2	18	54 minutes	2
	Total	19		60	180 minutes	

C. For subject with full marks 40

	Type of questions	No of questions	Weightage marks	Full marks	Time distribution	Optional questions
1	Long	2	6	12	27 minutes	1
2	Short	4	4	16	36 minutes	1
3	Very short	6	2	12	27 minutes	1
	Total	12		40	90 minutes	

Curriculum Structure

Diploma in Electrical and Electronics Engineering

Year: I

Part: I

Teaching Schedule			Mode					DISTRIBUTION OF MARKS						Total Marks	Remarks
S.N.	Course Code	Course Title	L	T	P	Lab	Total Hrs.	Theory			Practical				
								Asst. Marks	Final Marks	Time Hrs.	Asst. Marks	Final Marks	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 1102 ME	Engineering Drawing			4		4				60	40	4	100	
7	EG 1112 EE	Workshop Practice I	1		9		10				120	80	6	200	
Total			15	3	13	4	35	80	280		200	140		700	

Year: I

Part: II

Teaching Schedule			Mode					DISTRIBUTION OF MARKS						Total Marks	Remarks
S N	Course Code	Course Title	L	T	P	Lab	Total Hrs	Theory			Practical				
								Asst. Marks	Final Marks	Time Hrs	Asst. Marks	Final Marks	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 1215 EE	Principles of Electrical Engineering	4			3	7	20	80	3	30	20	3	150	
Total			18	3	8	7	36	100	360		170	120		750	

Diploma in Electrical and Electronics Engineering

Year: II

Part: I

Teaching Schedule			Mode					DISTRIBUTION OF MARKS						Total Marks	Remarks
S N	Course Code	Course Title	L	T	P	Lab	Total Hour	Theory			Practical				
								Asst. Marks	Final Marks	Time Hours	Asst. Marks	Mark Final	Time Hrs.		
1	EG 2102 CT	Computer Programming	2		2		4	10	40	1.5	30	20	3	100	Continuous Assessment
2	EG 2105 EX	Basic Electronics	3			3	6	20	80	3	30	20	3	150	
3	EG 2106 EX	Digital logic	3			3	6	20	80	3	30	20	3	150	
4	EG 2101 EE	Electrical and Electronics Engineering Material	4				4	20	80	3				100	
5	EG 2103 EE	Electric Circuit Theory	4			3	7	20	80	3	30	20	3	150	
6	EG 2105 EE	Electrical Installation			7		7				60	40	4	100	
7	EG 2106 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	18		13	9	40	100	400		240	160		900	

Year: II

Part: II

Teaching Schedule			Mode					DISTRIBUTION OF MARKS						Total Marks	Remark
S N	Course Code	Course Title	L	T	P	Lab	Total Hour	Theory			Practical				
								Asst. Marks	Final Marks	Time Hours	Asst. Marks	Mark Final	Time Hrs.		
1	EG 2202 EX	Electronics Devices and Circuits	3			2	5	20	60	3	10	10	2	100	Continuous Assessment
2	EG 2201 EE	Computer Aided Drawing	2		2		4	10	40	1.5	30	20	3	100	
3	EG 2205 EX	Microprocessors	3		2		5	20	60	3	10	10	2	100	
4	EG 2208 EX	Basic Programmable Logic Control (PLC)	3			2	5	20	60	3	10	10	2	100	
5	EG 2202 EE	Electrical Machines I	3			2	5	20	60	3	10	10	2	100	
6	EG 2203 EE	Electrical Measurements and Measuring Instruments	4			2	6	20	80	3	30	20	3	150	
7	EG 2205 EE	Transmission and Distribution of Electrical Power	4				4	20	80	3				100	
8	EG 2215 EX	Repair and Maintenance of Consumer Appliances I			6		6				60	40	4	100	
		Total	22		10	8	40	130	440		160	120		850	

Diploma in Electrical and Electronics Engineering

Year: III

Part: I

Teaching Schedule			Mode					DISTRIBUTION OF MARKS						Total Marks	Remark
S N	Course Code	Course Title	L	T	P	Lab	Total Hour	Theory			Practical				
								Asst. Marks	Final Marks	Time Hours	Asst. Marks	Mark Final	Time Hrs.		
1	EG 3101 EE	Switch Gear and Protection	3	1		3	7	20	80	3	30	20	3	150	Continuous Assessment
2	EG 3102 EE	Power Electronics	3			2	5	20	60	3	10	10	2	100	
3	EG 3103 EE	Electrical Machines II	3	1		3	7	20	80	3	30	20	3	150	
4	EG 3104 EE	Minor Project			4		4				60	40	4	100	
5	EG 3106 EX	Digital Electronics Circuit	4			3	7	20	80	3	30	20	3	150	
6	EG 3107 EX	Repair and Maintenance of Consumer Appliances II			5		5				60	40	4	100	
7	EG 3105 EE	Control System Components	3			2	5	20	60	3	10	10	2	100	
		Total	16	2	9	13	40	100	360		230	160		850	

Year: III

Part: II

Teaching Schedule			Mode					DISTRIBUTION OF MARKS						Total Marks	Remark
S N	Course Code	Course Title	L	T	P	Lab	Total Hour	Theory			Practical				
								Asst. Marks	Final Marks	Time Hours	Asst. Marks	Mark Final	Time Hrs.		
1	EG 3201 EX	Communication Systems	4			3	7	20	80	3	30	20	3	150	Continuous Assessment
3	EG 3208 EX	Design, Estimating & Costing of Electrical & Electronics Installation	3		2		5	20	60	3	10	10	2	100	
4	EG 3209 EX	Industry Based Major Project			8		8				120	80	6	200	
5	EG 3210 EX	Industrial Attachment			4		4				60	40	4	100	
6	EG 3201 MG	Entrepreneurship Development	3		2		5	20	60	3	10	10	1.5	100	
7	EG 3109 CT	Computer Architecture	3	1	2		6	20	60	3	10	10	2	100	
7		Elective (One of the followings)	3		2		5	20	60	3	10	10	2	100	
	EG 3202 EE	a) Hydro Power													
	EG 3211 EX	b) Radio & Television and Broadcasting System													
	EG 3202 EE	c) Renewable Energy Technology													
	EG 3202 EE	d) Electrical Energy Management													
	EG 3211 EX	e) Fiber Optic Communication													
	EG 3211 EX	f) Wireless Communication													
		Total	16	1	20	3	40	100	320		250	180		850	

First Year
(First and Second Semesters)

First Semester

Subjects:

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

कम्युनिकेसन नेपाली

ई.जी. १९०९ एस.एच.

वर्ष : प्रथम
सेमेष्टर: प्रथम

जम्मा: २ घण्टा/ हप्ता
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 समावेश 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, शब्द निर्माण र शब्द भण्डारको 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 शब्द स्रोत,
- वर्णविन्यास (प्राविधिक शब्दका सन्दर्भमा आवश्यक मात्र)
 - अर्थ र व्युत्पत्तिका लागि शब्दकोशको प्रयोगको अभ्यास

२.२ बुँदा टिपोट, सङ्क्षेपीकरण

- बुँदा लेखन
- सारांश लेखन

२.३ अनुच्छेद लेखन /प्रतिवेदन लेखन

२.४ निबन्ध लेखन

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

२.६ संवाद लेखन

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

३.१ कृति परिचयको ढाँचा :

- कृतिको नाम :
- कृतिकारको नाम :
- कृतिका मूल विषयवस्तु : (एक अनुच्छेद)
- कृतिको महत्व : (एक अनुच्छेद)
- कृतिले आफूलाई पारेको प्रभाव : (छोटो एक अनुच्छेद)
- कृतिको भाषाशैली : (छोटो एक अनुच्छेद)
- कृतिको कमी, कमजोरी र सुभाव : (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, इन्जिनियरिङ नेपाली, विद्यार्थी पुस्तक भण्डार, भोटाहिटी, काठमाण्डौं ।
- लालानाथ सुवेदी, नेपाली व्याकरण, बोध/रचना (सम्बन्धित अंशमात्र) विद्यार्थी पुस्तक भण्डार, भोटाहिटी, काठमाण्डौं ।
- गोरखापत्र, कान्तिपुर आदि पत्रिका सम्पादकीय, टिप्पणी र लेखहरू ।

Communication English
EG 1102 SH

Year: I
Semester: I

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

Course Description:

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

Course Objectives:

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

1. Familiarize with English sound and basic structures.
2. Communicate in English language at work/job environment
3. Define and use trade related technical terminologies
4. Demonstrate situational/structural conversation essential for job performance
5. Demonstrate various writing skills

Course Contents:

Unit 1. English sound and basic structures:

- | | |
|--|-----|
| 1.1. Define with examples: | [2] |
| ▪ Phonemes | |
| ▪ Morphemes | |
| 1.2. Introduction to English sounds with examples: | [2] |
| ▪ The Vowels | |
| ▪ The Consonants | |
| 1.3. Dictionary skills | [3] |
| ▪ Alphabetical order | |
| ▪ Dictionary entry | |
| ▪ Guide words, head words | |
| 1.4. Spellings | [1] |
| ▪ British and American English spelling | |

Unit 2. Introduction to grammatical units with examples:

- | | |
|-----------------------|-----|
| 2.1 Grammatical units | [2] |
| ▪ The word | |
| ▪ The phrase | |
| ▪ The clause | |

2.2	Types of sentence	[2]
	<ul style="list-style-type: none"> ▪ The sentence ▪ Forms ▪ Function 	
2.3	Communicative functions	[4]
	<ul style="list-style-type: none"> ▪ Introducing ▪ Requests and offers ▪ Expressing gratuities ▪ Expressing likes/dislikes ▪ Asking for permission ▪ Agreeing/disagreeing ▪ Encouraging/discouraging ▪ Inviting/making invites ▪ Accepting/declining ▪ Suggesting/advising ▪ Making and receiving telephone calls ▪ Group discussing and presentation 	
Unit 3.	Reading:	[2]
	<ul style="list-style-type: none"> ▪ Reading comprehension ▪ Defining trade related terminologies 	
Unit 4.	Writing skills in English:	[12]
4.1.	Writing paragraphs	
4.2.	Writing dialogues	
4.3.	Writing précis/summaries	
4.4.	Writing letters	
	<ul style="list-style-type: none"> ▪ Job application with resumes ▪ Leave application ▪ Business letters ▪ Orders ▪ Complains 	
4.5.	Writing essays	
4.6.	Writing technical reports	
4.7.	Writing meeting minutes	
4.8.	Writing notices	
4.9.	Writing Memo	
4.10.	Writing instructions	
4.11.	Writing technical proposal	

References:

1. Poudel, R.C., A Manual to Communicative English, K.P. PustakBhandar, 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, VidyarthiPustakBhandar, 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 University Press,
9. Better English Pronunciation, Cambridge University Press, New edition
10. Link English, Central Department of English, Tribhuvan University
11. References to be selected by the related lecturer(s) from among the texts available in the market that meet the content needs of this subject.
12. The related institute may develop its own textbook and approve from the related authority so as to have a prescribed textbook of this subject.

Engineering Mathematics I

EG 1103 SH

Year: I

Semester: I

Total: 5 hour /week

Lecture: 4 hours/week

Tutorial: 1 hours/week

Practical: hours/week

Lab: hours/week

Course Description:

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

Course Objectives:

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

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

Course Contents:

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

- 1.1. Review of trigonometric ratios:
 - Basic trigonometric formulae
 - Identities and conditional identities.
- 1.2. Trigonometric equations:
 - Periodicity of trigonometric functions
 - General solutions of the following equations:
 - $\sin x = k$, $\cos x = k$ and $\tan x = k$ and using trigonometric equations.
- 1.3. Inverse circular functions:
 - Domain and their graphs
 - Formulae involving inverse circular functions
 - Simple identities and equations involving circular functions
- 1.4. Properties of triangles:
 - The sin law
 - The cosine law
 - The projection law
 - The half angle formulae

- The area of a triangle
- The encircles and ex-circles of a triangle

Unit 2. **Coordinate Geometry:** [12]

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

Unit 3. **Algebra:** [12]

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

Unit 4. **Set relation and function:** [8]

- 4.1 Idea of set, set notations, set operations,
- 4.2. Venn diagram,
- 4.3. The set of real members and its subsets.
- 4.4. The absolute value of a real number.

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

References:

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

Year: I
Semester: I

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

Course Description:

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

Course Objectives:

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

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 about dimensions of physical quantities.
 - Scalar and Vector: definitions and examples, dot and cross product of two vectors
 - Composition and resolution of vectors (Triangle law and parallelogram law of vectors)
- 1.2 Newton's laws of motion:
 - Newton's laws of motion (First, second and third laws)
 - Principle of conservation of linear momentum
 - Solid friction: Dynamic and rolling friction, laws of solid friction and its verification
- 1.3. Uniform circular motion:
 - Angular displacement and velocity.
 - Centripetal force and acceleration.
 - Motion of bicycle rider

- 1.4. Gravitation:
 - Newton's law of universal gravitation.
 - Gravitational attraction of earth:
 - Acceleration due to gravity.
 - Variation of acceleration due to gravity with height, depth, and latitude.
 - Motion of satellites:
 - Orbital velocity,
 - Geostationary satellites.
 - Weightlessness, motion of lift
- 1.5. Work, energy, and power:
 - Definition and units of work, energy and power.
 - Potential and kinetic energy.
 - Conservation of energy.
 - Conservative forces.
- 1.6. Simple harmonic motion (SHM):
 - Simple harmonic motion and its characteristics.
 - Energy of simple harmonic motion.
 - Simple pendulum.
- 1.7. Equilibrium and rotation of rigid bodies:
 - Forces in equilibrium, torque, couple, C.G. and center of mass.
 - Moment of inertia.
 - Angular momentum and
 - Its conservation.
 - Work done by torque.

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, $C_p - C_v = R$.
 - 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 hollow cylinder by using vernier calipers.
2. Determine density of a steel / glass ball by using screw gauge.
3. Determine thickness of glass plate using spherometer and calculate the area by using millimeter graph paper.
4. Determine the acceleration due to gravity by using simple pendulum.
5. Determine the magnetic movement of a bar magnet by using deflection magnetometer.
6. Determine the refractive index of the material of prism.
7. Determine specific heat capacity of solid by the method of mixtures.
8. Determine specific latent heat of ice by the method of mixtures.
9. Determine specific gravity of different solids by up thrust method.
10. Determine focal length of a converging lens by displacement method.

Text books:

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

References:

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

Engineering Chemistry I

EG 1105 SH

Year: I
Semester: I

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

Course Description:

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

Course Objectives:

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

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

Course Content:

- Unit 1: Language of chemistry: [4]**
- 1.1 Symbol:
 - Definition
 - Significance (qualitative and quantitative)
 - 1.2 Formula:
 - Definition
 - Significance (qualitative and quantitative)
 - Concept of valency in terms of combining capacity with H₂, O₂, and Cl₂
 - Variable valency (ref. Fe, Sn, Pb, Cu, Hg, S and N)
 - Radicals (electro- positive and electro - negative)
 - Writing a formula
 - 1.3 Chemical equation:
 - Definition
 - Types requisites
 - Significance and limitation
 - Balancing of chemical equation by hit and trial method and Partial equation method

Unit 2: General chemistry: [8]

- 2.1 Atom and molecule:
- Definition
 - Dalton's atomic theory and modern position of the theory
- 2.2 Atomic weight:
- Definition
 - Determination of atomic weight by Dulong and Petit's method and Related numerical problems
- 2.3 Molecular Weight:
- Definition
 - Avogadro's hypothesis
 - Application of Avogadro's hypotheses (Mol.Wt= $2 \times$ V.D., in the deduction of atomicity of elementary gases H₂, Cl₂, O₂, and N₂)
 - 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. H₂, O₂, N₂, CH₄, H₂O, NH₃, C₂H₂
 - Coordinate co-valency eg. H₂O₂, SO₂, O₃, SO₃)
 - Electronic dot structure of some compounds eg. H₂SO₄, CaCO₃, K₂SO₃
- 3.5 Electrolysis:
- Definition of electrolyte, non-electrolyte and electrolysis
 - Faraday laws of electrolysis,
 - Application of electrolysis (electroplating and electro refining)
 - Electrolysis of acidulated water
- 3.6 Oxidation and reduction:
- Classical definition
 - Electronic interpretation
 - Oxidizing agent: Definition and eg O₂, O₃, oxyacids, halogens, K₂Cr₂O₇, KMnO₄
 - Reducing agent: Definition and eg. H₂, H₂S with some examples,
 - auto-oxidation eg. H₂O₂, HNO₂, SO₂
 - Idea of oxidation number
 - Balancing chemical equation by oxidation number method
- 3.7 Atomic structure:
- Subatomic particles (electron, proton and neutron)
 - Classical α - rays scattering experiment

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

3.8 Corrosion:

- Definition
- Types
- Direct and indirect method and prevention against corrosion

3.9 Activity and electrochemical series:

- Definition
- Action of water, acid and oxygen on metals.

Engineering Chemistry Practical I

[30]

1. Simple Glass Working [6]
 - a. to cut the glass tube into three equal parts and round up their shape edges
 - b. to bore a hole through a cork
 - c. to bend the glass tubing into acute, obtuse and right angle
 - d. to draw a jet and capillary tube
 - e. to fit up a wash bottle
2. To separate sand and copper sulphate crystals in pure and dry state from the mixture of sand and copper sulphate [2]
3. To separate sand and calcium carbonate in pure and dry state from the mixture of sand and calcium carbonate [2]
4. To prepare pure water from supplied impure water by distillation and to test the purity of the sample prepared [2]
5. To neutralize dilute sulphuric acid with sodium carbonate solution, and to recover crystals of sodium sulphate [2]
6. To obtain pure and dry precipitate of barium sulphate by treating excess of dilute sulphuric acid with barium chloride solution [2]
7. To investigate the composition of water by electrolysis by using Hofmann's apparatus [2]
8. To determine the equivalent weight of reactive metal by hydrogen displacement method. [2]
9. To determine the pH of different unknown solution and using pH paper and universal indicator [2]
10. To prepare primary standard solution of sodium carbonate and to use it to standardize an approximate decinormal acid solution [2]

11. To standardize given unknown acid (Approximately N/10) solution by preparing standard alkali solution. (Expression of strength in different ways) [2]
12. To standardize given unknown alkali (approximately N/10) solution with the help of by preparing standard acid solution. (Expression of strength in different ways) [2]
13. To carry out conductivity experiments on solids and liquids (CuSO₄, Zn, Mg, Al, Fe, CCl₄, C₆H₆, C₂H₅OH) [2]

Text books:

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

Reference books:

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

EG 1102 ME

Year: I Semester: I	Total: 4 hour /week Lecture: hours/week Tutorial: hours/week Practical: 4 hours/week
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Course description

This course deals with geometrical construction, orthographic projections, and Orthographic Projection 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.
5. Draw pictorial projections from the given orthographic views,
6. Develop the surfaces of the geometrical solids, and,
7. Draw interpenetration line/curve for the given intersecting solids

Course Contents

Unit 1: Introduction

[2 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

[8 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, involutes

3.7. Exercise on construction of standard curves [Sheet 5]

Unit 4: Dimensioning

[2 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

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

5.5. 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

5.6. Exercise on projection of point and line [Sheet 7]

5.7. 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

5.8. True Length of an Oblique Line

5.9. True shape of an Oblique Plane

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

Unit 6: Surface Development

[8 Hours]

- 6.1. General concepts and practical considerations
- 6.2. Development of Right solids: Cylinder, Prism, Cone and Pyramid
- 6.3. Development of Oblique solids: Cylinder, Prism, Cone and Pyramid
- 6.4. Development of Truncated solids
- 6.5. Exercise on development of truncated right prism and cylinder [Sheet 11]
- 6.6. Exercise on development of oblique solids [Sheet 12]

Unit 7: Orthographic Projection **[16 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: Pictorial Projection: Isometric Drawing **[8 Hours]**

- 8.1. Introduction to Axonometric projection
- 8.2. Isometric projection and isometric drawing
- 8.3. Procedure of Making an Isometric Drawing
- 8.4. Non isometric Lines and Non isometric surfaces
- 8.5. Box and coordinate construction method
- 8.6. Angles in isometric
- 8.7. Circles and circular arcs in isometric
- 8.8. Orientation of object in isometric drawing
- 8.9. Exercise on isometric drawing of objects with horizontal and vertical planes [Sheet 15]
- 8.10. Exercise on isometric drawing of objects with cylindrical surfaces and cylindrical holes [Sheet 16]

Unit 9: Oblique Drawing **[4 Hours]**

- 9.1. Oblique projection and Oblique drawing
- 9.2. Procedure of Making an Oblique Drawing
- 9.3. Rules for Placing Object in Oblique
- 9.4. Angles, Circles and Circular Arcs in Oblique
- 9.5. Cavalier and Cabinet Projection
- 9.6. Exercise on oblique drawing of objects with plane and curved surfaces [Sheet 10]

References:

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

Workshop Practice I

EG 1112 EE

Year: I
Semester: I

Total: 10 hours /week
Lecture: 1 hours/week
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. Explain 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 scribe, 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 vice 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 finish accuracy $\pm 0.2\text{mm}$.
 - 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 the measuring instrument.

Unit 5 Power Tools

[2 Hours]

- 5.1 Drill machines
- Identify the hand drills machines, bench, gang, column, 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.

Unit7 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.

Unit8 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.

Unit9 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.

Unit10 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, scribe, 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.

Unit11 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

Unit12 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

Unit13 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.

Unit14 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

Unit15 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	key points
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	Filing 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. Manufacturing 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
EG1215 EE	Principles of Electrical Engineering

Engineering Mathematics II

EG 1201 SH

Year: I
Semester: II

Total: 4 hour /week
Lecture: 3 hours/week
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 form $A + ib$.	
	<ul style="list-style-type: none"> • Algebra of complex numbers. • Polar representation of complex numbers. 	
	2.2. De Moivre's theorem and its applications	
	2.3. Linear inequalities and their graphs.	
	<ul style="list-style-type: none"> • System of linear inequalities in two variables, • System of linear inequalities in two variables, • Linear programming: Problems involving two variables under given linear constraints 	
	2.4. Determinants and matrices,	
	<ul style="list-style-type: none"> • Algebra of matrices, • Properties of determinants, • Ad joint and inverse of matrices. • Solution of linear equations using Cramer's rule • Row equivalent matrices • Idea of polynomial equations 	
Unit 3.	Calculus:	[9]
	3.1. Applications of derivatives-	
	<ul style="list-style-type: none"> • Tangents and normal to a curve taking slope as derivative • Maxima and minima of a function • Derivative as rate of change 	
	3.2. Areas under curves:	
	<ul style="list-style-type: none"> • Use of definite integral as limit of a sum to find areas under curves • Areas of closed curves and • Areas between curves. 	
	3.3. Antiderivatives:	
	<ul style="list-style-type: none"> • Curve tracing, maxima and minima • Riemann sums & integral • Application of fundamental theorem 	
Unit 4.	Geometry:	[6]
	4.1. Coordinates in space,	
	4.2. Coordinates in planes.	
Unit 5.	Statistics:	[6]
	5.1. Statistics:	
	<ul style="list-style-type: none"> • Introduction to statistics • Measures of Central Tendency • Measures of Dispersion • Moments, Skewness and Kurtosis • Correlation and Regression 	

5.2. Probability:

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

Learning materials:

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

Engineering Physics II

EG 1202 SH

Year: I
Semester: II

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

Course Description:

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

Course Objectives:

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

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, Wheatstone bridge
 - Heating effect of current:
 - Joules law and its verification, electric power, maximum power theorem
 - The rate of heating from the concept of p.d.
 - Thermoelectricity:
 - Seebeck effect, variation of thermo e.m.f. with temperature
 - Peltier effect and
 - Thomson effect.
- 1.3. Magnetic effect of current and electromagnetism:
- Magnetic forces and magnetic field of current:
 - Force experienced by charge moving in magnetic field.
 - Maxwell's corkscrew rule.
 - Force applied by magnetic field on current carrying conductor.
 - Torque on current carrying coil in magnetic field.
 - Theory of moving coil galvanometer.
 - Biot-Savart's Law
 - Field due to a long straight conductor and due to circular coil.
 - Force between two parallel conductors carrying current.
 - Ampere's law
 - Magnetic field due to the solenoid and long straight conductor.
 - Electromagnetic induction:
 - Faraday's law of electromagnetic induction and Lenz's law.
 - Phenomenon of self-induction.

- A.C. generator.
- D.C. generator.
- Transformer.

1.4 Alternating current:

- Instantaneous and effective values of current and voltage.
- Phase between current and voltage across different elements of circuit.
- Capacitive and inductive reactance.
- Impedance.
- Resonance.
- Power in a.c. circuit

Unit 2. Waves:

[9]

2.1. Wave motion:

- Wave motion.
- Types of wave motion
- Characteristics of wave motion
- Wavelength, frequency and speed of waves
- Speed of waves in different media.
- Velocity of sound in air.

2.2. Wave phenomena:

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

2.3. Physical optics:

- Interference of light waves and coherent sources.
- Phase difference and path difference. Young's double slit experiment.
- Introduction of Diffraction of light waves.
- Introduction of Huygen's principle.
- Polarization and 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

Year: I
Semester: II

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

Course Description:

This subject consists of 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:

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 "Sulphur 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 copper
- 2.6 Zinc:
 - Properties & uses
- 2.7 Iron:
 - Properties & uses
- 2.8 Lead:
 - Properties & uses

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

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

- 3.1. Organic compounds
- Organic compounds:
 - Historical background, classification, and nomenclature
 - Functional groups and homologous series
 - Saturated hydrocarbon: Properties of Methane
 - Unsaturated hydrocarbon: Properties of Ethylene and Acetylene
 - Aromatic compounds:
 - Definition
 - Comparison of aliphatic and aromatic compounds
 - Properties of Benzene
- 3.2. Synthetic materials:
- Polymer and polymerization
 - Definition
 - Types of polymer
 - Rubber:
 - Types (Natural and Synthetic)
 - Preparation and uses.
 - Polyvinyl chloride (PVC):
 - Preparation and uses
 - Polythene:
 - Preparation and uses

Engineering Chemistry Practical II:

1. To compare the hardness of different types of water [2]
2. To prepare Bakelite (resin) in the laboratory [2]
3. To determine the condition in which corrosion takes place [2]
4. To investigate the action of acids on some metals (Zn, Mg, Fe, Al, Sn & Cu) (acids: HCl, H₂SO₄(dil.)& HNO₃ (dil) [2]
5. To prepare and study the properties of hydrogen gas [2]
6. To prepare and study the properties of ammonia gas [2]
7. To prepare and study the properties of hydrogen Sulphide gas. (This gas should not be prepared individually in woulf bottle but in Kipp's apparatus commonly) [2]
8. To detect the acid radicals (Cl⁻, NO₃⁻, SO₄⁻, CO₃⁻) 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

Year: I
Semester: II

Total: 4 hour /week
Lecture: 2 hours/week
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]

- 3.8 Text Editors (edit in DOS, notepad in Windows, vi editor in Linux)
- 3.9 Word Processing Package: Microsoft Word
- 3.10 Spreadsheet Package: Microsoft Excel
 - Entering data
 - Using formula
 - Basic calculations
 - Financial calculations
 - Charts
- 3.11 Concept of Database management system
- 3.12 Database management package: Microsoft Access
- 3.13 Presentation Package: Microsoft PowerPoint

Unit 5 Utility Programs [2 Hours]

- 3.14 Computer virus and its removal (antivirus programs)
- 3.15 Multimedia: Audio, Video and Graphics

Unit 6 Computer Networking and Data Communication [4 Hours]

- 3.16 Network topologies and protocols
- 3.17 Client and server concept
- 3.18 File and print sharing
- 3.19 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 Course in Computers*", Vikash Publishing

Safety Rules and Regulations

EG 1212 EE

Year: I
Semester: II

Total: 2 hour /week
Lecture: 2 hours/week
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 equipment and circuits.

Course objectives

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

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 state 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

Year: I
Semester: II

Total: 7 hour /week
Lecture: 1 hours/week
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. Identify electrical hazards and apply safety precaution.
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: Behavior 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 fluorescent lamp.
 P: Installation of fluorescent 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 – Foday
2. Electrical installation and workshop practice – F.G. Thompson
3. Conductor Technical manual – Cable manufacturer

Principles of Electrical Engineering

EG 1215 EE

Year: I
Semester: II

Total: 7 hour /week
Lecture: 4 hours/week
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. Explain the fundamental concept of electric circuits
2. Describe 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, field 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, statically 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. Verify Ohm's law

3. Verification of Kirchoff'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 2102 CT	Computer Programming
EG 2105 EX	Basic Electronics
EG 2106 EX	Digital logic
EG 2101 EE	Electrical and Electronic Engineering Material
EG 2103 EE	Electric Circuit Theory
EG 2105 EE	Electrical Installation
EG 2106 EE	Electrical and Electronic Engineering Drawing
EG 2107 ME	Elements of Engineering Economics

Computer Programming

EG 2102 CT

Year: II
Semester: I

Total: 4 hour /week
Lecture: 2 hours/week
Tutorial: hours/week
Practical: 2 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. Perform C programming skill and syntax.
2. Develop basic programming control statements and looping.
3. 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	
	<ul style="list-style-type: none">• 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. Perform Fundamentals program on C-Data types.
2. Perform examples by using if, if-else and switch control statements.
3. Perform examples by using for, while and while do Loops.
4. Illustrate the use of arrays and strings concept.
5. Illustrate the use of function concept.
6. Illustrate the use of file handling concept.

Textbooks:

1. Er. Bikal Adhikari “*A Course on Computer Programming with C and Fortran*” 1st Edition, Heritage publication, Kathmandu.

Reference books:

1. V. Rajaraman, “*Computer programming in C*”, 1st Edition, Publisher Prentice Hall of India, 2004
2. E. Balaguruswami, “*Programming in ANSI C*”, 7th Edition, Publisher Tata McGraw Hill, 2016
3. Byron Gottfried, “*Schaum’s Outline of Programming with C*”, 2nd Edition, Tata McGraw-Hill Publishing Company Ltd.
4. Stephen G. Kochan “*Programming in C*”, 3rd Edition, CBS Publishers.

Basic Electronics Engineering

EG 2105 EX

Year: II
Semester: I

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

Course description

This course will provide skill and knowledge to Basic Electronics engineering. The students will learn and practice on PN Junction diode, BJT and FET and other electronic devices.

Course objectives

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

1. Introduce basic electronics engineering of different fields.
2. Construct PN Junction diode.
3. Explain the working principles BJT.
4. Explain the working principles of FET.
5. Operate the electronic devices.

Course Content

Unit 1: Introduction

(4hrs)

- 1.1. Introduction and use of electronics engineering in different fields.
- 1.2. Independent and dependent voltage and current sources.
- 1.3. Passive and active components DC and AC quantities, and methods of analysis.
- 1.4. Intrinsic and extrinsic semiconductors (Si & Ge) and their electrical properties; valency, conductance and forbidden band
- 1.5. Doping, majority and minority charge carriers; free and bound charges; depletion layer and barrier potential.

Unit 2: PN Junction Diode

(10hrs)

- 2.1. Construction of PN Junction diode.
- 2.2. Forward and reverse biasing; IV-Characteristics and working formula; DC and ac resistances of diode in circuits; temperature effects upon PN Junction. $i_D = I_s (e^{V_D/nV_T} - 1)$
- 2.3. DC biasing of diode circuits: Graphical analysis using IV-Characteristic graph and load line, and, algebraic analysis.
- 2.4. Reverse breakdown phenomena and Zener diode: Zener and avalanche effects.
- 2.5. Rectifier circuits
 - 2.5.1. Half wave and full wave rectifier circuits. Peak value, RMS value and average value.
 - 2.5.2. Voltage doubler and tripler circuits.
- 2.6. Construction of dc voltage power supply from ac power source: dc voltage output, ripple voltage, PIV.

2.7.Regulated dc voltage power supply using Zener diode.

Unit 3: Bipolar Junction Transistor (BJT) (15hrs)

- 3.1.Construction and working principle in active region as amplifier; base-emitter junction; base-collector junction. Majority and minority charge carriers, depletion layer and barrier potential I_B , I_E and I_C currents, their inter-relationship using α and β terms.
- 3.2.Configurations of BJT amplifiers: CB, CE and CC amplifiers and their properties.
- 3.3.DC or static input-output IV characteristics
 - CB amplifier configuration
 - CE amplifier configuration
 - CC amplifier configuration
 - Active, saturation, cut off and breakdown regions of operations.
 - Leakage current and temperature effect
- 3.4.DC biasing for CE amplifier circuit
 - 3.4.1. Graphical and algebraic analyses to determine the dc operating Q- points.
 - 3.4.2. Circuit analysis of fixed biasing, emitter feedback biasing, collector feedback basing and voltage divider type DC biasing.
 - 3.4.3. Coupling of amplifiers: RC, transformer and direct couplings and their features.
 - 3.4.4. BJT as switch: NOT gate operation

Unit 4: Field Effect Transistor (FET) (8hrs)

- 4.1.Construction and working principle of JFET. IV-Characteristics and working formula, and different regions of operations.
- 4.2.Construction and working principle of MOSFET. IV-Characteristics and working formula, and different regions of operations.
- 4.3.DC biasing for C.S. amplifier circuit:
 - Graphical and algebraic methods of analysis to determine dc operating points.
- 4.4.Self biasing of FET amplifier circuit
- 4.5.FET as switch; NOT gate operation.

Unit 5: Special Semiconductor Devices and Circuits (8hrs)

Varactor Diode, Photodiode, LED, Solar Cell Schottky Diode, Opto-coupler, Hall Effect, UJT, SCR and BiFET, and their working principles, IV-characteristics and basic application circuits.

Practical:

Perform the following:

45 hrs

- 1. Demonstrate by teacher and practice by students to learn the knowledge of the following:
 - 1.1. Colour code reading of resister and capacitors.
 - 1.2. Analog and Digital AVO meter.
 - 1.3. Analog and Digital Oscilloscopes
 - 1.4. Function Generators.
 - 1.5. DC voltage power supplies used in laboratory.

2. Construct and analyze Zener diode in forward and reverse biased circuit.
3. Construct and analyse different rectifier circuits and unregulated dcv power supply circuit.
4. Construct and analyse FET circuit for dc output IV- characteristics.
5. Construct collector feedback, voltage divider type dc biasing circuits, and measure the voltages and currents at different nodes, and analyse them.
6. Construct and analyse NOT- gate circuits using BJT and FET.

References:

1. An Integrated course in Electronics Engineering by J.B Gupta.
2. Electronic Devices and Circuits by David A Bell.
3. Laboratory Manual for Electronic Devices and circuits by David A. Bell.
4. Electronic Devices and Circuits by Theodore F. Bogart.
5. Electronic Devices and Circuits Theory by Robert Boylestad and Luis Nashelsky.

Digital Logic

EG 2106 EX

Year: II
Semester: I

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

Course Description:

This course presents an introduction to Digital logic techniques and its practical application in computer and digital system for the students of diploma level who have completed either SLC or equivalent SLC (technical SLC).

Course Objective:

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

1. Explain conversion of different number systems and codes
2. Explain logic functions and gates
3. Perform combinational logic design
4. Perform sequential logic design
5. Perform Industrial application of logic system.

Course Contents:

Unit 1. Introduction:	[2]
1.1 Analog Signal and Digital Signal	
1.2 Digital logic and operation	
1.3 Clock wave form, positive logic, negative logic	
1.4 Propagation delay , Noise Margin	
Unit 2. Number Systems and Codes:	[6]
2.1 Decimal Number System	
2.2 Binary Number System	
2.3 Octal Number System	
2.4 Hexadecimal Number System	
2.5 Conversions among Different Number Systems	
2.5.1 Decimal to Binary, Octal and Hexadecimal	
2.5.2 Binary to Decimal, Octal and Hexadecimal	
2.6 Fraction Conversions from	
2.6.1 Decimal to Binary , Octal and Hexadecimal	
2.6.2 Binary to Decimal, Octal and Hexadecimal	
2.7 BCD Code and conversion from Binary	
2.8 Gray Code and conversion from Binary	
2.9 Alphanumeric Code	

	<ul style="list-style-type: none"> • ASCII Code • EBCDIC Code 	
Unit 3.	Arithmetic Logic Operations:	[5]
3.1	Binary Arithmetic <ul style="list-style-type: none"> • Binary Addition • Binary Subtraction 	
3.2	9's and 10's Complement Method <ul style="list-style-type: none"> • 9's Complement Subtraction • 10's Complement Subtraction 	
3.3	1's Complement and 2's Complement Method <ul style="list-style-type: none"> • 1's Complement Subtraction • 2's Complement Subtraction 	
Unit 4.	Logic Gates:	[5]
4.1	Basic Gates: AND, OR, NOT <ul style="list-style-type: none"> • Logic Equations • Truth Table and symbol 	
4.2	DeMorgan's Theorems <ul style="list-style-type: none"> • 4.2.1 Verification of DeMorgan's Theorem by truth Table 	
4.3	Universal Gates: NAND, NOR <ul style="list-style-type: none"> • Logic Equations • Truth Table and symbol • Verification of Universal properties of NAND and NOR gates 	
4.4	Exclusive Gates: XOR, XNOR	
4.5	Building Logic Circuits from Logic Equations	
Unit 5.	Boolean Functions and Logic Simplification:	[7]
5.1	Boolean Algebra and its Properties/Laws	
5.2	Simplification of Boolean Equations	
5.3	Sum of Product (SOP) Simplification	
5.4	Product of Sums (POS) Simplification	
5.5	Karnaugh Map <ul style="list-style-type: none"> • K-Map Simplification for Two Input Variables • K-Map Simplification for Three Input Variables • K-Map Simplification for Four Input Variables • Maps with <i>Don't Care</i> Conditions 	

Unit 6. Combinational Logic Circuits:

[10]

6.1 Adders

- Half Adder
- Full Adder
- Parallel Bit Adders (3 Bits and 4 Bits)

6.2 Sub tractors

- Half Sub tractors
- Full Sub tractors
- Parallel Bit Subtractors (3 Bits and 4 Bits)

6.3 Encoders

- Decimal to Binary Encoder
- Decimal to BCD Encoder
- Encoder IC Packages

6.4 Decoders

- Binary to Decimal Decoder
- BCD to Decimal Decoder
- Seven Segment Display Decoder
- Decoder IC Packages

6.5 Multiplexers

- 4-to-1 Multiplexer
- 8-to-1 Multiplexer
- Multiplexer Tree
- Multiplexer IC Packages

6.6 Demultiplexers

- Demultiplexer and Decoder Relations
- 1-to-4 Demultiplexer
- 1-to- 8 Demultiplexer
- Demultiplexer tree and Demultiplexer in IC Packages

Unit 7. Sequential Logic Circuits:

[10]

7.1 Latch and Flip-Flops

- RS Flip-Flop : its symbol and Truth Table
- Construction of RS flip-flops using NAND and NOR gates
- Application of Clock and set and preset inputs
- D Flip-Flop : its symbol and Truth Table

- JK Flip-Flop: its symbol and Truth Table
- T Flip-Flop: its symbol and Truth Table
- JK Master-Slave Flip-Flops: its symbol and Truth Table
- Applications of Flip-Flops

7.2 Shift-Registers

- Flip-flop as a One-bit Memory Device
- Right/Left Shift Registers
- Serial-in Serial-out (SISO) Shift Register(4 bits and timing diagram)
- 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

- Asynchronous Counters
- Ripple Counters and timing diagram
- Decade Counters and timing diagram
- Ring Counters
- Synchronous counter, Mod4,Mod 8 and Mod 10
- Applications of Counters

Practical:

Perform the following:

[45]

- 1 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 Verify with truth tables of basic gates: XOR, XNOR Gates
- 4 Realize 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 Verify truth tables of binary half adder/Subtractor and full adder/Subtractor
- 8 Realize the function of decimal to 3-4 bit binary binary encoder
- 9 Realize the function of 4 bit binary binary decoder
- 10 Realize the function of 4-to-1 multiplexer and 1-to-4 demultiplexer circuits.
- 11 Realize the function of latches and flip-flops, RS, D, JK, T flip-flops

- 12 Realize the function shift-registers: SISO, SIPO, PISO and PIPO
- 13 Realize the function ripple counters
- 14 Realize the function synchronous counters
- 15 Realize and designing of seven-segment display-decoder logic circuit

Reference books:

1. Thomas L. Floyd, "Digital Fundamentals", 8th Edition, Pearson Education Inc., 2004
2. John. M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.
3. John F. Wakerly, "Digital Design", Fourth Edition, Pearson/PHI, 2008
4. M. Morris Mano, "Digital Design", 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003

Electrical and Electronics Engineering Material

EG 2101 EE

Year: II
Semester: I

Total: 4 hour /week
Lecture: 4 hours/week
Tutorial: hours/week
Practical: 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. Explain dielectric, Dielectric, Resistor alloys

Course Contents

- Unit 1. Magnetic material** [24 hrs]
- 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 Magnetizing field or magnetic field intensity
 - 1.9 Magnetic permeability and susceptibility
 - 1.10 Domain structure: introduction and domain wall
 - 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, aluminum, 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 hrs]
- 2.1 Description of commonly used resistors, alloys of Nickel, Iron, Chromium, Aluminum, their mechanical and electrical characteristics and industrial application
- Unit 3. Dielectric materials** [18 hrs]
- 3.1. Introduction, macroscopic approach, Dielectric constant, Electric Dipole moment

- 3.2. Polarization mechanism: electronic polarization, orientation(dipolar) polarization, interfacial polarization and total polarization,
- 3.3. Dielectric losses, frequency and temperature effects
- 3.4. Dielectric strength and breakdown in gases, liquids, solids
- 3.5. Ferro electricity and Piezo-electricity
- 3.6. Properties of some dielectric materials
- 3.7. Insulating materials
- 3.8. Identification of insulating materials in general uses and their characteristics
- 3.9. 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 hrs]

- 4.1. Definition, elements of semi-conductor materials, electrical nature.
- 4.2. Band structure of Group IV materials, energy gap.
- 4.3. Atomic structure, electronic properties of silicon, germanium
- 4.4. Formation of electron and hole
- 4.5. Electrical conduction in semi-conductor
- 4.6. Intrinsic and Extrinsic semiconductor, concept of doping
- 4.7. N type semiconductor
- 4.8. P type semiconductor
- 4.9. Fermi level, contact potential and seebeck effect
- 4.10. Metal semic-conductor Junction: Schottky Junction and Ohmic contact

References:

- 1. Electrical Engineering Materials by Bhadra Prasad Pokhrel and Nava Raj Karki
- 2. Electrical engineering materials by P. B. Tonega
- 3. An Introduction to Electrical engineering C. S. Irdal van

Electric Circuit Theory

EG 2103 EE

Year: II
Semester: I

Total: 7 hour /week
Lecture: 4 hours/week
Tutorial: 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. Explain the basic circuit theorems and their application for analysis of DC networks
2. Explain the fundamental knowledge of AC circuits and analysis of AC networks
3. Describe the 3 phase AC systems and their application

Course Contents

Unit 1: DC Network Theorems and Circuit Analysis

[18 hrs]

- 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 hrs]

- 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, addition & 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**[18 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 imbalanced 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) Perform handling of oscilloscope to measure ac quantities such as peak values, rms value, time period & frequency.
- 2) Measure voltage, current & power of R-L-C series circuit.
- 3) Measure voltage, current & power in RL & RC parallel circuit.
- 4) Verify Mesh Analysis, Superposition Theorem, Thevenin's Theorem, Norton's Theorem
- 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) Verify 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

EG 2105 EE

Year: II
Semester: I

Total: 7 hour /week
Lecture: hours/week
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
4. Prepare Schedule, number of quantities and estimate cost
5. Read circuit diagram and install according to diagram;
6. Install and test earthing system;
7. Test the installation system
8. Apply rules of wiring and code of practice

Course Contents

- Unit 1. PVC Conduit wiring preferably in Cubical [16 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 output. Reconnect those two lamps in parallel and observe light output and compare with the previous case. Carryout - continuity test, polarity test & insulation test.
 - 1.3 Perform the installation of two lamps controlled by two way switches. Use second method (live line on both switches) as per lay –out diagram. Carry out - continuity test, polarity test
- Unit 2. Installation of Distribution Board [12 Hours]**
- 2.1 Introduction of the wiring accessories such as switch, socket, distribution box, junction box, pull box- their construction and function.
 - 2.2 Protective devices - such as fuse, MCB, MCCB, ELCB, RCCB, types and Application
 - 2.3 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 3. Consumer Intake [10 Hours]**
- 3.1 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
- 3.2 Install 6 ways MCB distribution board as a consumer control unit along with kWh meter
- Unit 4. Installation of Earth Electrode [10 Hours]**
- 4.1 Purpose of earthing, Earth loop impedance, types, system earthing, protection of earthing, electrode, plate, rod, mesh., star, size, depth, 8 S.W.G wire, strip, charcoal, common salt, watering provision brazing. Protection, function, test, recommended ohm, correction.
- 4.2 Install a electrode and test it with an earth tester. i) New earthing ii) Existing earthing
- Unit 5. Wiring Project in Cubical [8 Hours]**
- 5.1 Prepare plan in Elevation of the Cubical with Electrical lay-out diagram of a wiring system with 6-ways DB (two light circuit, 1 power socket, two spare MCB), 2×40 fluorescent lamps, ceiling dome, wall bracket, call bell, power sockets, dimmer, regulator
- Unit 6. Installation Testing [8Hours]**
- 6.1 Describe importance of testing procedure and testing instruments. Continuity test, Insulation test, Polarity test.
- Perform test on previous project with no bulbs/ fuses switch ON and all bulbs/ fuses switch OFF.
 - Prepare certificate
 - Prepare list of material
- Unit 7. Installation of Fan/Pump motor [14 Hours]**
- 7.1 Installation of 1ph – Universal/ capacitor start – run motor with DP switch and protection (use multicore cable with saddle, Direction of rotation, Clockwise/ Anti clockwise
- 7.2 Installation of frequency meter, power factor meter and Capacitor Bank
- 7.3 Installation of PLC with 1ph-motor control
- Unit 8. Use of DOL starter for motor [6 Hours]**
- 1.1 Replace DP switch by DOL starter in the above job.
- Unit 9. Use of DOL starter for 3 phase motor [7 Hours]**
- 9.1 Connect and start 3 ph. Squirrel cage induction motor (up to 3HP) using drum type ON/OFF switch and HRC/MCB fuses (use con
- Unit 10. Installation of EPABX & CCTV System [14 Hours]**
- 10.1 Installation, programming & trouble shooting of EPABX system
- 10.2 Installation, programming & trouble shooting of CCTV system

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
5. Product installation manual of EPABX and CCTV system.

Electrical & Electronics Engineering Drawing

EG 2106 EE

Year: II
Semester: I

Total: 4 hour /week
Lecture: hours/week
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. 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 and
7. Draw sectional view of the given three dimensional solid

Course Contents

Unit 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, earthlings, lamps, tube lights etc.

Unit 2. Basic symbols used in electronic circuits: [2 Hours]

- 2.1 Active components as semiconductor devices (transistors PNP/NPN, diodes, SCR, MOSFET, CMOS, JFET, FET, Thyristors.
- 2.2 Digital electronic devices such as gates(AND,OR,NOT, NAND, NOR, XOR, XNOR, Flip-Flops)

Unit 3. Passive components such as Resistors, capacitors, Inductors, Variable resistors and capacitors [2 Hours]

Unit 4. Draw simple, two way and intermediate switches connection for building lighting and impulse relay and timer for street lighting. [3 Hours]

Unit 5. Circuit diagram of simple measuring instruments [5 Hours]

- 5.1. Multi-range voltmeter
- 5.2. Multi-range ammeter
- 5.3. Multi-range ohmmeter

5.4. Conversion of galvanometer to

- Voltmeter
- Ammeter

Unit 6. Connection diagram of electrical machines

6.1. Draw connection diagram of DC generator and its control circuit [4 Hours]

- a) Separately excited b) Series c) Shunt d) Compound wound

6.2. Draw connection diagram of DC rotor and its control circuit [4 Hours]

- a) Series b) Shunt c) Compound wound

6.3. Draw connection and diagram of capacitor start, capacitor run and capacitor start and Run single phase motor. [4 Hours]

Unit 7. 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

Unit 8. Control Circuit diagram of 3-phase Induction motor.

8.1. 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]

8.2. 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 [4Hours]

8.3 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]

Unit 9. Draw wiring and connection diagram of substation with incoming and outgoing

11KV OCBS, its control and differential protection. [4 Hours]

Unit10. Draw block diagram of basic computer and computer monitor. [2 Hours]

Unit 11. Draw the circuit diagram of rectifier circuits. [2 Hours]

Unit 12. Sectional Views [8 Hours]

12.1 Use of sectional views

12.2 Cutting plane line and hatching lines

12.3 Types of Section: Full section and Half Section

12.4 Exercises on Full Section of Transformer

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

Elements of Engineering Economics

EG 2107 ME

Year: II
Semester: I

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

Course description:

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

Course objectives:

After completing this course the students will be able to:

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

Course content:

- Unit 1: Introduction to Engineering Economics [2]**
- 1.1 Role of engineering/technical manpower in organization
 - 1.2 Types of engineering economic decision
- Unit 2: Brief Understanding of Financial Statements [3]**
- 2.1 Familiarization with balance sheets, income statement and cash-flow statement components
 - 2.2 Calculation of financial ratios and their familiarization
 - 2.3 Related numerical problems on 2.1 and 2.2
- Unit 3: Cost and Revenue [2]**
- 3.1 The elements of cost
 - 3.2 Direct cost, Indirect cost and Overhead cost allocation
 - 3.3 Job and Process costing
 - 3.4 Revenue and its types
 - 3.5 Related numerical problems on 3.2 and 3.3
- Unit 4: Time value of Money, Interest Rate and Depreciation concept [3]**
- 4.1 Time value of Money
 - 4.2 Simple and compound interest rates, effective interest, and continuous compound interest
 - 4.3 Depreciation methods, straight line, declining balance method
 - 4.4 Related numerical problems on 4.2 and 4.3

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

Suggestions for instructions:

1. The method of teaching is lecture on theory augmented by relevant examples.
2. Use relevant diagrams and charts as much as possible.
3. Use calculator or/and interest factor table during calculation demonstration.

4. Give examples of locally operating engineering activities and projects as much as possible.
5. Demonstrate the basic computer applications using MS Excel program if the computer facility is available.

Reference:

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

Fourth Semester

Subjects:

EG 2202 EX	Electronic Device and Circuits
EG 2201 EE	Computer Aided Drawing
EG 2205 EX	Microprocessors
EG 2208 EX	Programmable Logic Control (PLC)
EG 2202 EE	Electrical Machines I
EG 2203 EE	Electrical Measurements and Measuring Instruments
EG 2205 EE	Transmission and Distribution of Electrical Power
EG 2215 EX	Repair and Maintenance of Consumer Appliances I

Electronics Devices and circuits

EG 2202 EX

Year: II
Semester: II

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

Course description

This course will provide skill and knowledge to Basic Electronics to the students of diploma II year II semester. The course will familiarize with the BJT, FET circuits, amplifiers, Oscillators and nonlinear circuits.

Course objectives

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

1. Operate signal amplifier.
2. Analyze voltage divider type dc biasing methods.
3. Familiarize with negative and positive feedbacks in amplifiers.
4. Operate differential amplifier.
5. Explain the working principles of switching regulators.

Unit 1: BJT Circuits

(9Hrs)

- 1.1. dc biasing - analysis and design of β - independent dc biasing method.
- 1.2. Transfer characteristic
- 1.3. amplifier analysis: CB, CE and CC amplifiers
- 1.4. LC - tuned amplifier: ω_o , BW and Q-factor
- 1.5. BJT as switch: NOT, NOR and NAND gates.

Unit 2: FET Circuits

(7Hrs)

- 2.1. DC biasing - analysis of voltage divider type dc biasing method – JFET and MOSFET.
- 2.2. Transfer characteristics, square law formulas:

$$i_D = I_{DSS} \left(1 - \frac{V_{gs}}{V_P}\right)^2 \text{ and } i_D = K (V_{gs} - V_t)^2, i_D \text{ and } g_m = i_D V_{gs}$$

- 2.3. FET as switch: NOT, NOR, NAND gates.
- 2.4. CMOS circuit: NOT gate (and others)

Unit 3: Feedback Amplifiers

(4Hrs)

- 3.1. Introduction and concept of negative and positive feedbacks in amplifiers.
- 3.2. Negative feedback circuits
 - Voltage - series feedback
 - Voltage - shunt feedback

Current - series feedback

Current - shunt feedback

3.3. Positive feedback

Application in oscillators, schmitt triggers and multivibrators

Unit 4: Operational Amplifiers

(5Hrs)

4.1. Concept of differential amplifier, current mirror, level-shifting and output stage.

4.2. Properties of ideal opamp :

Important 6 properties

4.3. Inverting and non-inverting amplifiers

4.4. Precision diode and summing amplifiers.

4.5. Integrating and differentiating amplifiers.

4.6. Low pass and high pass filter amplifiers.

Unit 5: Power Amplifier and Heat Sink

(5 Hrs)

5.1. Class A amplifiers with resistive load and transformer load.

5.2. Class B amplifier with transformer coupling.

5.3. Class B and class AB amplifiers:

Direct coupled and complementary symmetry circuits.

5.4. IC power amplifiers.

5.5. Power dissipation in BJT and working principle of heatsink.

Unit 6: DC Voltage Regulator

(6 Hrs)

6.1. DC voltage regulators using BJT and opamp with Zener diode as voltage reference source (V_{ref})

6.2. Maximum output power rating and short circuit protection circuit.

6.3.3- terminal IC regulators. 78XX, 79XX, LM317 and LM 337

6.4. Switching regulators: Concept and working principle

Unit 7: Oscillators and Non-linear Circuits (Applications of BJT, FET and opamp) (9Hrs)

7.1. LC and crystal oscillators.

7.2. RC oscillators: Sine wave and non-sinewave output signals

7.3. Schmitt trigger and mono stable multi vibrator circuits.

7.4. Study of 555, 566 and 565 IC circuits.

Practical:**30hrs**

1. Review the use of laboratory equipment, electronic devices and PCB circuits
2. Construct and analyze BJT and FET amplifier circuits. Determine the voltage gain, input resistance and output resistance.
3. Construct sine wave and square wave oscillator circuits using opamp (741). Measure the output voltage and frequency of oscillation, and compare them with calculated values using formula.
4. Construct rectangular, square and triangular waves oscillator circuits using ICS 555 and 566. Compare the output frequency of measured value and calculated value using appropriate formula.
5. Construct and analyse series DC voltage regulators using BJT and Zener diode, and LM317/LM337 IC. Determine the output voltage (VO) and voltage stability factor (SV).
6. Construct and analyse IC power amplifier circuit. Measure maximum power output.
Note: Use IC : TDA2003, LM380
7. Construct non-inverting amplifier and summing amplifier circuits. Determine input and output voltages' relationship.

Reference Books:

- a. An Integrated Course in Electronics Engineering by J.B Gupta.
- b. Electronic Device and Circuits by David A Bell.
- c. Laboratory Manual for Electronic Devices and circuits by David A. Bell.
- d. Electronic Devices and Circuits by Theodore F. Bogart.
- e. Electronic Devices and Circuits Theory by Robert Boylestad and Luis Nashelsky.

Computer Aided Drawing

EG 2201 EE

Year: II
Semester: II

Total: 4 hour /week
Lecture: 2 hours/week
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 on Building Plan using standard symbols.
3. Insert dimension and text on drawing.

Course Contents

Unit 1: Introduction **[3 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: Types of coordinate system

Unit 2: Basic Drawing Commands **[3Hours]**

- 2.1 LINE command and its options
- 2.2 POINT command
- 2.3 Construction Line command and its options
- 2.4 RECTANGLE command and its options
- 2.5 ARC command and its options
- 2.6 CIRCLE command and its options
- 2.7 POLYGON command and its options
- 2.8 POLY LINE command and its options
- 2.9 MULTI LINE command and its options
- 2.10 SPLINE command and its options
- 2.11 ELLIPSE command and its options
- 2.12 POINT command and its options

Unit 3: Modifying commands	[4Hours]
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 BREAK, LENGTHEN, DIVIDE commands	
3.9 PEDIT command	
3.10 DDSELECT, DDMODIFY commands	
3.11 Layers, Properties	
3.12 Match Properties	
Unit 4: Drawing Aids in AutoCAD	[2 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	[2Hours]
6.1 HELP command	
6.2 ID, DIST, AREA commands	
6.3 MASSPROP command	
6.4 LIST, DBLIST, STATUS commands	
6.5 TIME command	
Unit 7: Fine tuning drawings	[2 Hours]
7.1 HATCH and BHATCH commands	
7.2 Creating Isometric drawing	
Unit 8: Grouping in AutoCAD	[2 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 [3 Hours]

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

Unit 12: Plotting drawings [3 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. Exercise & Perform Drawing and Modifying commands on Building Plan [*Week 1*]
2. Exercise & Perform on Drawing Aids and Display Commands [*Week 2 and 3*]
3. Exercise & Perform on Inquiry commands & Hatching and Isometric Drawing [*Week 4 and 5*]
4. Exercise & Perform on BLOCK command, Text and Dimensions & Layout Drawing [Week 6]
5. Construct Electrical Symbols on Auto Cad worksheet [Week 7]
6. Perform lighting circuit layout in building [*Week 8 to 14*]
7. Exercise on Plotting in pdf format [*Week 15*]

References:

George. Omura; “Mastering AutoCAD 2016 and AutoCAD LT 2016”

Microprocessors

EG 2205 EX

Year: II
Semester: II

Total: 5 hours/week
Lecture: 3 hours/week
Tutorial: hours/week
Practical: 2 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. Describe the working principle of a computer
2. Discuss the working principle of microprocessor (8 bit and 16 bit)
3. Explain the process of writing and executing low level language
4. Interface devices with a computer.

Course Contents

Unit1.	Introduction to Microprocessor	[6 Hours]
	1.1. History of microprocessor development	
	1.2. Definition of Microprocessor, microcomputer, microcontroller	
	1.3. General architecture of a microcomputer system showing control buses	
	1.4. Block diagram of a typical microprocessor and microcontroller	
	1.5. Instruction set of microprocessors	
	1.6. 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 assemblers, linkers and debugger	
	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	[12 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. 8086 Instruction set [6 Hours]**
- 5.1. Internal architecture of 8086
 - 5.2. Instruction format
 - 5.3. Addressing mode in 8086
 - 5.4. 8086 Instruction set (arithmetic, logical, data transfer, program control transfer and process control)
- Unit6. Introduction to 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 [30 Hours]

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

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

References books

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
4. Das, ‘The X 86 Microprocessors: Architecture, Programming and Interfacing (8086 to Pentium’, Pearson.

Basic Programmable Logic Control (PLC)

EG 2208 EX

Year: II
Semester: II

Total: 5 hour /week
Lecture: 3 hours/week
Tutorial: 0 hours/week
Lab: 2 hours/week

Course description

This course is designed to provide fundamental concepts of PLC, Ladder programming using functions of PLC and its applications and simulations.

Course objectives

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

1. Interpret the structure of a PLC, and its various components
2. Design a PLC system, component, or process to meet a set of specifications.
3. Explain of the role of PLCs in safety critical systems.
4. Illustrate a PLC simulation software package.
5. Utilize this software package to solve problems on a wide-range of PLC problems.

Course Contents

Unit 1 Introduction to Programmable Controllers [10 Hours]

- 1-1 Definition, history of electric, electronic and PLC control
- 1-2 PLCs versus Other Types of Controls advantage and disadvantage
- 1-3 PLC and Control System Components, principle of operation
- 1-4 PLC Product Application Ranges
- 1-5 Ladder Diagrams and the PLC
- 1-6 PLC Circuits and Logic Contact Symbol
- 1-7 Configuring the PLC Memory—I/O Addressing
- 1-8 PLC Instructions for Discrete Inputs
- 1-9 PLC Instructions for Discrete Outputs

Unit 2 PLC Logic, Timer, Counter Functions [5 Hours]

- 2-1 Introduction to PLC programming
- 2-2 Programming Logic Gate Functions and its basic applications
- 2-3 Retentive timers, Nonreactive timers and timer applications
- 2-4 Basic counter functions, Counter applications

Unit 3 PLC Math Functions [3 Hours]

- 3-1 Addition, Subtraction, Multiplication, Division
- 3-2 Square root, Scaling, Absolute value, X to the power of Y
- 3-3 Natural Logarithm, Base 10 logarithm 6-4, Sine, Cosine, Tangent

Unit 4 PLC Logic Functions [5 Hours]

- 4-1 Bit functions
- 4-2 Shift and rotate functions
- 4-3 PLC Compare, Jump, and MCR Functions
- 4-4 PLC Subroutine Functions
- 4-5 PLC Sequencer Functions

Unit 5 PLC Interrupts **[4 Hours]**

- 5-1 The principle and the structure of interrupt function
- 5-2 Application of interrupt service routine
- 5-3 Interrupt source, label and priority
- 5-4 Interrupt configuration and examples of interrupt routing

Unit 6 Process Control **[6 Hours]**

- 6-1 Features of PLC based process control
- 6-2 Point of Loop Controller
- 6-3 internal mechanism of Loop Controller
- 6-4 Outline of Procedures to build PLC-based Process Control System

Unit 7 PLC Networks **[6 Hours]**

- 7-1 Serial networks (RS-232, RS-485)
- 7-2 TCP/IP networks

Unit 8 PLC Applications and Case Studies **[6 Hours]**

- 8-1 large scale PLC system design
- 8-2 Human-machine interface

Practical

Perform the following tasks: **(30 Hours)**

1. Make program for logic function and make any application using logic functions of PLC. (For ex. water level control, sensor operated light control, alarms etc.)
2. Make program for timer, counter, move, math, 7 segment display, encoder, decoder and other required functions and make any application. (For ex. traffic light, tank filling, motor, stepper motor control, security systems)
3. Make program for, bit, shift, rotate, jump, subroutine, sequencer function and make any application. (For ex. moving display, simple industrial, home automation)
4. Make a large scale project for industry automation using process control, human machine interface.

References:

1. M. Rabiee, Programmable Logic Controllers: Hardware and Programming, Good heart-Willcox, 2002.
2. M. Rabiee, Programmable Logic Controllers: Hardware and Programming Laboratory Manual, Goodheart-Willcox, 2002.
3. Programmable Controllers (Theory and Implementation) By L. A. Bryan and E. A. Bryan
4. Programmable-Logic-Controllers-Fourth Edition, Author: W. Bolton
5. Programmable Logic Controllers: An Emphasis on Design and application, Author: Kelvin T. Ericson
6. Programmable Logic Controller by Frank Petruzella

Electrical Machines I

EG 2202 EE

Year: II
Semester: II

Total: 2 hour /week
Lecture: 3 hours/week
Tutorial: 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,
- Explain the characteristics of single-phase transformer, three-phase transformer, dc generator and dc motor, equivalent circuit of transformer and dc machines,
- Operate single-phase transformer, three-phase transformer, dc generator and dc motor, equivalent circuit of transformer and dc machines,
- Perform testing of transformer.

Course Contents

Unit 1. Single Phase Transformer : **[15 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, Capacitive 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, Buchholz's relay, tap-changer.
- 2.5 Study of name plate specification of transformer.

Unit 3. DC Generator : [12 Hours]

- 3.1 Constructional Details – Yoke, Field poles, Field winding, Armature and its winding.
- 3.2 Operation – Operating principle, emf equation,
- 3.3 Types of dc generator – Separately excited and self-excited and voltage build-up process, Shunt, series and compound generators, their circuit diagrams, relation between emf generated and load terminal voltage, characteristics and applications.
- 3.4 Losses and efficiency.
- 3.5 Armature reaction and method of reducing armature reaction.
- 3.6 Commutation

Unit 4. DC Motor : [10 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
- 4.6 **Swinburne's test**

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 2203 EE

Year: II
Semester: II

Total: 6 hour /week
Lecture: 4 hours/week
Tutorial: hours/week
Practical: 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. Explain 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.
4. Measure frequency, power & energy of electrical quantities.
5. Familiarize with digital measuring instruments.

Course Contents

Unit 1. Electrical Measuring Instrument. [12Hours]

- 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 [6 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 [6 Hours]**
- 4.1 Shunts and Multipliers – use and characteristics.
- 4.2 Multi-range meters – ammeter, voltmeter, ohmmeter and multimeter.
- Unit 5. Potentiometer [5 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 [12Hours]**
- 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. [10Hours]**
- 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. Digital Measuring Instrument. [3 Hours]**
- 8.1 Operating principle, construction, characteristics and application in measurements.

Practical Exercise:**(30 Hours)**

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 2205 EE

Year: II
Semester: II

Total: 4 hour /week
Lecture: 4 hours/week
Tutorial: hours/week
Practical: 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. Describe the transmission and distribution operation and its components
2. Explain the characteristics of interconnected power system
3. Describe the basic concepts of voltage control and compensation techniques

Course Contents

Unit 1: Introduction

[5 Hours]

- 1.1 Importance of Electrical Power
- 1.2 Sources of Electrical Power
- 1.3 Generation of Electrical Power
- 1.4 Role of Transmission and distribution as the components of power system
- 1.5 Advantages of interconnected transmission network (grid system)

Unit 2: Supply Systems

[5 Hours]

- 2.1 Transmission and distribution voltage
- 2.2 Single phase and three phase transmissions
- 2.3 Advantages of three phase
- 2.4 Concept of line phase and quantities of three phase system
- 2.5 Advantages of Interconnected transmission network (grid System)

Unit 3: Transmission line components

[18 Hours]

- 3.1 Overhead line vs underground cable
- 3.2 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.
- 3.3 Mechanical and electrical considerations
 - Conductor spacing and clearance criterion
 - Sag tension computation
- 3.4 Underground cables

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

Unit 4: Transmission line performance [12 Hours]

4.1 General evaluation of transmission line efficiency and regulations

4.2 Transmission Line parameters:

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

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

4.4 Phasor diagrams

4.5 Ferranti effect

Unit 5: Distribution system [10 Hours]

5.1 Primary and secondary distribution systems

5.2 Radial , loop and ring main feeders

5.3 Voltage drop and power losses in radial and loop feeders

5.4 Guidelines for rural and urban distribution

5.5 Single phase and three phase distribution

5.6 Underground cables for distribution

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

Unit 6: Voltage Control [6 Hours]

6.1 Necessity of voltage control, voltage fluctuation and associated problems

6.2 Method for voltage control

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

Unit 7: Interconnected system [4 Hours]

7.1 Advantage of interconnection

7.2 Effects on voltage and frequency fluctuation with interconnected system

7.3 Flexibility in real and reactive power dispatching

References:

1. J.B. Gupta, "Transmission and Distribution of Electrical Power", S. K. Kataria and sons
2. V. K. Mehta, Rohit Mehta , "Principles of Power System", S. Chand
3. M. L. Soni, P. V. Gupta, U.S. Bhtnagar & A Chkrabarti, "A text Book on Power System Engineering", Dhanpat Rai & Co., India
4. A. S. Pabla, "Electric Power Distribution", Tata McGraw-Hill Publishing Company Ltd, India
5. J. J. Burke, "Power Distribution Engineering Fundamentals & Applications", Marcel Dekker, Inc., New York.

Repair and Maintenance of Consumer Appliances I

EG 2215 EX

Year: II
Semester: II

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

Course description

This course will provide skill and knowledge to repair and maintenance of electrical motor and generator (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: Transformer

[18 Hours]

- 1.1 Introduction
- 1.2 Identify parts of Transformer.
- 1.3 Calculate the winding of transformer
- 1.4 Calculate the measurement of bobbin
- 1.5 Remove coils.
- 1.6 Test the Transformer.
- 1.7 Three phase distribution transformer

Unit 2: DC Motor

[20 Hours]

- 2.1 Introduction.
- 2.2 Identify parts of D.C. motor.
- 2.3 Trace the data of winding.
- 2.4 Dismantle cover where required.
- 2.5 Remove coils
- 2.6 Rewind the coils
- 2.7 Reassemble the parts of motor
- 2.8 Test the motor.

Unit 3: Single phase A.C. Motor

[16 Hours]

- 3.1 Introduction single phase motor
- 3.2 Types single phase motor
- 3.3 Identify parts of single phase motor
- 3.4 Trace the data of winding.

- 3.5 Dismantle cover where required.
- 3.6 Remove coils
- 3.7 Rewind the coils
- 3.8 Reassemble the parts of motor
- 3.9 Test the motor.

Unit 4: Polyphase Machine

[18 Hours]

- 4.1 Introduction poly phase motor
- 4.2 Types three phase induction motor
- 4.3 Identify parts of poly phase motor
- 4.4 Trace the data of winding.
- 4.5 Dismantle cover where required.
- 4.6 Remove coils
- 4.7 Rewind the coils
- 4.8 Reassemble the parts of motor
- 4.9 Test the motor

Unit 5: Voltage Regulator

[18 Hours]

- 5.1 Concept of voltage regulation
- 5.1 Component use in voltage regulation.
- 5.1 Circuit of voltage regulation.
- 5.1 ICs use in voltage regulation.
- 5.1 Dismantle of voltage regulator.
- 5.1 Assemble of voltage regulator.
- 5.1 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

(5th and 6th semesters)

Fifth Semester

Subjects:

EG 3101 EE	Switch Gear and Protection
EG 3102 EE	Power Electronics
EG 3103 EE	Electrical Machines II
EG 3104 EE	Minor Project
EG 3106 EX	Digital Electronics Circuit
EG 3107 EX	Repair and Maintenance of Consumer Appliances II
EG 3105 EE	Control System Components

Switchgear and Protection

EG 3101EE

Year: III
Semester: I

Total: 7 hour /week
Lecture: 3 hours/week
Tutorial: 1 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:

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

1. Study the principles describe the concepts of switchgear & protection.
2. Emphasize on various type of relays and circuit breakers.
3. Identify various faults that may happen in a power system.
4. Explain applications, characteristics and operation of various protecting devices e.g. Fuse, MCB, relay and circuit breakers.
5. Enable to install and maintain different protecting devices.

Course Contents:

- Unit 5. Fundamental of protection system [5]**
- 1.1 Need for a Power System Control and Protection.
 - 1.2 Functions of basic elements of protective system.
 - 1.3 Basic Components of a Protection Scheme.
 - 1.4 Primary and Backup Protection, coordination, Protection Zone.
 - 1.5 Types, causes and effects of various Faults.
- Unit 6. Protective Transformers [4]**
- 1.1 Types of Instrument Transformers.
 - 1.2 Current Transformers :
 - Types of Current Transformer
 - Standard Current Transformer Ratios
 - Phasor Diagram of Current Transformer
 - Error In Current Transformer
 - Accuracy Classifications of Current Transformers
 - 1.3 Potential Transformers:

- Types of Potential Transformers
- Potential Transformers connections and Terminal Markings
- Phasor Diagram of a Potential Transformer
- Accuracy Classifications of Potential Transformers

Unit 3: Circuit Interrupting Devices [8 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
- Operating Principle and Characteristic of MCBs
 - Applications of MCBs
 - Comparison to Fuse
- 3.3 Contactors
- Construction and operation
 - Normally open and close contacts
 - Applications of Contactors
- 3.4 Isolator:
- Construction and Operating Principle of an Isolator
 - Applications of an Isolator

Unit 4: Circuit Breaker [8 Hours]

- 4.1 Arc Phenomena and Arc Extinction method
- 4.2 Duties of Circuit Breaker
- 4.3 Construction, Working Principle and Applications
- Air Break and Air Blast Circuit Breaker
 - Oil Circuit Breaker
 - Vacuum Circuit Breaker
 - Sulphur Hexa Fluoride (SF₆) Circuit Breaker
- 4.4 Auto-reclosure
- 4.5 Testing of Circuit Breaker
- 4.6 Working Principle of arc quenching in HVDC circuit Breaker

Unit 5: Earthing [6 Hours]

- 5.1 Definitions, Purpose, System Earthing and Body Earthing
- 5.2 Methods of Earthing, Substation Earthing, Measurement of Soil Resistivity
- 5.3 Causes of Over Voltages : Internal Cause and External Cause
- 5.4 Over Voltage Protection: Overhead earth wire, angle of Protection
- 5.5 Lightning Arrester : Horn gap and rod gap lightening arrestor
- 5.6 Isolated neutral, solid neutral, resistance earthing, reactance earthing, Peterson Coil earthing

Unit 6: Protective Relays**[14 Hours]**

- 6.1 Classification and selection of relays
- 6.2 Method of earth fault detection
- 6.3 Principle of working, Construction and operation of electromagnetic induction (Shaded pole, watt-hour meter and induction cup), Thermal relay
- 6.4 Settings of various types of relays
- 6.5 Over current relays
 - Inverse definite minimum time (IDMT) relay, TDS, PSM
 - Application of IDMT relay in sectionalized HV feeder, Time Graded Protection, Current Graded Protection
- 6.6 Directional relay
- 6.7 Distance relay (impedance, reactance and mho)
- 6.8 Unit protection scheme / Differential protection
 - Advantage of unit protection scheme over non unit protection
 - Application of unit protection / differential protection scheme to HV feeders
 - Transformer and generators
- 6.9 Static relay, construction and types
- 6.10 Principle and working of Microprocessor based relay
- 6.11 Maintenance and testing of relays

Practical:**(45 Hours)****Perform the following tasks:**

1. Check the Polarity of Current Transformer and Potential Transformer and connect it with the relay.
2. Identify various switchgear equipment available in the lab and write its specification and symbols.
3. Identify parts of various circuit breakers and their specification
4. Find the fusing factor of a given fusing material.
5. Identify the various components of circuit breaker.
6. Test overload relay and plot Time-Current characteristic
7. Test thermal overload relay for protection of motor and set the relay properly.
8. Test static relay for the protection of motor
9. Apply balance current protection scheme using appropriate switch gear
10. Visit a substation and prepare its technical report emphasizing on control side

References:

1. Rao S. S., "Switchgear and Protection", Khanna Publications, New Delhi
2. Gupta J. B. Switchgear and Protection, Katariya Publications. New Delhi
3. Ram B and Vishwakarma D. N. , "System Protection and Switchgear" , TMH, New Delhi

Power Electronics

EG 3102 EE

Year: III
Semester: I

Total: 5 hour /week
Lecture: 3 hours/week
Tutorial: 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 [10 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 with 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 rectifier 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 [10 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 **[10 Hours]**

- 4.1 Single phase square wave inverter – Circuit diagram, operating principle, rms value of output voltage, operation with resistive load and inductive load.
- 4.2 Three-phase bridge inverter with six-step output voltage waveform – 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 **[5 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/Lab 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 3103 EE

Year: III
Semester: I

Total: 7 hour /week
Lecture: 3 hours/week
Tutorial: 1 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 1. Three Phase Induction Motor** **[15 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, reverses the direction of rotation.
 - 1.3 Stand still condition – equivalent circuit, starting current and starting torque.
 - 1.4 Running condition - equivalent circuit, running current and torque.
 - 1.5 Torque-Speed characteristics, effect of applied voltage on T-S characteristic, effect of rotor resistance on T-S characteristic.
 - 1.6 Power stages, losses and efficiency
 - 1.7 Starting methods – Direct On-line starting, Primary resistor method, Auto-transformer method, Star-Delta method.
 - 1.8 Speed control – Primary voltage control method, Rotor resistance control method, frequency control method, Cascade connection method.

1.9 Induction generator – principle of operation, excitation requirement, voltage build-up process, isolated and grid connected modes of operation.

Unit 2. Single Phase AC Motors : [8 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 3. Three-phase Synchronous Generator [10 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 4. Synchronous Motor [6 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.

Unit 5. Asynchronous Motor [6 Hours]

5.1 Principle of operation and starting method.

5.2 General features and applications

5.3 No-load and load operation

5.4 Effect of excitation on armature current and power factor- V and inverted V curves.

5.5 Power-Angle characteristic.

Practical/Lab 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.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.

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.

Minor Project

Year: III
Semester: I

Total: 4 hours/week
Practical: 4 hours/week

Course description

This course deals with mini projects for diploma course on Electronics and Electrical Engineering. The students will carry out a small scale project to develop hands-on experience of working in a project. During the course, the student will also develop small but practical usable device and apply effectively. The students will learn working as a team, basic collaboration and project management skills. The student will also learn about formulating project documentations as well.

Following minor project list is built using a variety of sensors, microcontrollers, motors, buzzers etc to cover a wide scale of electronics and electrical domains. With circuit diagram and video tutorials these mini projects form the base of practical electronics and electrical knowledge. The mini project topics cover a wide range of electronics domains and are easy to implement using provided circuit diagrams. These minor projects give hints and knowledge that you understand how to start with practical electronics development and grow in the field. The minor project list with brief descriptions can be based on following topics:

1. **Home Security System Project:** This is password based home security system using 8051. This security system consists of two sections: The user interface section and the execution section. The user interface section consists of a matrix keypad and an LCD display. The execution section consists of an 8051 microcontroller and a relay. This system is meant to provide door security where only privileged members can enter. The system has a five digit password which is stored inside the microcontroller and it is given to the user. If the password is wrong then the system gives two more chances to the user and if it all goes wrong an alert is given. Necessary instructions are displayed on an LCD module.
2. **Street Light Circuit:** This mini project can be used to design a street light that brightens up when night falls and automatically turns off when daylight comes in. In order to detect the amount of light that is needed to decide when to cut-off the circuit and later activate it, this project is done with the help of a sensor called light dependent resistor (LDR).
3. **Battery Charger Circuit Using SCR:** This is one of the most basic and best minor projects in electronics. Here a simple circuit that can be used to charge batteries is designed and created. A silicon controlled rectifier (SCR) is used to rectify the AC mains voltage to charge the battery.
4. **Air Flow Detector Circuit:** This simple minor project is used to design an indicator to show the rate of air flow in a given space. The air flow is sensed with the help of an incandescent bulb filament. The variations due to the change of resistance in the bulb due to the air flow are given to the input of an LM339 operational amplifier.
5. **Water Level Alarm Circuit:** This circuit is basically used to produce an alarm output (bell or light) when the level of water rises above a certain level. This circuit uses a basic astable multi vibrator made from a 555 timer IC. A resistance probe is set on a point at which the alarm is to set on, as soon as the water rises up to that level. The number of components needed for this circuit is very less and can be easily assembled on a PCB.

6. **Low Cost Fire Alarm Circuit:** This project can be used for detecting a fire and producing an alarm, thus alerting the people in the building where it is installed. A transistor sensor called BC177 is used to sense the heat produced due to the fire. A preset level can be kept for the transistor. As soon as the temperature rises above the set preset level, the leakage current of the transistor rises, thus driving the other transistors in the circuit.
7. **Single Chip FM Radio Circuit:** This is a mini project and it is mainly meant for diploma engineering students. An IC named TDA7000 is used for the purpose. The IC is integrated with a Frequency-Locked-Loop system with an intermediate frequency of 70 kHz.
8. **Digital Stop Watch Circuit:** This project consists of a digital watch designed with the help of a 555 timer IC and 4-bit digit counter IC called IC MM&4C926, and also a 7 segment LED display. The circuit can be easily designed and assembled on a printed circuit board.
9. **High and Low Voltage Cut-off with Delay and Alarm:** This circuit can not only be presented as a mini project but can also be applied to our home electrical equipment to protect them from overvoltage fluctuations. The circuit requires very simple components like a monostable multivibrator using a 555 timer, a few transistors, and some diodes, relays and LED.
10. **Light Activated Switch Circuit:** This circuit uses an LM 311 comparator IC and a light dependent resistor as its sensor. The output of the LDR is given to the inverting input of the comparator. The resistance remains high when there is no light and the resistance drops as soon as light falls on it. This lessens the voltage at the inverting input and thus the comparator produces a high output which turns a transistor and thus the relay on. A much more detailed working can be obtained from the original post.
11. **Mobile Incoming Call Indicator:** This circuit can be used to escape from the nuisance of mobile phone rings when you are at home. This circuit will give a visual indication if placed near a mobile phone even if the ringer is deactivated.
12. **Water Level Controller using Micro Controller - AT89S51:** This project is a classic minor project for electronics and electrical engineering students. This project, developed using AT89S51 (a version of 8051 from Atmel) with a well-explained circuit diagram and program, controls the water level in a tank by controlling a water pump motor depending on the current water levels. The program is written in assembly language using the MCS-51 instruction set.
13. **Digital Voltmeter using 8051 Microcontroller – AT89S51:** In this project, we can make a simple digital voltmeter application which can measure up to 5 volts (0 to 5 volts). The circuit is developed using ADC0804 and AT89S51 microcontroller. The output is displayed using two 7 segment displays. The software is developed in assembly language.
14. **Automatic Changeover Switch:** Generally, in case of failure of power supply alternative methods were used such as generators, inverters etc. This project shows automatic change over switch that switches DC power automatically to battery or AC to DC converter if there is failure.
15. **Brake Failure Indicator:** The circuit shown here gives early warning if the brake of the vehicle fails. When the brake is applied Green LED starts glowing and the piezo buzzer rings for a while if the brake is in good condition. If there is any fault in the brake Red LED glows and buzzer does not produce any sound.

16. **Design of an Intelligent and Efficient Light Control System:** This project uses a PIR sensor and an LDR for efficient use of lighting system. This system considers two factors; one is the light intensity of the room, while the second one is presence of any one in the room. Light intensity of the room is measured by the LDR sensor, while the human presence is measured by the PIR sensor. Accordingly the lights are switched on and off.
17. **Soft Starter for 3 Phase Induction Motor using Microcontroller:** Starting of an induction motors is very difficult task as they require more current and torque initially. There are many methods to do this. This project shows starting of an induction motor using SCR firing and triggering.
18. **Touch Switch Circuit:** This circuit shows a simple ON and OFF switch using NE555 timer. Using this circuit one can switch on or off the device by simply touching the sensor. A piezo sensor is used for touch sensing.
19. **Phase Sequence Checker for Three Phase Supply:** Phase sequence checking is very important in 3 phase supply. Because in 3 phase if there any phase reversal it may damage the device completely. This project shows the system for checking the phase of the supply.
20. **AC Power Control using MOSFET / IGBT:** Rating of electrical appliances determines the power utilized by them to work properly. This project shows the controlling of that AC power applied to the devices. This is done using IGBT/Mosfet.
21. **Temperature Controlled System:** This project shows a temperature controlled system. When the temperature raises more than a threshold value this system automatically switches on the fan.
22. **Brushless DC Motor Speed Control using Microcontroller:** This project shows the controlling of BLDC motor using a microcontroller. It employs a closed loop control technique.
23. **Smoke Detector Alarm Circuit:** Here is the circuit showing smoke detector alarm. This can also be used to indicate the fire. This circuit uses a smoke detector and a LM358 Comparator.
24. **Overload Protection of Transformer:** This circuit shows the over load protection of the transformer which simply cuts the load through a relay if over load condition occurs. As over load may damage the transformer it is necessary to protect the transformer from overload condition.
25. **Variable Power Supply Circuits:** This article shows the different circuits for designing circuits a variable power supply .Three circuits were shown here. The first circuit shows a variable power supply of range 1.2 to 30V with 1 ampere of current, while the second one shows 0-28V variable voltage and 6-8A current. Third one shows 5-12 variable voltage.
26. **Highway Alert Signal Lamp:** This project shows a highway alert signal lamp. When any vehicle approaches the rear window of the vehicle it glows a tricolor high bright LEDs. They will glow until the vehicle over takes.

27. **Fuse and Power Failure Indicator:** This project shows a fuse and power failure indicator circuit. This circuit follows a simple logic using LDR and LED. When the power is failed or fuse is blown the LDR goes into and dark speaker connected to the circuit starts ringing.
28. **Variable Power Supply and Charger:** This is a circuit which helps to check or test your electronic projects at your workbench and also to charge the Mobile phone batteries. This circuit is also very useful during power cuts (blackouts) as it can also work as an emergency light.
29. **Temperature Controlled DC Fan using Microcontroller:** The main principle of the circuit is to switch ON the fan connected to DC motor when the temperature (measured through a temperature sensor) is greater than a threshold value. This can be used in home applications particularly in CPU to reduce heat by automatically switching ON the fan.
30. **Automatic Star Delta Starter** using Relays and adjustable electronic timer for Induction Motor.

Systematic Minor Project Methodology:

1. Project Ideas and Proposal Guidance (4 hours)

A project idea and proposal is unique to each project, of course, but the format is basically the same, if you follow a basic outline. We have even created a [free project proposal template](#) to help you structure your document so you don't have to reinvent the wheel each time you're drafting your proposal. This helps you focus on the substance of the proposed plan, while using an easy-to-follow project proposal outline.

2. Application Development (10 hours)

The era of electronics started with the invention of the transistor in the year 1947 and silicon-based semiconductor technology. After almost 7 decades we are now surrounded by electronic devices and we can't even imagine a day without them, as they have become a part of us. From the day semiconductor technology was invented, the electronics revolution started. So it is natural that the devices that we are seeing today may go extinct in some years, such is the pace in which the electronics technology is advancing. To help you to stay updated with these latest technologies, here we are suggesting some of the latest electronics projects that you can do.

These minor projects have been compiled by electronics researchers to guide you in your electronics and electrical practical to real development fields. This list of minor projects for this course is designed specifically for 3rd year 1st part diploma course in electronics and electrical engineering students to help in their studies and research.

3. Project Management, Team Work and Collaboration (8 hours)

- a. Project management techniques
- b. Project handling and result oriented techniques
- c. Project management is about more than just getting the work done.
- d. It is about delivering results on time efficiently and effectively.
- e. Make it easy for everyone to see what they're working on, who they're working with, and what comes next — whatever size your team is.

- f. Everything you need to collaborate effectively, hit deadlines, and achieves high-performance results.
- g. Regardless of methodology, job title, or certifications, teamwork projects lets you work the way what you want to complete on time with great results!
- h. Collaborative development environment is the most essential as well.

4. Project Guidance (5 hours)

The main Aim of this minor project is to give final year students an opportunity to develop their skills and knowledge in an experimental manner that they have studied in their academic syllabus. It is just put industrial experience with all the facilities required which helps finally completing “Dream Project”.

Diploma students where they can develop their final year projects on their own by attending theory lectures and performing various practical in well organized and procedural manner.

5. Project Work (30 hours)

Project goals should be defined in as a plan. There are many ways to do this. The project plan could further explain the goals of the project. No matter how a project chooses to incorporate the goals into the project plan, the important thing is to maintain a clear link between the project work demand and project management on time. Following can be some important hints to do project work on time:

- Project Goals
- Project Scope
- Academic Project Guidance
- Key achievements for a project
- Project's Budget
- Project Sponsor
- Team work management
- Risk Management Plan
- Empower to do practice for the concept of research

6. Project Documentation Guidance (3 hours)

- Basic Principle of Project Documentation Guidance
- The basic principle of documentation in any report is very simple: readers should be able to understand your work and grade your project by just reading your report without you. For this purpose I suggest you keep in mind the following four points.
- Readers of your report should be able to tell what you have accomplished. For example, you can include the following ideas if they are relevant to your problems: what problems you have worked on, what assumptions you have made in your work, how much you have accomplished, what parts you did not finish (or limitation of the result of your work: do not try to hide the problems; nobody's work is perfect), how well you did, how important your work is, why it is important, where it can be applied, what

- kinds of difficult problems you had during your work, what the remaining problems are, what parts can be done as next steps, etc.
- The report should be easily readable and understandable. No matter how significant your work may be, it is not worth full credit, if you cannot convince readers. Use clear and concise English. Keep in mind you should write to communicate with readers, not document for yourself.
 - The report should be well organized. It should have a clear logical sequence. Organize your work in chapters, sections, and sub-sections with meaningful headings. Include diagrams, tables, or figures whenever appropriate.
 - The report should be self-contained, if possible. Do not ask readers to look around other references, unless you have a reason to do so.

References:

- Monthly Magazine: Electronics for You.
- Electronics Project Books
- Electrical Projects Books

Digital Electronics Circuit

EG 3106 EX

Year: III
Semester: I

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

Course description:

This course deals with fundamentals of digital electronics, like as understanding about the switching characteristics of semiconductor junction diode, bipolar junction transistor (BJT), metal-oxide semiconductor field-effect transistor (MOSFET). To know about basic function of timer ICs such as 555IC, building various circuits using 555ICs, behavior of different multivibrator circuits and function of Schmitt trigger. This course is aimed to elaborate analysis of different types of integrated logic circuit (families) and their major parameters.

Course Objectives:

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

1. Introduce about the switching behaviors semiconductor diode and transistors.
2. Generate and apply clock pulses to digital logic devices.
3. Analyze different bipolar and MOS logical circuits.
4. Explain various logic specifications.
5. Explain construction and operation of different volatile and non-volatile memory devices.

Unit 1 Fundamentals of Switching

(8 hours)

- 1.1 Analog Signals
- 1.2 Digital Signals
- 1.3 Electronic Switch
 - 1.3.1 Diode as a Switch
 - 1.3.2 BJT as a Switch
 - 1.3.3 En-MOSFET as a Switch
- 1.4 Positive and Negative Logic
- 1.5 Pulse Transition Detector

Unit 2 Waveform Generators

(9 hours)

- 1.6 Clock Waveforms
- 1.7 Timer IC 555
- 1.8 Schmitt Trigger
- 1.9 Multivibrators
 - 1.9.1 Astable Multivibrator
 - 1.9.2 Bistable Multivibrator
 - 1.9.3 Monostable Multivibrator
- 1.10 Multivibrators using Timer IC 555

Unit 3 Analysis of Logic Circuits

(8 hours)

- 1.11 Logic Level Diagrams
- 1.12 Transfer Characteristic Curve
- 1.13 Logic Specifications

- 1.14 Logic Families
- 1.15 Logic IC Packages`

Unit 4 Logic Specifications (7hours)

- 1.16 Voltage Levels
- 1.17 Power Dissipation
- 1.18 Operating Temperature
- 1.19 Propagation Delay
- 1.20 Noise Margin
- 1.21 Fan In
- 1.22 Fan Out

Unit 5 Logic Families (16hours)

- 1.23 Diode-Diode Logic (DDL)
- 1.24 Resistor-Transistor Logic (RTL)
- 1.25 Diode-Transistor Logic (DTL)
- 1.26 Transistor-Transistor Logic (TTL)
- 1.27 TTL Sub-families
- 1.28 TTL Tristate Logic
- 1.29 MOS Logic

Unit 6 Memory Devices (12 hours)

- 1.30 Programmable Logic Arrays
- 1.31 Volatile and Non-Volatile Memories
- 1.32 Read Only Memory (ROM)
- 1.33 ROM Family
- 1.34 Random Access Memory (RAM)
- 1.35 RAM Family

Practical (45 hours)

Perform the following tasks:

1. Realize an RTL Inverter circuit.
2. Build a DDL logic gate circuit.
3. Make a modified DTL logic gate.
4. Measure power dissipation and propagation delay in TTL logic circuits
5. Compare ideal and real voltage transfer characteristic curve of CMOS Inverter
6. Construct a timer IC 555 based astablemultivibrator
7. Connect a timer IC 555 based bistablemultivibrator
8. Build a timer IC 555 based clock pulse generator

References:

1. Gupta B. R. and Singhal V., "Digital Electronics" S. K. Katariaa & Sons, 5th Edition, 2005.
2. Donald P. Leach, Albert Paul Malvinoand Goutam Saha, "Digital Principles and Applications", 6th edition , Tata McGraw-Hill, 2006
3. William H. Gothmann, "Digital Electronics, An Introduction to Theory and Practice", 2nd edition, PHI, 2009.

Repair and Maintenance of Consumer Appliances II

EG 3107 EX

Year: III
Semester: I

Total: 5 hour /week
Lecture: hours/week
Tutorial: hours/week
Practical: 5 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. Trouble shoot the faulty parts/section
3. Repair and Replace the faulty part
4. Reform and supervise repair work
5. 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. AM/FM Radio Receiver [10 Hours]

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

- Unit 4. Electric Iron [4 Hours]**
 4.1. Ordinary electric iron and automatic electric iron ON/OFF switch indicator, heating element and plug-leads
 4.2. Visual inspection, continuity test, disassembling and assembling procedure and final test
- Unit 5. Heater [4 Hours]**
 5.1. Ordinary - immersion ON/OFF switch, heat control, two rod heater
 5.2. Visual and continuity test, body leakage test, disassembling and assembling procedure and final test
- Unit 6. Rice Cooker [6 Hours]**
 6.1. Thermal fuse, magnetic switch, bi-metallic thermostatic switch ON/OFF switch indicator, cooking element and warmer element
 6.2. Visual inspection, disassembling and assembling procedure and final test
- Unit 7. Grinder, Mixture and Dryer [8 Hours]**
 7.1. Armature winding, field winding, capacitor suppression, limit switch, carbon brush, holders and carbon heating element
 7.2. Visual inspection, continuity test, body leakage test, disassembling and assembling procedure and final test
- Unit 8. Volt - guard & Freeze-guard [8 Hours]**
 8.1. Transformer, spike suppression, electronic components, low-high cut system, relay unit, continuity of components and body leakage
- Unit 9. Battery- charger [6 Hours]**
 9.1. Transformer, electronic circuit, rectifiers-filter control and float and boost charge in indicator
 9.2. Continuity test, leakage test, disassembling and assembling procedure and final test
- Unit 10. Manual Voltage stabilizer [8 Hours]**
 10.1. Safety precautions and demonstration of principle of operation
 10.2. Consideration when troubleshooting
 10.3. Transformer, electronic components, DC circuit, continuity of components and body leakage

References:

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

Control System Components

EG 3105 EE

Year: III
Semester: I

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

Course Description:

This course introduces the fundamentals of control system components and operation of an automatic control system. The students learn the theory of fundamentals of control system components.

Course Objectives:

After completing this course the students will be able to:

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

Course content:

- Unit 1: The general concept of control system [4]**
- 1.1 Definition of control system, its brief history and practical uses in various fields as industry, industry, medical, construction etc.
 - 1.2 Open loop control systems :its basic examples, use, advantages and disadvantages
 - 1.3 Close loop control systems: its basic examples, use, advantages and disadvantages.
 - 1.4 Different types of control systems:
 1. System Base: analog control system: switch type, time base, frequency base, digital control system
 2. Technology Base: Mechanical Control, Electrical Control, Electronic control, Pneumatic Control, Hydraulic Control
- Unit 2: Sensors and Transducers, feedback system and comparator [8]**
- 2.1 Definition of sensor and transducer
 - 2.2 Different types of sensors and transducers: strain gauge, potentiometer, tachometer, LDR, photodiode-photo transistors, thermistors
 - 2.3 Sensors as component of feedback system
 - 2.4 Signal conditioning usable for feed back in control systems: amplifier, regulating, comparing, ADC

- 2.5 Comparison of input signal and feed back signal: operational amplifier as comparator
- 2.6 Noise, disturbance in control system and Reduction using feedback system

Unit 3: Control System Actuators [4]

- 3.1 Recognition of the applications and operating characteristics of, electric, hydraulic, and pneumatic linear actuators.
- 3.2 Operating principles of control valves and other components in hydraulic and pneumatic systems.

Unit 4: Control System Switching Devices [6]

- 4.1 Operating principles
- 4.2 Applications for, relays, transistors, rectifiers, diac, triacs and other switching devices.
- 4.3 Operational Amplifier and related signal conditioning circuits in control systems.

Unit 5: Controllers [6]

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

Unit 6 Time response analysis and stability [8]

- 3.1. Dynamic characteristics of systems
- 3.2. Linear and non-linear systems
- 3.3. Physical meaning of Step response of first order and second order systems- overshoot and undershoot, damping ratio with graphical representation
- 3.4. Steady state response and error
- 3.5. Concept of stability

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

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

Unit 8: AC Motors in Control Systems [3]

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

Practical:

[30]

Perform the following tasks:

- 1 Perform Switching characteristics of Transistor and Operational Amplifier circuits
- 2 Demonstrate ON/OFF Temperature Control Using thermo-couple as sensor and operational amplifier as control switch
- 3 Construct PID controller circuits using Operational Amplifier
- 4 Perform Close loop Speed Control of DC servomotor with Tacho-generator as sensor
- 5 Demonstrate Pneumatic PID controllers
- 6 Demonstrate a process control system
- 7 Demonstrate using SIMULINK for basic control system with 1 order, 2nd order and disturbance and noise.

Suggestions for instruction:

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

References:

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

Sixth Semester

Subjects:

EG 3201 EX	Communication System
EG 3208 EX	Design, Estimating & Costing of Electrical & Electronics Installation
EG 3209 EX	Industry Based Major Project
EG 3210 EX	Industrial Attachment
EG 3201 MG	Entrepreneurship Development
EG 3109 CT	Computer Architecture

Elective (One of the followings)

EG 3202 EE	a) Hydro Power
EG 3211 EX	b) Radio/Television and Broadcasting System
EG 3202 EE	c) Renewable Energy Technology
EG 3202 EE	d) Electrical Energy Management
EG 3211 EX	e) Fiber Optic Communication
EG 3211 EX	f) Wireless Communication

Communication Systems

EG 3201 EX

Year: III
Semester: II

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

Course Description:

This course deals with the basic fundamentals of communication engineering.

Course Objectives:

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

1. Explain the principles and characteristics of communication services/systems
2. Explain principles and necessity of signal modulation in information transmission
3. Describe principles of various modulation techniques
4. Explain working principles of optical fiber and radio receivers

Course Contents:

Unit 1. Introduction to Communication

[5]

- 1.1. Modulation, Need for modulation and demodulation in communication systems
- 1.2. Analog communication system: definition, block diagram
- 1.3. Electromagnetic spectrum and its various ranges: VLF, LF, MF, HF, VHF, UHF etc.
- 1.4. Communication channel: definition, types (wire, wireless), examples
- 1.5. Noise in communication: definition, types (external, internal)

Unit 2. Amplitude Modulation:

[8]

- 2.1 DSB-AM: Derivation of expression for an amplitude modulated wave, Carrier and side band components, Modulation index, Spectrum and Bandwidth of AM Wave, Relative power distribution in carrier and side bands.
- 2.2 Elementary idea of DSB-SC, SSB, ISB and VSB modulations, their comparison and areas of applications.

Unit 3. Frequency Modulation:

[7]

- 3.1 Definition, principle, characteristics, applications
- 3.2 Stereo FM (introduction only)
- 3.3 Expression for frequency modulated wave and its frequency spectrum (without Proof and analysis of Bessel function), Modulation index, maximum frequency deviation, BW of FM signals, Carson's rule.
- 3.4 Comparison of FM and AM in communication systems

Unit 5. Radio Transmitters:

[8]

- 5.1. Classification of transmitters on the basis of modulation, service, frequency and power
- 5.2. Block diagram of a typical AM radio broadcasting transmitter, operation, characteristics
- 5.3. Block diagram of a typical SSB radio communication transmitter, operation, characteristics
- 5.4. Block diagram and working principles of reactance FET and Armstrong FM transmitters

Unit 6. Radio Receivers:**[14]**

- 6.1. Block diagram and working principle of super heterodyne AM receiver. Function of each block and typical waveforms at input and output of each block
- 6.2. SSB communication receiver: Block diagram, operation, characteristics
- 6.3. Performance characteristics of radio receiver: sensitivity, selectivity, S/N ratio, image rejection ratio and their measurement procedure
- 6.4. Selection criteria for intermediate frequency (IF)
- 6.5. Concepts of simple and delayed AGC
- 6.6. Block diagram of an FM receiver, function of each block and waveforms at input and output of different blocks.
- 6.7. Need for limiting and de-emphasis in FM reception
- 6.8. Block diagram of communication receivers, differences with respect to broadcast receivers.

Unit 7. Pulse Modulation:**[12]**

- 7.1 Electrical representation of binary data (unipolar, polar, bipolar signaling etc.)
- 7.2 Statement of sampling theorem; Nyquist rate, Nyquist interval
- 7.3 Basic ideas about PAM, PPM, PWM
- 7.4 Pulse code Modulation (PCM)
 - Quantization and quantization error
 - Block diagram of TDM-PCM communication system and function of each block
 - Concepts of differential PCM (DPCM)
 - Concept of Delta Modulation (DM)
 - Concept of adaptive delta modulation (ADM)

Unit 8 Optical fiber communication:**[6]**

8. 1. Advantages of Fiber optic communication
8. 2. Block diagram of a fiber-optic communication link
8. 3. Optical sources: LED, laser diode
8. 4. Optical detectors: photo diode, photo transistor
8. 5. Basic idea of Fiber connection techniques

PRACTICAL:**30 hours****Perform the following tasks:**

1. Observe amplitude modulated wave for different modulating signals and measure the modulation index of the wave obtained.
2. Generate a DSB-SC signal and observe the pattern on CRO for different levels of modulating signal.
3. Plot the sensitivity characteristics of a radio receiver and determination of the frequency for maximum sensitivity
4. Observe and note the pulse modulated signals (PAM, PPM, PWM) and compare them with the corresponding analog input signal

RECOMMENDED BOOKS

- Electronic Communication Systems, by G. Kennedy and B. Davis, Tata McGraw-Hill, New Delhi, 2008
- Communication Systems, by Sanjay Sharma, Publisher S.K. Kataria and sons, 2nd Edition,
- An Introduction to analog and digital communications, by Simon Haykin. , 2nd Edition, Publisher John Wiley and Sons, 2006.
- Radio Engineering by G.K. Mittal , 4th Edition, Khanna Publishers, New Delhi

Design, Estimating and Costing of Electrical and Electronic Installation

EG 3208 EX

Year: III
Semester: II

Total: 5 hour /week
Lecture: 3 hours/week
Tutorial: hours/week
Practical: 2 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, estimate and cost electrical installation for residential, commercial and industrial buildings.
2. Describe the various types of wiring system and selection of wiring material and accessories.
3. Explain 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 Electrical Energy Survey and Power Factor [15 Hours]

- 4.1 Electricity tariffs
- 4.2 Energy Audits
 - 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.
- 4.3 Power factor fundamentals
- 4.4 Causes of low power factor
- 4.5 Leading and lagging power factor and kVAr flow
- 4.6 Effects of low power factor and benefits of its improvement
 - System capacity
 - Capital cost for new system
 - Distribution system loss
- 4.7 Power factor correction
 - Individual compensation
 - Group compensation
 - Central compensation
 - Synchronous condenser

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 single line and connection diagrams of electric light and power circuit
2. Design and estimate the cost of electrical installation for residential, commercial and industrial (small) buildings.

3. Design and estimate cost 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

Year: III
Semester: II

Total: 8 hour /week
Lecture: hours/week
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

Industrial Attachment

EG 3210 EX

Year: III
Semester: II

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

Year: III
Semester: II

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. Define 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) प्रशिक्षकहरूका लागि निर्मित निर्देशिका तथा प्रशिक्षण सामग्री, प्राविधिक शिक्षा तथा व्यावसायिक तालीम परिषद्, २०६९

ख) प्रशिक्षार्थीहरूका लागि निर्मित पाठ्यसामग्री तथा कार्यपुस्तिका, प्राविधिक शिक्षा तथा व्यावसायिक तालीम परिषद्

(अप्रकाशित), २०६९

Reference book:

Entrepreneur's Handbook, Technonet Asia, 1981.

Computer Architecture

EG 3109 CT

Year: III
Semester: I

Total: 6 hour/week
Lecture: 3 hours/week
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. Define the basic concepts of the central processing unit
2. Simulate different arithmetic processes
3. Explain the principles behind the memory system and I/O organization
4. Design the Control Unit.

Course Contents

Unit 1 Basic computer architecture [4 Hours]

- 1.1 History of computer architecture
- 1.2 Overview of computer organization
- 1.4 Organization and Architecture
- 1.4 Structure and Function

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 [10 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 [3 Hours]

4.1 RISC versus CISC

Unit 5 Arithmetic Processor Design [6 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 [12 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

Practical: [30]

Perform the following tasks:

1. OS Installation
2. Straight and Cross cable Connection of Cat 6 cable with Rj-45 cable
3. Sharing of Data files of two LAN connected PC
4. Multi byte Addition and Subtraction
5. Multi byte decimal addition and subtraction
6. Adder and subtractor circuit

References:

1. A. Tanenbaum, "Structured Computer Organization" 5th Edition, Pearson, Prentice hall, 2006
2. M. Morris Mano, Charles R. Kime, "Logic and Computer Design Fundamentals" 4th Edition, Pearson, 2007
3. William Stalling, "Computer Organization and Architecture" 8th Edition. Pearson, 2010
4. Peter Abel, IBM PC Assembly Language and Programming 3rd Edition, Prentice Hall, 2000

Hydropower

(Elective)

EG 3202 EE

Year: III

Semester: II

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

Course Description:

This course familiarizes the students of diploma level with the basics of hydropower project and major design criteria so that they would more effectively take part for implementation work of such project.

Course Objective:

After completion of the course the students are able to

- Describe the Basics of Hydropower Generation
- Search for different possible layout options for a hydropower potential area
- Identify typical major Components
- Apply Basic Design Principle and criteria
- Draw the typical layout arrangement
- Carry out the implementation work as per design for the recommended various electrical components of a particular project

Unit 1 Energy and Electricity

[4 hours]

- 1.1. Introduction to Energy
- 1.2. Major sources of energy
- 1.3. Energy and Electricity Scenario of the World
- 1.4. Energy and Electricity scenario of Nepal
- 1.5. Historical development of hydropower in Nepal.
- 1.6. Private sector development in hydropower in Nepal

Unit 2. Hydrology and Project environment

[6 hours]

- 2.1 . Method of Discharge Measurement
- 2.2 Calculation of River Discharge: Velocity area method, salt dilution method, floats method.
- 2.3 Hydrograph and Flow duration curve (FDC).
- 2.4 Determination of Design Discharge
- 2.5 Advantages of hydropower and socio environmental aspects
- 2.6 Hydropower project site selection criteria

Unit 3. Project Components and Power Output

[9 hours]

- 3.1 Types of Hydropower plants based on head, storage and capacity
- 3.2 Major components of Hydropower project and its layout
- 3.3 Concept of Gross Head & Net head
- 3.4 Power output equation of hydropower

- 3.5 Installed capacity, Firm power, secondary power, Energy generation, Dry energy, wet energy, Capacity factor
- 3.6 Number of Units in Hydropower project
- 3.7 Power house: classification, advantages/disadvantages of each type.

Unit 4. Water Turbine and Governing System [6 hours]

- 4.1. Types of Turbine: Pelton, Francis, Cross flow, Propeller/Kaplan
- 4.2. Concept of Turbine selection criteria, according to head, specific speed and efficiency curves
- 4.3. Purpose and Working Principle of Governors

Unit 5. Electrical Design Considerations in Hydropower Project [20 hours]

- 5.1. Selection of Generator
- 5.2. Excitation system: brushless and static excitation system
- 5.3. Generator transformer schemes
- 5.4. Transformers selection: Numbers and Ratings
- 5.5. Suitable type and ratings of circuit breaker at different voltage level
- 5.6. Concept of protection scheme for generator and transformer
- 5.7. Auxiliary Power Supply system in hydropower station
- 5.8. Busbar types: Radial, Main and Transfer, Ring system
- 5.9. Concept of Power Transmission: Voltage level, conductor selection
- 5.10. Concept of Earthing in Power station
- 5.11. Need of DC supply System in power station

Practical: 30 hours

Perform the following tasks:

1. Students will make a Study Visit to a Hydropower station. The purpose of the visit will make the students able to
 - list out and describe major components of the project,
 - identify sizes/ratings and purposes of electromechanical components
 - prepare a field study report
 - deliver a presentation
2. A sample project data (head, discharge and so on) is given to the students. For the project student will
 - determine installed capacity,
 - choose appropriate numbers of units
 - recommend major electro-mechanical equipment e.g. turbine, generator, transformers and so on and
 - draw a single line layout of electrical system from water to wire

References:

- US Army Corps of Engineers. ENGINEER MANUAL- Hydroelectric Power Plants Electrical Design, 1994.
- A text book of Power Plant Engineering, PC Sharma, SK Katria and Sons (first publication 1973, revised edition 2013).
- Installation and commission manual for Micro Hydro power plant by ICIMOD Kathmandu 1999.

Radio and Television Broadcasting System

(Elective)
EG 3211 EX

Year: III
Semester: II

Total: 5 hour /week
Lecture: 3 hours/week
Tutorial: 0 hours/week
Practical: 2 hours/week

Course description

This course is designed to provide fundamental concepts of Radio and Television system, audio amplifiers, telephony, CCTV.

Course objectives

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

1. Explain the principle and use of the audio system, audio amplifier, microphone, speaker PA system and telephone system.
2. Explain the principle of modulation, AM radio, FM stereo radio transmitter and receiver.
3. Explain and installation of TV system, CCTV.
4. Find basic fault finding of radio and TV systems.

Course Contents

Unit 1 Audio signal and audio amplifiers-types

6 hours

1. Audio signal and audio signal generation
2. Noise in audio signal, noise reduction methods: Dolby sound
3. Stereo sound, multi-dimensional sound
4. Audio Amplifier: simple concept of audio amplifier, low power amplifier simple circuit and working principle
5. Amplifier and its power, impedance, coupling
6. Headphone amplifier and hearing aid amplifier features
7. Equalizer, its application
8. HI-FI sound, Dynamic Sound, QFX sound

Unit 2 Microphones and speakers-types, features

6 hours

1. Microphone: definition, basic features
2. Types of microphone: moving coil, condenser, crystal-schematic diagram, working principle, specification, features
3. Speaker: definition, types: moving coil speaker, crystal microphone-schematic diagram, working principle, specification, feature
4. Horn Type Speaker-working principle, efficiency
5. Speaker Enclosure: baffle, sound reflex-concept, feature
6. Speaker System: multi speaker system: two-three way
7. Speaker public address system
8. Basic feature of sound system in studio

Unit 3 Fundamental of digital audio **4 hours**
1. Concept of digitization, audio ADC, DAC
2. Popular digital audio formats: MP-1, MP-3 and DVD
3. Audio digital recording systems-magnetic, optical, semiconductor-modern USB memory.

Unit 4 Telephone system **2 hours**
1. Basic telephone system: block diagram and working principle
2. Intercom and modern EPABX system

Unit 5 Fundamental of AM radio **6 hours**
1. Modulation –definition, requirement
2. AM modulation-concept, simple circuit diagram and working principle, application
3. Percentage of modulation, bandwidth, channels, types of AM modulation: double side band, SSB, AM demodulation
4. AM radio receiver: Super heterodyne process, basic block diagram and its working principle.
5. AM radio broadcasting system- basic block diagram and working principle

Unit-6 Fundamental of FM radio **6 hours**
1. FM modulation: concept, advantages over AM modulation, simple circuit diagram and working principle, modulation index, application
2. FM demodulation: double side discriminator, single side discriminator, ratio FM detector, FM broadcasting-Block diagram and working principle
4. FM radio receiver: block diagram & working principle,
5. Principle of Digital radio broadcasting and receiving system
6. Principle of Sound mixer, sound effect and sound editing

Unit 7 TV system: TV system, TV receivers and broadcasting system **10 hours**
1. TV system- introduction, scanning system- scanning, interlaced scanning, aspect ratio, resolution
2. Basic monochrome TV system: basic block diagram and working principle
3. Camera system: CCD BASED VIDEO CAMERA
4. Basic COLOUR TV systems-PAL, SECAM, NTSC
5. MONITORS: CRT, LCD, LED
6. DIGITAL Video Formats-MP-2, MP-4, DVD
7. Digital TV, HD TV, SMART 4K TV
8. Cable TV, internet TV, Dish-Home TV
9. TV antenna: dipole- yagi antenna, DISC antenna
10. TV broadcasting system: basic block diagram and working principle, features
11. Big size TV screen, curved big screen
12. Video recorders-analog, digital, feature format, resolutions

Unit 8 CCTV, IP-CCTV system, features and application **5 hours**
1. CCTV: Definition, application, advantages
2. Analog and digital CCTV, multi TV camera CCTV system
3. CCTV-power distribution, DVR-NVR CCTV system

4. Single IP camera with Wi-Fi, tracking, PIR sensor, alarm, dual sound, USB MEMORY, microphone IP camera features and application.

Practical:

Perform the following tasks:

30 hours

1. Test an amplifier by measuring voltages, simple fault findings of amplifier-10 hours
2. Test a simple FM radio by measuring voltage and basic fault finding methods-10 hours
3. Disassemble and Assemble of simple LED TV-5 hours
4. Install CCTV with Wi-Fi configuring by using mobile app and DVR, NVR-5 hours

References:

1. *Audio video system- RG Gupta*
2. *Audio video system- Bali and Bali*
3. *Audio video TV Engineering-Ajay Sharma*
4. *Fundamental of audio video system-M. L. Anand*
5. *Monochrome and Colour TV-R. R. Gulati*

Renewable Energy Technology

EG 3202 EE
(Elective)

Year: III
Semester: II

Total: 5 hour /week
Lecture: 3 hours/week
Tutorial: hours/week
Practical: 2 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. Describe the basic principles behind renewable energy sources like hydro, solar, wind and biomass.
3. Compare the prospects of renewable energy resources

Course Contents

Unit 1	Energy	5 Hours
1.1	Introduction	
1.2	World energy scenario	
1.3	Energy crisis, Potential of Different Sources of Energy in Nepal, Supply and Demand of Energy in World, Asia, South Asia and Nepal	
1.4	Renewable energy resources	
	<ul style="list-style-type: none">• Solar energy• Hydro electricity• Biomass/Bio Energy• Energy Generation from Waste• Wind energy• Geothermal energy• Tidal energy	
Unit 2	Solar Energy	12 Hours
2.1.	Solar radiation/Photovoltaic System	
2.2.	Electromagnetic spectrum	
2.3.	Solar Constant, Irradiance, Insolation, Peak Sun	
2.4.	Fundamental principle of photovoltaic conversion	
2.5.	Types of photovoltaic cells (mono-crystalline, poly-crystalline, thin film or amorphous cells)	
2.6.	Characteristic of Solar Cell	
2.7.	Prediction of solar radiation	

- 2.8. Solar module, energy storage battery, charge controller
- 2.9. Solar thermal energy
- 2.10. Domestic hot water system
- 2.11. Solar dryer, Solar distillation, Solar ponds, Swimming pool heating, Concentrating collectors, Flat plate collectors & Solar-electricity
- 2.12. Estimation of 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 equipment
 - turbine
 - generator
 - governer
 - automatic voltage regulator
 - electronic load controller
 - ancillary equipment

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 Biomass Conversion into Energy
- 4.4 Components of Biogas system
 - Biogas constituents
 - Biodigester
 - Biogas inputs (feeds)
 - Digestion
 - Slurry
 - Use of Biogas (cooking, lighting etc)
- 4.5 Traditional Cooking Stoves and Improved Cooking Stoves(ICS)

Unit 5 Wind Energy **8 Hours**

- 5.1 Wind Power in Global Scenario
- 5.2 Wind Energy Potential in Nepal
- 5.3 Wind Energy Conversion System
- 5.4 Power from the winds
- 5.5 Wind turbines

- Horizontal axis turbines
 - Vertical axis turbines
- 5.6 Electricity generation from wind turbines
- 5.7 Wind farm

Practical:

30 Hours

Perform the following practical tasks:

1. Measure the solar radiation of your Place [Week 1]
2. Install the Solar Home System & solar water pumping : Solar cells and connection, charge controller and storage battery [Week 2 to 10]
3. Use Solar heaters, Solar ovens, Solar dryers, Solar Cooker [Week 2 to 10]
4. Study of Micro-hydropower systems/ Peltric set with electronic load controller [Week 11 to 14]

References:

1. Renewable Energy, Power for a sustainable future by Godfrey Boyle, Oxford University Press.
2. John Twidell and Tony Weir, "Renewable Energy Resources" Third Edition, Taylor & Francis Group, an informa business.

Electrical Energy Management

EG 3202 EE

(Elective)

Year: III
Semester: II

Total: 5 hour /week
Lecture: 3 hours/week
Tutorial: hours/week
Practical: 2 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. Explain the Power factor correction.
3. Explain lighting system.
4. Explain operation of process equipment.

Course Contents

Unit 1	Introduction	3 Hours
1.1	Electrical energy in Nepal. <ul style="list-style-type: none">• The growth of consumption.• The cost of new power plant• Electricity Price• Electrical energy conservation: The national prospective.	
Unit 2	Plant Electrical Distribution System	10 Hours
2.1	Typical system bus design: <ul style="list-style-type: none">• Simple radial single bus system• Double bus system• Sectionalized and special bus system	
2.2	Voltage Levels and Wiring System	
2.3	Conductor Size <ul style="list-style-type: none">• Energy losses in conductor• Optimum conductor size• Transformer• Transformer losses• Transformer selection	
2.4	Design of new plant distribution system	
Unit 3	Load Management	10 Hours
3.1	Maximum demand <ul style="list-style-type: none">• Measurement of maximum demand• Demand charge	

- Cost saving from demand control
- 3.2 Analysis of potential for demand control
 - Load factor
 - Load curve or demand profile
 - Identification of load
- 3.3 Methods of demand control
 - Manual demand control (load shedding and monitoring)
 - Automatic demand control

Unit 4 Electric Motors 6 Hours

- 4.1 Motor efficiency and motor losses
 - Motor losses: stator and rotor losses, iron or magnetic core losses, friction and wind age losses, stray load losses.
- 4.2 Standard motor efficiencies.
- 4.3 Factor affecting electric motor efficiency
 - Motor size
 - Motor load
 - Motor selection and sizing
 - Motor maintenance
 - Motor rewinding
- 4.4 High efficiency motors.

Unit 5 Lighting 8 Hours

- 5.1 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
- 5.2 Ballasts
- 5.3 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 6 Process Equipment 8 Hours

- 6.1 Energy saving in process equipment
 - Turn off idle equipment
 - Operate equipment at design loading
- 6.2 Compressor
 - Minimize flow rate of compressed air
 - Minimum operating pressure of compressor air system

6.3 Pumps

- Reducing friction losses
- Reducing the flow

6.4 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]

Perform the following practical tasks:

1. Conduct the industry visit (plant)
2. Draw a single line diagram of electric distribution system for any one of visited plant
3. Perform a case study of energy conservation by load management
4. Perform a case study of energy conservation by power factor improvement
5. Perform a case study of energy conservation in electric motor.
6. Perform 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
- A course on “Principles and Practices of Energy Conservation.

Fiber Optic Communication

EG 3211 EX

(Elective)

Year: III

Semester: II

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

Course description

This course is designed to provide a generalized approach in Fiber Optic Communication. Students will understand the concept of information transmission via Optical Fiber and various elements involved in optical fiber transmission link.

Course objectives

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

1. Describe fiber optic concept to information transmission.
2. Identify the elements of an optical fiber transmission link.
3. Explain optical fiber structure, wave guiding and fabrication
4. Compute and simulate the modes in slab waveguide, step index fiber and graded index fiber.

Course Contents

Chapter 1 The overview of fiber optic systems [6 Hours]

- 1-1 Evolution of fiber optic systems
- 1-2 Forms of communication systems
- 1-3 Elements of an optical fiber transmission link

Chapter 2 Optical fiber Structures [6 Hours]

- 2-1 Nature of Light
- 2-2 Basic Optical Laws
- 2-3 Optical Fiber Modes and Configuration

Chapter 3 Single-Mode and graded-index fiber structure [6 Hours]

- 3-1 Single Mode Fiber Structure
- 3-2 Graded-Index Fiber Structure

Chapter 4 Signal degradation in optical fibers [7 Hours]

- 4-1 Attenuation
- 4-2 Signal Distortion in Optical Waveguides
- 4-3 Pulse Broadening in Degraded-index Waveguides
- 4-4 Mode Coupling
- 4-5 Design Optimization of Single Mode Fibers

Chapter 5 Optical Sources [7Hours]

- 5-1 Semiconductor Physics
- 5-2 Light Emitting Diodes

5-3 Light Source Linearity

Chapter 6 Optical Receiver Performance and Operation [7 Hours]

7-1 Receiver Operation Fundamental

7-2 Digital Receiver

7-3 Analog Receiver

Chapter 7 Optical Measurements [6 Hours]

8-1 Point to Point Links

8-2 Line Coding

8-3 Noise Effects on System Performance

Practical [30 Hours]

Perform the following tasks:

- Demonstrate of physical structure optical fiber
- Demonstrate of various connectors for optical fiber connections
- Demonstrate Fiber Optic Splicing: Fusion Splicing Method (if splicing device is available)
- Demonstrate Fiber Optic Splicing: Mechanical Splicing Method (if device is available)

References:

1. Gerd Keiser, Optical Fiber Communications, third edition, McGraw Hill, 2000
2. Joseph Palais, Fiber Optic Communications, fourth edition, Prentice Hall, 1998

Software:

MATLAB, MATHCAD, EXCEL and PTDS Virtual Pho.

Wireless Communications

EG 3211 EX
(Elective)

Year: III
Semester: II

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

Course description

This course is designed to provide a generalized approach in Mobile Communication. After dealing with the introductory concepts and the evolution of mobile communication systems till the present-day status, the cellular engineering fundamentals are discussed at length to make the students realize the importance of the practical engineering aspects of this subject.

Course objectives

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

1. Describe telecom wireless fundamentals.
2. Identify the elements of mobile communication.
3. Describe the modern wireless communication system.
4. Describe cellular techniques
5. Describe transmitting and receiving techniques

Course Contents

Chapter 1: The Telecom/Wireless Fundamentals [6 Hours]

- 1-1 Evolution of Mobile Radio Communications
- 1-2 Present Day Mobile Communication
- 1-3 How a Mobile Call is Actually Made?
- 1-4 Future Trends

Chapter 2: Modern Wireless Communication System [7 Hours]

- 2-1 1G: First Generation Networks
- 2-2 2G: Second Generation Networks
- 2-3 3G: Third Generation Networks (UMTS)
- 2-4 4G: Fourth Generation Networks (LTE)
- 2-5G: Fifth Generation Networks

Chapter 3: The Cellular Engineering Fundamentals [7 Hours]

- 3-1 Introduction
- 3-2 Frequency Reuse
- 3-3 Channel Assignment Strategies
- 3-4 Handoff Process
- 3-5 Interference & System Capacity

Chapter 4: Free Space Radio wave propagation [7 Hours]

- 4-1 Introduction
- 4-2 Free Space Propagation Model
- 4-3 Basic Methods of Propagation (Reflection, Diffraction, Scattering)
- 4-4 Mode Coupling
- 4-5 Design Optimization of Single Mode Fibers
- 4-6 Propagation Model (Indoor and Outdoor)

Chapter 5: Multipath Wave Propagation and Fading [6 Hours]

- 5-1 Multipath Propagation
- 5-2 Fading

Chapter 6: Transmitter and Receiver Techniques [6 Hours]

- 7-1 Introduction
- 7-2 Modulation
- 7-3 Analog Receiver

Chapter 7: Techniques to Mitigate Fading Effects [6 Hours]

- 8-1 Introduction
- 8-2 Equalization

Practical [30 Hours]

Perform the following practical tasks:

- Demonstrate the working mechanism of mobile phone
 - Establish a voice call
 - Establish a SMS message
 - Establish a DATA service
- Identify entities involved during mobile call.
 - Identify entities involved during voice call
 - Identify entities involved during Messaging
 - Identify entities involved during DATA service
- Identify mobile frequency spectrum
 - Identify various frequency spectrum in mobile communication

References:

3. T. S. Rappaport, Wireless Communications: Principles and Practice, 2nd ed. Singapore: Pearson Education, Inc., 2002.
4. K. Feher, Wireless Digital Communications: Modulation and Spread Spectrum Applications. Upper Saddle River, NJ: Prentice Hall, 1995.
5. J. G. Proakis, Digital Communications, 4th ed. NY: McGraw Hill, 2000.

Software:

MATLAB, MATHCAD, EXCEL and PTDS Virtual Photonics

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