CURRICULUM

DIPLOMA

In

Biomedical Engineering

(Three year program-semester system)

Council for Technical Education and Vocational Training

Curriculum Development Division

Sanothimi, Bhaktapur

2013

Table of Content

1. Introduction:

Biomedical Engineering is an emerging field in the engineering and technology sector. Many people in the developed countries, developing countries and under developed countries have given emphasis for the broader application of Biomedical Engineering. This field 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 workforce equipped with knowledge and skills related to the areas of Biomedical 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 Biomedical Engineering

2. Course title:

Diploma in Biomedical Engineering (DBME)

3. Programme objectives:

This curriculum has following objectives to:

1. Prepare technicians who are able to work as biomedical technician in different level of hospitals and nursing homes;
2. Produce middle level competent technical workforce/human resources that could provide maintenance services of medical equipments;
3. Prepare technical workforce who will demonstrate positive attitude and respect for the profession and socio-cultural values;
4. Help in meeting the demand of biomedical technician required for the public and private hospitals of Nepal;
5. Reduce the dependence on employing such technicians from foreign countries and
6. Create self employment opportunities.

4. Programme description:

This course is based on the job required to perform by the Biomedical Technicians at different level of hospitals and nursing homes in Nepal. Therefore, this curriculum is designed to provide knowledge and skills focusing on Biomedical Engineering related to the occupation. There are six semesters in total within the period of three years. The first year courses are offered focusing on foundational and core subjects of engineering; the second year courses are focused on basic disciplinary subjects of Biomedical Engineering. Similarly, the third year comprises of the disciplinary subjects including provision of elective subjects. Moreover, the third year insists on the application of learned skills and knowledge through the project I and Project II as infusion model of subjects.

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

produce competent and highly employable middle level technical workforces in the field of biomedical engineering.

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

5. Duration:

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

6. Target group:

The target group for this programme will be all interested individuals who passed School Leaving Certificate (SLC) with English, Science, and Mathematics or equivalent and related Technical School Leaving Certificate (TSLC).

7. Group size:

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

8. Target location:

The target location will be all over Nepal.

9. Entry qualification:

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

10. Entry criteria:

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

11. Selection:

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

12. Medium of instruction:

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

13. Pattern of attendance:

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

14. Teacher and student ratio:

- For theory: As per the nature of the course
- For practical / demonstration: 1:10
- For bench work: 1:8

15. Teachers and demonstrators:

- The disciplinary subjects' related teachers should be a bachelor's degree holder in the related area with three years experience in the related field.

- The demonstrators should be bachelor's degree holder in the related area with two years experiences in training activities.
- The foundational subjects' related teachers (refer to course code SH) should be master's degree holder in the related area.

16. Instructional media and materials:

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

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

17. Teaching learning methodologies:

The methods of teachings for this curricular program will be a combination of several approaches. Such as Illustrated Lecture, Tutorial, Group Discussion, Demonstration, Simulation, Guided practice, Practical experiences, Fieldwork, Report writing, Hospital visit, Term paper presentation, Case analysis, Tutoring, Role-playing, Heuristic, Project work and Other Independent learning.

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

18. Mode of education:

There will be inductive and deductive mode of education

19. Examination and marking scheme:

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

20. Provision of back paper:

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

21. Disciplinary and ethical requirements:

- Intoxication, insubordination or rudeness to peers will result in immediate suspension followed by review by the disciplinary review committee of the institute.

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

22. Pass marks:

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

23. Grading system:

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

Marks division:

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

24. Certification and degree awards:

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

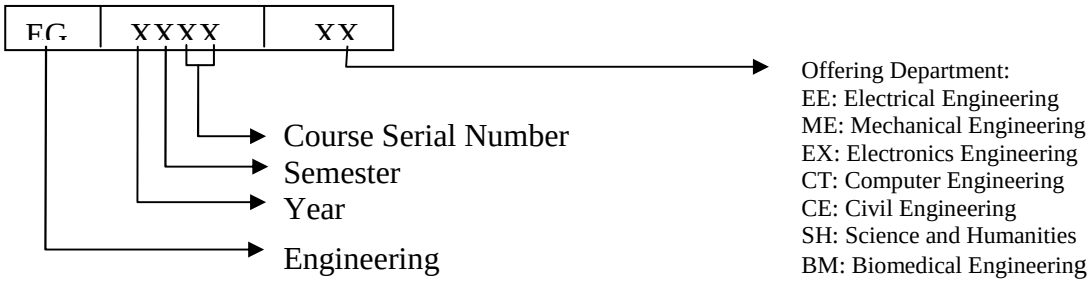
25. Career path:

The graduates will be eligible for the position equivalent to Non-gazetted 1st class (technical) as Biomedical Equipment Technician or as prescribed by the Public Service Commission of Nepal. The graduate will be eligible for registration with the related Council in the grade as provisioned in the related Council Act (if any).

26. Curriculum and credits:

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

27. Subjects Codes



28. Provision of specialization:

There will be no provision of specializing but some subjects are offered here with provision of the elective; viz Data Communication, Embedded System Design, Cardio-vascular and ICU Equipment, Medical Laboratory and Ophthalmic Equipment and Medical Imaging Equipment.

Course Structure of Diploma in Biomedical Engineering

Year : I **Part : I**

Teaching Schedule			Mode					DISTRIBUTION OF MARKS						Total Marks	Remark
								Theory			Practical				
SN	Course Code	Course Title	L	T	P	Lab	Total Hour	Int. Marks	Final Marks	Time Hours	Int. Marks	Final Mark	Time Hours		
1	EG1101SH	Communication Nepali	2				2	10	40	1.5				50	* Continuous Assessment
2	EG1102SH	Communication English	2				2	10	40	1.5				50	
3	EG1103SH	Engineering Mathematics I	4	1			5	20	80	3				100	
4	EG1104SH	Engineering Physics I	3	1		2	6	20	60	3	10	10	1.5	100	
5	EG1105SH	Engineering Chemistry I	3	1		2	6	20	60	3	10	10	1.5	100	
6	EG1106ME	Engineering Drawing I				4	4				60	40	4	100	
7	EG1109 EE	Electrical Engineering I	4			3	7	20	80	3	30	20	3	150	
8	EG1112EE	Workshop Practice	2		6		8				90	60	4	150	
		Total	**20**	**3**	**6**	**11**	**40**	**100**	**360**		**200**	**140**		**800**	

Year : I **Part : II**

Teaching Schedule			Mode					DISTRIBUTION OF MARKS						Total Marks	Remark
								Theory			Practical				
SN	Course Code	Course Title	L	T	P	Lab	Total Hour	Int. Marks	Final Marks	Time Hours	Int. Marks	Final Mark	Time Hours		
1	EG 1201 SH	Engineering Mathematics II	3	1			4	20	80	3	0	0		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	EG1204 ME	Engineering Drawing II			4		4				60	40	4	100	
5	EG1204 SH	Biology	3			2	5	20	60		10	10	1.5	100	
6	EG1206 EE	Electrical Engineering II	3			3	6	20	80	3	30	20	3	150	
7	EG 1207 CT	Introduction to Computers	2		2		4	10	40	1.5	30	20	3	100	
8	EG1208 EX	Electronics Devices and Circuits I	3		2		5	20	80	3	30	20	3	150	
		Total	**20**	**3**	**8**	**9**	**40**	**130**	**460**		**180**	**130**		**900**	

Year : II **Part : I**

Teaching Schedule			Mode					DISTRIBUTION OF MARKS						Total Marks	Remark
								Theory			Practical				
SN	Course Code	Course Title	L	T	P	Lab	Total Hour	Int. Marks	Final Marks	Time Hours	Int. Marks	Final Mark	Time Hours		
1	EG2101EX	Logic Circuits	3		3		6	20	80	3	30	20		150	* continuous assessment
2	EG2102 EX	Electronic Devices and Circuits II	4	1	3		8	20	80	3	30	20	3	150	
3	EG2103 EX	Electronics Drawing	1		2		3				30	20	3	50	
4	EG 2104 SH	Engineering Mathematics III	3	1			4	20	80	3				100	
5	EG2105 SH	Human Anatomy and Physiology	4		3		7	20	80		30	20	3	150	
6	EG 2106 EE	Electrical Measurements	2	1			3	10	40	1.5				50	
7	EG 2107 CT	Computer Programming	3		3		6	20	80	3	30	20	3	150	
		Total	**20**	**3**	**14**		**37**	**110**	**440**		**150**	**100**		**800**	

Year : II **Part : II**

Teaching Schedule			Mode					DISTRIBUTION OF MARKS						Total Marks	Remark
								Theory			Practical				
SN	Course Code	Course Title	L	T	P	Lab	Total Hour	Int. Marks	Final Marks	Time Hours	Int. Marks	Final Mark	Time Hours		
1	EG2201ME	Basic Mechanics	3				3	20	80	3				100	* continuous assessment
2	EG2202EX	Electronic Devices and Circuits III	4		3		7	20	80	3	30	20	3	150	
3	EG2203 EX	Introduction to Microprocessors	3		3		6	20	80	3	30	20	3	150	
4	EG2204 EX	Electronic Instruments & Measurements	3		3		6	20	80	3	30	20	3	150	
5	EG2205 EX	Instrumentation and Control	3			3	6	20	80	3	30	20	3	150	
6	EG2206 SH	Social Studies	2				2	10	40	1.5				50	
7	EG2201 BM	Medical Electronics I	3		3		6	20	80	3	30	20	3	150	
8	EG 2202BM	Bio-Engineering Materials and Devices	4				4	20	80	3				100	
		Total	**25**		**12**	**3**	**40**	**150**	**600**		**150**	**100**		**1000**	

Year : III **Part : I**

Teaching Schedule			Mode					DISTRIBUTION OF MARKS						Total Marks	Remark
								Theory			Practical				
SN	Course Code	Course Title	L	T	P	Lab	Total Hour	Int. Marks	Final Marks	Time Hours	Int. Marks	Final Mark	Time Hours		
1	EG3101BM	Introduction to Bio-Mechanics	3				3	20	80	3				100	
2	EG3102BM	Medical Electronics II	3	1	3		7	20	80	3	30	20	3	150	* continuous assessment
3	EG3103BM	Medical Imaging Technology	4		3		7	20	80	3	30	20	3	150	
4	EG3104BM	Bio-Medical Instrumentation I	3	1	3		7	20	80	3	30	20	3	150	
5	EG3103EX	Elective I (any one)	3	1	3		7	20	80	3	30	20	3	150	
a		Data Communication													
b		Embedded System Design													
6	EG3105BM	Bio-Medical Equipment Maintenance I	2		3		5			1.5	60	40	3	100	
7	EG3106BM	Project I			4		4				60	40	3	100	
		Total	**18**	**3**	**19**		**40**	**100**	**400**		**240**	**160**		**900**	

Year : III **Part : II**

Teaching Schedule			Mode					DISTRIBUTION OF MARKS						Total Marks	Remark
								Theory			Practical				
SN	Course Code	Course Title	L	T	P	Lab	Total Hour	Int. Marks	Final Marks	Time Hours	Int. Marks	Final Mark	Time Hours		
	EG3201BM	Medical Electronics III	3	1	3		7	20	80	3	30	20	3	150	* continuous assessment
1	EG3202 BM	Bio-Medical Instrumentation II	3	1	3		7	20	80	3	30	20	3	150	
2	EG3203 BM	Bio-Medical Equipment Maintenance II	2		4		6				60	40	4	100	
3	EG3204 BM	Elective II (any one)	3	1	3		7	20	80	3	30	20	3	150	
a		Cardio-Vascular and ICU Equipment													
b		Medical Laboratory and Ophthalmic Equipment													
c		Medical Imaging Equipment													
4	EG 3201 SH	Entrepreneurship Development	3		2		5	20	60	3	10	10	3	100	
5	EG3205 BM	Project II			8		8				120	80	4	200	
		Total	**14**	**3**	**23**		**40**	**80**	**300**		**280**	**190**		**850**	

First Year
(First and Second Semesters)

First Semester

Subjects:

EG 1101 SH	Communication Nepali
EG 1102 SH	Communication English
EG 1103 SH	Engineering Mathematics I
EG 1104 SH	Engineering Physics I
EG 1105 SH	Engineering Chemistry I
EG 1106 ME	Engineering Drawing I
EG 1109 EE	Electrical Engineering I
EG 1112 EE	Workshop Practice

कम्युनिकेसन नेपाली

ई.जी. ११०१ एस.एच.

वर्षः प्रथम **जम्माः २ घण्टा/ हप्ता**
सेमेष्टरः प्रथम **प्रवचनः २ घण्टा/ हप्ताः**
विशेषः घण्टा/ हप्ताः
प्रयोगात्मकः घण्टा/ हप्ताः
प्रयोगशालाः: घण्टा/ हप्ताः

कोर्षको परिचय :

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

कोर्षको उद्देश्य :

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

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

पाठ्यांशको विषयवस्तु

एकाइः 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, बुंदाटिपोट, सङ्क्षेपीकरण र शब्दभण्डारको ज्ञान र अभ्यास

- अनुच्छेद लेखन
- संवाद लेखन
- बुँदा लेखन
- सारांश लेखन

- पत्र लेखन (निमन्त्रणा पत्र, सूचना, सम्पादकलाई चिठ्ठी र निवेदन आदि)
- निबन्ध लेखन
- प्राविधिक तथा पारिभाषिक शब्दहरूको ज्ञान र प्रयोग

२.२ शब्द निर्माणको अभ्यास

- उपसर्ग
- प्रत्यय, (कृत् तथा तद्धित)
- समास

२.३ प्राविधिक/पारिभाषिक शब्दहरूको शब्दस्रोत,

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

२.४ प्रतिवेदन लेखन

एकाइ ३ कृति परिचय ***[५]***

निम्न लिखित ढाँचामा तलका कृतिको परिचय लेख्ने अभ्यास

३.१ कृतिहरू:

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

३.२ कृति परिचयको ढांचा

- कृतिको नाम:
- कृतिकारको नाम:
- कृतिका मुख्य विषय: (एक अनुच्छेद)
- कृतिको महत्व: (एक अनुच्छेद)
- कृतिले आफूलाई पारेको प्रभाव : (छोटो एक अनुच्छेद)
- कृतिको भाषा शैली: (छोटो एक अनुच्छेद)
- कृतिको कमी, कमजोरी र सुझाव: (छोटो एक अनुच्छेद)

सिकाई सामग्रीहरू

- त्रि. वि. पाठ्यक्रम विकास केन्द्र, अनिवार्य नेपाली शिक्षण निर्देशन, काठमाण्डौं
- लालानाथ सुवेदी, इन्जिनीयरिङ नेपाली विद्यार्थी पुस्तक भण्डार, भोटाहिटी, काठमाण्डौं ।
- लालानाथ सुवेदी, नेपाली व्याकरण, बोध/रचना (सम्बन्धित अंश मात्र) विद्यार्थी पुस्तक भण्डार, भाटाहिटी, काठमाण्डौं ।
- गोरखापत्र, कान्तिपुर आदि पत्रिका सम्पादकीय, टिप्पणी र लेखहरू ।
- प्रशिक्षकहरूले आफ्नो पुस्तक तयार गर्न वा बजारमा पाइने सामग्री छानेर पढाउन सक्ने, तर परीक्षा महाशाखालाई यसको पूर्व जानकारी दिनुपर्ने ।

Communication English

EG 1102 SH

Total: 2 hour /week

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

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

Practical: hours/week

Lab : hours/week

Course description:

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

Course objectives:

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

Course Contents:

Unit 1. Communicative English: [3 hrs]

1.1. The structure of English:
- Introduction
- Grammatical units:
  - The word
  - The phrase
  - The clause
  - The sentence
- The grammatical structures:
  - The structure of the phrase
  - The structure of the clause
  - The structure of sentence (functions)
  - The structure of sentence (realizations)

1.2. Everyday functions.
1.3. Requests and offers.
1.4. Direct functions.
1.5. Asking about / expressing.
1.6. Asking about / stating.
1.7. Functions of English.
1.8. Using dictionary
1.9. Reading comprehension
1.10. Collection and definitions of trade related terminologies

Unit 2. Writing skills in English: [15 hrs]

2.1 Writing paragraphs
2.2 Writing dialogues
2.3 Writing Précis
2.4 Writing summaries
2.5 Writing letters:
- Applications
- Official letters
- Business letters
- Invitation letters

2.6 Writing essays
2.7 Writing reports:
- General reports
- Technical reports
- Needs assessment reports
- Review reports

2.8 Writing resumes
2.9 Writing bibliographies
2.10 Writing minutes
2.11 Writing notes
2.12 Writing proposals:
- Technical proposals
- Academic proposals

2.13 Writing for action
2.14 Writing for job
2.15 Writing technical articles:
2.16 Using technical journals/articles
2.17 Writing instructions
2.18 Introduction to writing technical manuals
2.19 Writing memos

Unit 3. English sounds and structures: [4 hrs]

3.1 Definitions of phonology, sounds of English, morphology, lexicology, syntax, and semantics
3.2 Sounds of English:
- The vowels
- The consonants
- Consonant clusters
- Vowel sequences
- Syllable structure
- Stress
- Intonation

Unit 4. English conversation practices and guidance: [8 hrs]

4.1. Situational conversation
4.2. Structural conversation
4.3. Familiarization with English spoken skills for employment during the stage of visa application to workstation in abroad.

4.4. Guidance for:

- TOEFL preparation
- EILTS preparation
- Group discussion and presentation
- Seminar conduction

Learning materials:

1. Poudel, R.C., A Manual to Communicative English, K.P.Pustak Bhandar, Kathmandu, 1956/57.
2. Shah ,B.L.,Atext book of writing skills in English, First edition Hira Books Enterprises, Kathmandu,
3. Fruehling, R. T. and Oldham N. B., Write to the point, McGraw- Hill, Inc. New York NY 10020
4. Tayior, G., English conversation practice, 1975.
5. Maharjan L. B..A textbook of English sounds and Structures, Vidyarthi Pustak Bhandar, Kathmandu, 2000.
6. Todd, LAN introduction to Linguistics, Longman York press, 1991.
7. 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.
8. The related institute may develop its own textbook and approve from the related authority so as to have a prescribed textbook of this subject.

Engineering Mathematics I

EG 1103 SH

Total: 5 hour /week

Year: I **Lecture: 4 hours/week**

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

Practical : hours/week

Lab : hours/week

Course description:

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

Course objectives:

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

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

Course Contents:

Unit 1. Trigonometry: [16 hrs]

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: [16 hrs]

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 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: [8 hrs]

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. Calculus: [20 hrs]

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.

4.7. Limit of community.

4.8. Derivatives from definition of simple functions like:

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

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

4.10. Integration, Rules for finding integrals.

4.11. Standard integrals and their uses.

4.12. Definite integrals- definition and evaluation.

4.13. Definite integral as limit of sum.

Learning materials:

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

Engineering Physics I

EG 1104 SH

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

Course description:

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

Course objectives:

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

1. Mechanics.
2. Heat and thermodynamics.
3. Optics.
4. Magnetism.

Course Contents:

Theory

a. Mechanics: [14 hrs]

1.1 Basic units and measurements:
- Measurement of physical quantities
- Introductory ideas abut dimensions of physical quantities.
- Scalar and Vector: definitions and examples, dot and cross product of two vectors
- Composition and resolution of vectors.

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 and banked track

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.

1.5. Work, energy, and power:
- Definition and units of work, energy and power.
- Potential and kinetic energy.
- Conservation of energy.
- Conservative forces.
- Transformation of energy.
- Power efficiency.

1.6. Simple harmonic motion (SHM):
- Simple harmonic motion and its characteristics.
- Period, frequency, and amplitude of simple harmonic motion.
- Speed and acceleration in simple harmonic motion.
- Energy of simple harmonic motion.
- Simple pendulum.

1.7. 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.

b. Heat and thermodynamics: [11 hrs]

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.
- 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.
- Barometric height correction.

2.4 Heat Transfer:

- Thermal conduction conductivity and determination of the coefficient of thermal conductivity.
- Convection and convection coefficient.
- 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,
  - isothermal and
  - Isobaric.
- Specific and molar heat capacities for different thermodynamic processes, Cp-Cv =R.
- Second law of thermodynamics.
- Carnot engine, Otto cycle and their efficiencies.

c. Optics: [10 hrs]

3.1 Light and Illumination:

- Nature of light, sources of light, rays.
- Luminous s flux.
- Luminous intensity of a point source.

3.2 Reflection and Refraction by plane Surfaces:

- Review of reflection and refraction by plane surfaces.
- Speed of light in different media.
- Deviation due to reflection and refraction.
- Phenomenon of total internal reflection, critical angle.
- Real and apparent depth.
- Determination of reflective index.

3.3 Reflection by Spherical Surfaces:

- Review of reflection by spherical surfaces.
- Method of construction pf image by ray diagrams.
- Real and virtual images.

- Nature of images formed by spherical mirrors.
- Spherical aberration: parabolic mirror.
- Uses of Mirrors: driving mirror of a car, field of view.

3.4 Refraction through Prisms and Lenses:

- Deviation due to prism and minimum deviation.
- Refraction through lenses.
- Lens maker equation.
- Converging lens, diverging lens and thin lens equation.
- Formation of images by lenses.
- Combination of lenses.
- Magnification,
- Power of a lens.
- Uses of lenses:
  - simple microscope,
  - compound microscope and
  - Telescope
- Human eye.

d. Magnetism: [10 hrs]

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.
- Deflection and oscillation magnetometer.

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

Practical

1. Determine volume of hallow cylinder by using vernier calipers.
2. Determine density of a steel / glass ball by using screw gauge.
3. Determine thickness of glass plate using spherometer and calculate the area by using millimeter graph paper.
4. Determine the acceleration due to gravity by using simple pendulum.
5. Determine the magnetic movement of a bar magnet by using deflection magnetometer.

6. Determine the refractive index of the material of prism.
7. Determine specific heat capacity of solid by the method of mixtures.
8. Determine specific latent heat of ice by the method of mixtures.
9. Determine specific gravity of different solids by up thrust method.
10. Determine focal length of a converging lens by displacement method.

Learning materials:

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

Engineering Chemistry I

EG 1105 SH

Total: 6 hour /week

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

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

Practical : hours/week

Lab : 2 hours/week

Course description:

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

Course objectives:

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

- General chemistry
- Language of chemistry
- System of classification

Course Contents:

Theory

Unit: 1: General chemistry: [8 hrs]

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

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

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

1.4 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)

1.5 Simple mole concept:

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

Unit: 2: Language of chemistry: [4 hrs]

2.1 Symbol:

- Definition
- Significance (qualitative and quantitative)

2.2 Formula:

- Definition
- Significance (qualitative and quantitative)
- Concept of valency in terms of combining capacity with H_2, O_2, and Cl_2
- Variable valency (ref. Fe, Sn, Pb, Cu, Hg, S and N)
- Radicals (electro- positive and electro - negative)
- Writing a formula

2.3 Chemical equation:

- Definition
- Types requisites
- Significance and limitation
- Balancing of chemical equation by hit and trial method and Partial equation method

Unit: 3: System of classification: [33 hrs]

3.1 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
- 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

3.2 Electronic theory valency:

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

3.3 Oxidation and reduction:

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

3.4 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

3.5 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 Activity and electrochemical series:

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

3.7 Corrosion:

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

3.8 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
- Preparation of acid and base (at least 2 -methods).
- Properties of acid and base.
- Definition of Salt
- Types of salt (normal, acidic and basic)
- Preparation of salt (at least 3 - methods)
- Concept of hydrogen ion concentration, pH value and pH Scale
- Buffer solution.

3.9 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

Practical

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

Text books:

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

References:

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

Other learning materials:

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

Engineering Drawing I

EG 1106 ME

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

Course description:

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

Course objectives:

After completing this course the students will be able to

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

Course contents:

Unit 1: Introduction [4]

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 hrs]

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

Unit 3: Geometrical Construction [12 hrs]

3.1 Construction on straight lines and angles

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

3.2 Construction of polygons

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

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

3.4 Construction on circular arcs and circles

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

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

3.6 Construction of standard curves

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

3.7 Exercise on construction of standard curves [Sheet 5]

Unit 4: Dimensioning [4 hrs]

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 hrs]

5.1 Principle of projection

5.2 Principle planes of projections, Four quadrants

5.3 Projection of point

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

5.4 Projection of line

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

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

5.6 Projection of plane

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

5.7 True Length of an Oblique Line

5.8 True shape of an Oblique Plane

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

Unit 6: Projection of Geometrical Solids [4 hrs

6.1 Types of Solids: Polyhedra and Solids of revolution

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

6.3 Projection of points on the surfaces solids

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

Unit 7: Orthographic Projection [20 hrs]

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]

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

Exercise on orthographic projection of objects with cylindrical surfaces [Sheet 12 &13]

Exercise on orthographic projection and dimensioning [Sheet 14]

Unit 8 Freehand Sketching [4 hrs]

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

Reference:

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

Electrical Engineering I

EG 1109 EE

Total: 7 hours/week

Year: I **Lecture: 4 hours/week**

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

Practical: hours/week

Lab : 3 hours/week

Course description:
This course deals with fundamentals of electric current and the basic laws that deal with electrical network analysis. .

Course objectives:
After completion of this course the students will be able to:
1. Understand the basic concept of electric current and voltage
2. Understand the fundamental principles of electricity and electromagnetism
3. Identify the basics network theorems and their use

Course Content:

Theory

Unit 1: Introduction **[8 hrs]**
- 1.1. Matter, molecule and atom
- 1.2. Electric charge and current
- 1.3. Potential difference and electromotive force
- 1.4. Resistance and its variation with temperature
- 1.5. Direct and alternating current
- 1.6. Series and parallel circuits, Ohm's law
- 1.7. Electric power and energy

Unit 2: Electric Circuit Fundamentals **[6 hrs]**
- 2.1. 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. Electric power and energy

Unit 3: DC Network Theorems and Circuit Analysis **[8 hrs]**
- 3.1. Kirchhoff's current and voltage laws
- 3.2. Thevenin's theorem
- 3.3. Nortorn's theorem
- 3.4. Superposition theorem
- 3.5. Maximum power transfer theorem
- 3.6. Mesh current method of circuit analysis
- 3.7. Node voltage method of circuit analysis

Unit 4: Electrostatics **[10 hrs]**
- 4.1. Laws of electric forces
- 4.2. Electric field, electric fluxes and flux density
- 4.3. Dielectrics and permittivity
- 4.4. Electric potential, potential difference
- 4.5. Capacitors and capacitance
- 4.6. Series and parallel connection of capacitors

4.7. Energy stored in charged capacitor, charging and discharging of capacitor, phasor diagram of current / voltage relationship in capacitor

Unit 5: Electromagnetism and Electromagnetic Induction [8 hrs]

5.1. Definition of magnetic field, magnetic flux, flux density, filed intensity and permeability of magnetic material, domain theory of magnetism
5.2. Magnetic field due to current carrying conductor, force on a current carrying conductor
5.3. Faraday's laws of electromagnetic induction, induced EMF, lenz's law
5.4. Magnetic circuit concept, analogy to electric circuit
5.5. Hysteresis loop for magnetic material, hard and soft magnetic material
5.6. Inductor and inductance
5.7. Energy stored in a current carrying inductor and phasor diagram relationships of current and voltage in inductor

Unit 6: Electrolysis and its Application [4 hrs]

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

1. Verification of Ohm's law
2. Verification of Kirchhoff's current and voltage laws
3. Resistance and resistivity of wire
4. Wheatstone bridge
5. Verification of maximum power transfer theorem
6. Basic application of electromagnets
7. Electromagnetic induction
8. Inductance and capacitance in DC circuits
9. Measurement of internal resistance of batteries
10. 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

Workshop Practice

EG 1112 EE

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

Course description:

This course deals with identification, selection, using of 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:

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

1. Apply the safety rules in the workshop.
2. Identify the tools, measuring instrument, power tools
3. Use hand tools and power tools for the marking, measuring and cutting the metal in shape.
4. Understand foundry process
5. Joining the metal by different process
6. Maintenance and care the measuring instrument, hand tools and power tools
7. Use arc, gas winding equipment, use for gas and heat treatment process.

Course contents:

Theory

Unit 1. Safety rules in the workshop [2 hrs]

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 hrs]

2.1 Layout tools
2.2 Hammer/hammering
2.3: Wrenches
2.4: Work holding device

Unit 3. Cutting tools [2 hrs]

3.1: Chisels
3.2: Hand saw and sawing
3.3: Files and filling
3.4: Scraper and scraping

Unit 4. Measuring instrument [2 hrs]

4.1: 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 hrs]

5.1 Drill machines

- Hand drills machines, bench, gang, colon, and radial drill machine.

Unit 6. Reamer and Thread [2 hrs]

6.1: Reamer and reaming

6.2: Thread and threading

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

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

Unit 8. Rivet and riveting [1 hr]

8.1: Rivets, size, head, metal, riveting sets punches.

Unit 9. Solder and soldering [1 hr]

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

Unit 10. The sheet metal work [2 hrs]

10.1: Hand tool metal
10.2: Marking tools
10.3: Power tools
10.4: Development sheet
10.5: Sheet metal joining
10.6: Safety

Unit 11. Introduction to are welding [3 hrs]

11.1: Introduction to are welding
11.2: Arc column theory
11.3: Power sources for arc welding
11.4: Safety precautions in arc welding
11.5: Arc welding machines: types, uses and care
11.6: Problems in welding machines: troubles, causes and remedies.
11.7: Arc welding machine accessories and operators' accessories.
11.8: Arc welding electrode: classification, application and uses:

Unit 12. Introduction to oxyacetylene (Gas) welding: [3 hrs]

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

Unit 13. Brazing: [3 hrs]

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

Unit 14. Forging [2 hrs]

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

Unit 15. Foundry: [2 hrs]

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.	Practical tasks	Time
1	Marking : straight, curve ,dot	5 hrs
2	Measuring: rules, vernier caliper, gauge	5 hrs
3	Hammering by ball, cross, soft straight pin	5 hrs
4	Sawing by hand saw power	5 hrs
5	Filling with single , double and rasp cut	15 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	8 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
	Total	**90 hrs**

References:

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

Second Semester

Subjects:

EG 1201 SH	Engineering Mathematics II
EG 1202 SH	Engineering Physics II
EG 1203 SH	Engineering Chemistry II
EG1204 ME	Engineering Drawing II
EG 1204 SH	Biology
EG 1206 EE	Electrical Engineering II
EG 1207 CT	Introduction to Computers
EG 1208 EX	Electronics Devices and Circuits I

Engineering Mathematics II

EG 1201 SH

Total: 4 hour /week

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

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

Practical: hours/week

Lab: hours/week

Course description:

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

Course objectives:

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

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

Course Contents:

Unit 1. Vectors: **[5 hrs]**

- 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 hrs]**

- 2.1. Complex number in the from A+ ib.
- 2.2. Algebra of complex numbers.
- 2.3. Polar representation of complex numbers.
- 2.4. De Moivre's theorem and its applications

2.5. Linear inequalities and their graphs.
2.6. System of linear inequalities in two variables,
2.7. System of linear inequalities in two variables,
2.8. Linear programming: Problems involving two variables under given linear constraints
2.9. Determinants and matrices,
2.10 Algebra of matrices,
2.11 Properties of determinants,
2.12. Ad joint and inverse of matrices.
2.13. Solution of linear equations using cramers' rule
2.14. Row equivalent matrices
2.15. Idea of polynomial equations

Unit 3. Calculus: [12 hrs]

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

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

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

Unit 4. Geometry: [4 hrs]

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

Unit 5. Statistics: [9 hrs]

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

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

5.3 Concept of normal curve and normal distribution
5.4. Concept of sampling, estimation and tests of significance

Learning materials:

1. A Text book of Statistics – B.C. Bajracharya
2. Elementary Statistics – H. C. Saxena
3. Statistical Methods – Mrigendralal Singh
4. 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.
5. The related institute may develop its own textbook and approve from the related authority so as to have a prescribed textbook of this subject

Engineering Physics II

EG 1202 SH

Total: 6 hour /week

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

Course description:

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

Course objectives:

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

1. Explain the basic concepts related to the electricity and apply it in the field of the related engineering area
2. Explain the basic concepts related to the waves and apply it in the field of the related engineering area
3. Explain the basic concepts related to the properties of matter and apply it in the field of the related engineering area
4. Explain the basic concepts related to the modern physics and apply it in the field of the related engineering area.

Content Contents:

Theory

Unit 1. Electricity: **[16 hrs]**

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.
- Mechanical measurements:
- Galvanometer.
- Ammeter and voltmeter
- Potentiometer and measurement of emf.
- Whitestone bridge
- Kirchhoff's law and their use to analyze simple circuits.
- Heating effect of current:
- Joules law
- The rate of heating from the concept of p.d.
- Thermoelectricity:
- See-beck effect
- Peltier effect and
- Thomson effect.
- Chemical effect of current:
- Faraday's law of electrolysis.
- Accumulator.

1.3. Magnetic effect of current and electromagnetism:

- Magnetic forces and magnetic field of current:
- Force experienced by charge moving in magnetic field.
- Maxwell's crockscrew rule.
- Force applied by magnetic field on current carrying conductor.
- Torque on current carrying coil in magnetic field.
- Theory of moving coil galvanometer.
- Biot-Savart's Law
  - Field due to a long straight conductor and due to circular coil.
  - Force between two parallel conductors carrying current.
- Ampere’s law
  - Magic field due to the solenoid or toroid 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 hrs]

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.
- Reflection of sound waves.
- Interference of sound waves.
- Diffraction of 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.
- Distraction of light waves.
- Huygen's principle.
- Polarization and un polarized lights, polarization by reflection(Brewster's law)

Unit 3. Properties of matter: [10 hrs]

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 contract.
- 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, Viscous forces at higher relative velocities (qualitative).
- Temperature dependence of the coefficient of viscosity of liquid and gases.

Unit 4. Modern physics: [10 hrs]

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, transistor action and uses of npn transistor

4.3 Nuclear physics:

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

Practical

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.

Text books (For Both Parts I and II):

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

Supplementary text:

1. College Physics by sears, Zemansky and Young, Fourth edition 1985

Text book for laboratory work:

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

Text book for numerical problems:

1. Numerical exercise in physics volume I and volume II -

Prepared by Physics Dept., Pulchowk Campus, and published by Institute of Engineering.

Other learning materials:

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

Engineering Chemistry II

EG 1203 SH

Total: 6 hour /week

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

Course description:

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

Course objectives:

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

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

Course Contents:

Theory

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

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

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

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

1.4 Halogens (Chlorine):

- Lab preparation
- Properties and uses

1.5 Hydrochloric acid:
- Lab preparation
- Properties and uses

1.6 Hydrogen Sulphide:
- Lab preparation
- Properties and uses

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

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

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

2.1 General study of metals and their components:
- 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

2.6 Zinc:
- Properties & uses

2.7 Iron:
- Properties & uses

2.8 Lead:
- Properties & uses

2.9 Alloys:
- Definition
- Purpose of making alloys
- Composition,
- Properties and uses of alloys of steel, aluminum, copper and zinc

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

3.1. Organic compounds
- Organic compounds:
  - Historical background, classification, and nomenclature

- Functional groups and homologous series
- Comparison of aliphatic and aromatic compounds
- Saturated hydrocarbon: Properties of Methane
- Unsaturated hydrocarbon: Properties of Ethylene and Acetylene
- 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

Practical

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

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

References:

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

Engineering Drawing II

EG 1204 ME

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

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

Course objectives:
After the completion of this course, students will be able to:
1. Draw sectional view of the given three dimensional solid,
2. Draw pictorial projections from the given orthographic views,
3. Develop the surfaces of the geometrical solids, and,
4. Draw interpenetration line/curve for the given intersecting solids.

Course Contents:

Unit 1: Sectional Views [8 hrs]
- 1.1 Use of sectional views
- 1.2 Cutting plane line and hatching lines
- 1.3 Types of Section: Full section and Half Section
- 1.4 Exercise on Full Section [Sheet 1]
  Exercise on Half Section [*Sheet 2]*

Unit 2: Pictorial Projection: Isometric Drawing [12 hrs]
- 2.1 Introduction to Axonometric projection
- 2.2 Isometric projection and isometric drawing
- 2.3 Procedure of Making an Isometric Drawing
- 2.4 Non isometric Lines and Non isometric surfaces
- 2.5 Box and coordinate construction method
- 2.6 Angles in isometric
- 2.7 Circles and circular arcs in isometric
- 2.8 Orientation of object in isometric drawing
- 2.9 Exercise on isometric drawing of rectangular objects with horizontal and vertical planes [Sheet 3]
  Exercise on isometric drawing of rectangular objects with inclined planes [Sheet 4]
  Exercise on isometric drawing of objects with cylindrical surfaces and cylindrical holes [*Sheet 5*]

Unit 3: Oblique Drawing [4 hrs]
- 3.1 Oblique projection and Oblique drawing
- 3.2 Procedure of Making an Oblique Drawing
- 3.3 Rules for Placing Object in Oblique
- 3.4 Angles, Circles and Circular Arcs in Oblique

3.5 Cavalier and Cabinet Projection

3.6 Exercise on oblique drawing of objects with plane and curved surfaces [Sheet 6]

Unit 4: Surface Development [16 hrs]

4.1 General concepts and practical considerations

4.2 Development of Right solids: Cylinder, Prism, Cone and Pyramid

4.3 Development of Oblique solids: Cylinder, Prism, Cone and Pyramid

4.4 Development of Truncated solids

4.5 Exercise on development of truncated right prism and cylinder [Sheet 7]
Exercise on development of truncated right pyramid [Sheet 8]
Exercise on development of truncated right cone [Sheet 9]
Exercise on development of oblique solids [Sheet 10]

Unit 5: Intersection of solids [12 hrs]

5.1 Lines of intersection of geometric surfaces

5.2 Intersection of two cylinders

5.3 Intersection of two prisms

5.4 Intersection of a prism and a cylinder

5.5 Intersection of a prism and a pyramid

5.6 Intersection of a prism and a cone

5.7 Intersection of a cylinder and a cone

5.8 Intersection of a cylinder and a pyramid

5.9 Exercise on intersection of two cylinders, intersection of two prisms, intersection of a prism and a cylinder [*Sheet 11*]
Exercise on intersection of a prism and a pyramid, intersection of a prism and a cone [*Sheet 12*]
Exercise on intersection of a cylinder and a cone, intersection of a cylinder and a yramid [Sheet 13]

Unit 6: Pattern Making [8 hrs]

6.1 Pattern of three dimensional solids

6.2 Pattern of geometrical solids

6.3 Pattern of intersecting solids

6.4 Exercise on patterns of any two solid objects from Sheet 1 and 2 [*Sheet 14*]

6.5 Exercise on patterns of any two solid objects from Sheet 7, 8, 9 and 10 [*Sheet 15*]

References:

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

Biology

EG 1204 SH

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

Course description:
This course provides knowledge and skills about the various aspects of biology of animals. This course has a brief introduction of biology and its relationship with other sciences and evolution of animals that are governed by various theories. It covers the various animals that are classified under different phyla as per their characteristics. The various animal tissues, the various systems that are present in the human body which helps us in different ways in our daily life are included in brief along with animal behaviour and nutrition.

***Course objectives*:**
After completion of this course, students will be able to:

1. Understand the evolution of life and the process and theory of evolution of animals.
2. Explain the different categories of animals in different classes as per the hierarchy of their characteristics.
3. Know the various basic systems of the human body and their functions in brief.
4. Learn about various animal behaviours.
5. Know about the human body organization in order to help themselves for further projects related to biomedical field.

Course Contents:

Theory

1.0 Introduction to Biology: (1 hr)

1.1. Nature and Scope of Biology
1.2. Branch and Relation with Other Sciences

2.0 Origin and Evolution of Life: (4 hrs)

2.1. Meaning of Evolution
2.2. Life and its Origin
2.3. A Brief History of Evolutionary Ideas
2.4. Oparin and Haldane's Theory
2.5. Miller and Urey Experiment
2.6. Organic Evolution
2.7. Lamarckism
2.8. Darwinism and concept of Neo-Darwinism
2.9. Human Evolution

3.0 Kingdom Protista: (3 hrs)

3.1. Characteristics and Classification of Phylum Protozoa up to Class with Examples
3.2. Habit and Habitat, Structure, Reproduction and Life Cycle of Paramecium

4.0 Kingdom Animalia: **(5 hrs)**

General Characters and Classification up to Class of (with examples):

- Porifera
- Coelenterata
- Platyhelminthes
- Aschelminthes
- Annelida
- Arthropoda
- Mollusca
- Echinodermata
- chordata

5.0 Animal Tissues: **(4 hrs)**

5.1. Epithelial Tissue
5.2. Connective Tissue
5.3. Muscular Tissue
5.4. Nervous Tissue

6.0 Nutrition: **(2 hrs)**

6.1. Definition of Nutrition
6.2. Nutrition in Man
6.3. The Balanced Diet of Man and its Necessity
6.4. Effects of Various Nutritional Deficiencies and Imbalances

7.0 Digestion: **(3 hrs)**

7.1. Concept of Digestive Organs
7.2. Digestion of Food

8.0 Respiration: **(3 hrs)**

8.1. Respiratory Organs
8.2. Structure of the Lungs
8.3. Mechanism of Respiration

9.0 Circulation: **(2 hrs)**

9.1. Human Heart
9.2. Blood Vessels
9.3. Blood Circulation
9.4. Blood Groups in Human Being

10.0 Urinary System: **(2 hrs)**

10.1. Organs in Urinary System
10.2. Structure of Human Kidney and Nephron
10.3. Process of Urine Formation
10.4. Functions of Kidney

11.0 Nervous Co-ordination: **(3 hrs)**

11.1. Different Types of Nervous System
11.2. Human Brain
11.3. Process of Nerve Impulse Conduction

12.0 Endocrine Glands: **(4 hrs)**

12.1 Difference Between Endocrine and Exocrine Glands

12.2. Pituitary Gland
12.3. Thyroid Gland
12.4. Parathyroid Gland
12.5. Pancreatic Gland
12.6 Adrenal Gland

13.0 Sense Organs: (3 hrs)

13.1. Different Types of Sense Organs
13.2. Location, Structure and Function of Eye
- Common Defects of Eye: Myopia, Hypermetropia, Cataract, Glucoma

13.3. Location, Structure and Function of Ear

14.0 Reproductive System: (4 hrs)

14.1. Reproductive Organs of Male and Female
14.2. Structure and Function of Male and Female Sex Organs
14.3. Associated Glands

15.0. Animal Behaviour (2 hrs)

15.1. Taxes, Reflexes and Reflex Action
15.2. Dominance and Leadership
15.3. Animal Adaption

Laboratory

1. Study of Paramecium.
2. Study of Amoeba.
3. Study of Sycon.
4. Study of Hydra.
5. Study of Liver Fluke.
6. Study of Tapeworm.
7. Study of Ascaris.
8. Study of Leech.
9. Study of Prawn/Crab/Millipede/Butterfly/Spider.
10. Study of Pila/Unio.
11. Study of Star Fish.
12. Study of Fish.
13. Study of Frog.
14. Study of Lizard.
15. Study of Bird.
16. Study of Bat/Rat/Squirrel.

References:

1.0 Keshari Arvind K., Ghimire Khaga Raj, Mishra Bijay Shankar, Adhikari Kamal K., "A Text Book of Higher Secondary Biology." Class XI
2.0 Keshari Arvind K., Adhikari Kamal K., "A Text Book of Higher Secondary Biology." Class XII

Electrical Engineering II

EG 1206 EE

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

Course description:
This course focuses on fundamental concepts of single phase and three phase AC networks, different types of electrical machines and protection schemes.

Course objectives:
After the completion of this course, students will be able to:
1. Identify AC quantities and active and reactive power
2. Understand the basic principles of different types of electrical machines
3. Identify the different protection schemes in the system

Course Contents:

Theory

Unit 1. Single Phase AC Circuit Analysis [10 hrs]
- 1.1 Generation of sinusoidal EMF and its mathematical equations
- 1.2 Definitions of period, frequency, wavelength, phase and phase difference
- 1.3 Instantaneous, peak, average and RMS values
- 1.4 Application of complex number, review of complex number calculation and use of j operator
- 1.5 Phasor representation of AC quantities
- 1.6 Phase relationship in resistance, inductance and capacitance
- 1.7 Reactance of inductance and capacitance
- 1.8 AC excitation for purely resistive, inductive and capacitive circuits
- 1.9 AC excitation for RL, RC and RLC series and parallel circuits
- 1.10 Resonance in RLC series and parallel circuits
- 1.11 Power in AC circuits: active power, reactive power, apparent power, power triangle and power factor

Unit 2. Three Phase AC Circuits Analysis [6 hrs]
- 2.1 Generation of 3-phase sinusoidal voltage, phase sequence
- 2.2 Advantage of 3-phase system
- 2.3 Line and phase quantities (current, voltage)
- 2.4 Star and delta connection of 3-phase source and load.
- 2.5 Power in 3-phase circuits
- 2.6 Transmission and distribution in three phase system

Unit 3. Transformers [5 hrs]
- 3.1 Construction and working principle of transformers
- 3.2 Step up and step down transformers and their uses
- 3.3 Auto transformer and its use
- 3.4 Losses in transformers

Unit 4. DC Machines [6 hrs]
- 4.1 Construction of DC machine
- 4.2 Principle of DC motor action

4.3 Series, shunt and compound motors, their characteristics and application
4.4 Speed control in DC motors
4.5 DC machine working as DC generator

Unit 5. AC Motors/Generators [8 hrs]

5.1 Construction, working principle and characteristics of three phase induction motor
5.2 Induction machine as generator
5.3 Construction, working principle and characteristics of three phase synchronous generators
5.4 Synchronous machine as motor
5.5 Single phase induction motors, capacitor start motor, shaded pole motors, pulse and hysteresis motors

Unit 6. Safety techniques and Protection [6 hrs]

6.1 Safety devices such as fuses, circuit breakers, thermal strips, isolating transformers etc.
6.2 Identification and use of protective devices
6.3 Earthing and its importance
6.4 Earthing material and procedure
6.5 Lightning protection and lightning arrestors

Unit 7. Illumination [4 hrs]

7.1 Importance of illumination
7.2 Luminous flux and intensity
7.3 Simple calculations required for determining light intensity

Practical

1 AC excitation in RL and RC circuits
2 Use of oscilloscope to measure AC quantities such as peak value, RMS value, frequency, time period etc.
3 Active and Reactive and apparent power measurements in RLC circuits
4 RLC series resonance circuits
5 Phase and line quantity measurements in 3 phase star/delta circuits
6 Step-up and step down transformers.
7 DC motors characteristics
8 Speed control of DC motors
9 Induction motors characteristics
10 Earthing and earth resistance measurement

References:

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

Introduction to Computers

EG 1207 CT

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

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

Course objectives:
After the completion of this course, students will be able to:
1. Understand the basic architecture of Computer.
2. Understands the different Operating Systems
3. Use the different Software applications.
4. Install and use the different peripheral devices
5. Understand and use Network and Internet.

Course Contents:

Theory

Unit 1. Fundamentals **[4 hrs]**

1.1 Evolution of Computer
1.2 Classification
- Operation
  - Analog and Digital
- Uses of Computer
  - General purpose
  - Specific purpose
- Capacity
  - Main Frame computer
  - Mini computer
  - Personal computer
  - Super computer
  - Notebook /laptop / palm top / PDA

Unit 2. Basic Architecture **[10 hrs]**

2.1 Building blocks of a PC
- Block diagram - Input /Output, processor, memory and bus
- Central Processing Unit
  - 286, 386 and 486 processors
  - Pentium, Pentium II, Pentium III, Pentium IV, Core 2 Duo
  - Data lines, address lines and registers
- Memory devices
- Input/Output devices
  - Command Oriented control and text input by keyboard

- Action oriented control and graphical input by mouse
- Visual output on monitor

- The storage devices
  - Floppy Disk
  - Hard disk
  - Volatile and Non Volatile
  - Performance
  - Concepts of heads, cylinders, sectors
  - Installation Guidelines

Unit 3. Operating System [5 hrs]

3.1 Definition and Classification

3.2 Functions of OS

- Command Interpretation
- Resource allocation and management
- Services

3.3 DOS, Windows, Mac OS, Unix, Linux, and OS/2

Unit 4. Programming Languages, Interpreters and Compilers [3 hrs]

4.1 Basic ideas of Programming Languages

4.2 Assembler

4.3 Interpreter

4.4 Compiler A.J. Linker

Unit 5. Software Applications [5 hrs]

5.1 Word Processor

- Features in different word processing packages
- Formatting documents
- Uses

5.2 Spreadsheet

- Features in different Spreadsheet packages
- Formatting documents, graphs and charts
- Uses

5.3 Database

- Features in different database packages
- Tables and fields
- Uses

5.4 Graphics

- Features in different graphics, page layouts
- Image editing
- File extensions
- Uses

5.5 Features in different Engineering Software Packages

Unit 6. Peripherals and Accessories [8 hrs]

6.1 Printers

- Different printing technologies
- Comparison in terms of quality, cost and performance
- Printer Sharing in Network Environment
- Installation guidelines

6.2 Scanner

- Different types of scanners available
- Installation Guidelines

6.3 Mouse
- Mechanical and Optical Mouse

6.4 CD-R/W/Optical Drive/Tape Drive
- Operating principles
- Concepts of Backup

Unit 7. Network and Internet [7 hrs]

7.1 Brief Introduction of LAN, MAN, WAN
7.2 Topologies: Bus, Ring and Star
7.3 Hub
7.4 Switch
7.5 Modem
7.6 Network Cabling
7.7 NIC
7.8 Network OS
7.9 Internet
- ISP
- E-mail
- WWW
- Search Engines
- Statistical Information of Internet

Unit 8. Computer Applications [3 hrs]

8.1 Applications in different fields
8.2 Future Developments

Practical

1. Identification of hardware components
2. Assembling a computer
3. Physical Installation Procedures
   - 3.1. Memory Module Physical Installation Procedure
   - 3.2. Motherboard Physical Installation Procedure
   - 3.3. Hard Disk Drive Physical Installation Procedure
   - 3.4. CD-ROM Drive Physical Installation Procedure
   - 3.5. Processor Physical Installation Procedure
   - 3.6. Heat Connector Physical Installation Procedure
   - 3.7. PS/2 Mouse Port Connector Physical Installation Procedure
   - 3.8 Video Card Physical Installation Procedure
4. Safety precaution concept
5. Management of Hard disk (partitioning / formatting)
6. Installation of application programs
7. Installation of utilities programs
8. Application on
   - 8.1. Word processing
   - 8.2. Spreadsheets
   - 8.3. Presentation tools
   - 8.4. Prepare presentation of class work
9. Installation of OS and drivers
10. Introduction and Installation of network interface card and various network devices like hub, switch, router etc.
11. Network Cabling

References:

1. Winn Rosch, " Harware Bible"
2. Noel Kalicharan, " Introduction to computer Studies" , Cambridge Low Price Edition
3. P.K Sinha, " Computer Fundamentals"
4. Rajaraman V.**,** "Fundamentals Of Computers" , PHI

Electronic Devices and Circuits I

EG 1208 EX

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

Course description:

This course deals with various types of electronic devices and circuits required for the electronic works.

Course objectives:

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

1 Differentiate between passive and active devices, understand their characteristics.
2 Identify basic types of vacuum tuber their characteristics and applications.
3 Identify and explain the working principles of various semiconductor devices, relate their characteristics and applications.
4 Explain the characteristics of CB, CE and CC configuration circuits.

Course Contents:

Theory

Unit 1. Basic Passive Devices: R, C and L [3 hrs]

1.1. Construction, types, color coding and characteristics.

Unit 2. Introduction to electron vacuum tubes: Diode, Triode and Pentode [3 hrs]

Unit 3. Semiconductor Devices (Especially Si Devices): [6 hrs]

Energy levels, valence and conduction bands, conduction of electrons and holes in solids.

Intrinsic and extrinsic semiconductor devices (Si), impurities, doping, majority and minor charge carries in P – type and N – type materials. Definition is characteristic.

Diffusion and drift currents – definition and characteristics.

PN Junction and depletion layer and potential barrier – definition and characteristics.

Forward and reverse biasing of PN junction diode – IV characteristics, principles of operation, and effects of temperature and junction capacitance.

Forward and reverse breakdown of PN junction diode – Zener and avalanche effects – Principles of operation and IV characteristics.

Electrical analysis of PN junction diode with IV characteristics and mathematical expressions with equivalent model circuit diagrams.

Unit 4. Power Supplies - [4 hrs]

4.1. Basic rectifying circuits – Types, working principles, characteristics and applications.
4.2. Analysis of simple DC voltage power supplies – Principles, characteristics and ripple (voltages) factors.
4.3. Simple voltage regulation using Zener diodes – Principles, circuits, characteristics and application.

Unit 5. Pripolar Junction Transistors (npn and pnp) – Types, construction, working principle as an amplifier and characteristics. [10 hrs]

5.1. Classification of amplifiers: CB, CE and CC amplifier circuits – Working principles, basic circuits to investigate input and output IV characteristics and their results.

5.2. Other characteristics of BJT – Saturation and cutoff modes: Definition, circuits, principles and characteristics.

5.3. Types of amplifier circuits: Class A, class B and class C – Definition characteristics and applications.

5.4. Specifications and data book.

Unit 6. Field Effect Transistor (JFET and MOSFETS) – Types, construction, working principles as an amplifier and characteristics. [10 hrs]

6.1. Basic circuits for investigating input and output IV characteristics – Working principles, characteristics and applications.

6.2. Saturation, cut off breakdown and ohmic regions of operation – Investigation of IV characteristics curves.

6.3. Specifications and data book.

Unit 7. Special Semiconductor Devices – Working principles, functional circuits, characteristics and applications.` [9 hrs]

7.1. UJT, PUT, SCR, Diar and Triac.

7.2. Photo voltaic effects and solar cells.

7.3. Photodiode, phototransistor, LED, LDR, optocouplers and isolators.

7.4. Tunnel diode, schottyky diode, GaAs Transistors, MESFET.

7.5. Charge coupled devices, Hall effects, solid state relay ad thermister.

Practical

1. Diode characteristics – PHJ diode and Zener diode.
2. BJT characteristics – C.E. input and output characteristics.
3. FET characteristics – C.S. input and output characteristics.
4. HW and FW rectifier – waveforms and characteristics.
5. UJT characteristics – IV characteristics.
6. PUT characteristics – IV characteristics.
7. SCR characteristics – IV characteristics.
8. Tunnel diode characteristics – IV characteristics.
9. Photo diode characteristics – IV characteristics.

References:

1. Electronic Devices and circuits – David A Bell
2. Electronic Devices and circuits – TF Bogart
3. Electronic Devices and circuits – JB Gupta
4. Electronic Devices and circuits – DC kulshrestha
5. Electronic Devices and circuits –
6. Basic Electronic Solid state – B.L. Theraja
7. Electronic Principles – Sanjaya Sharma
8. Electronic Devices - Thomsa L. Floyd
9. Principles of Electronics – Albert Paul Malvino
10. Electronics Vol 1-7 - Harry Mileaf
11. Basic Radio Vol 1-6 - Marvin Tepper

Second Year
(Third and Fourth Semesters)

Third Semester

Subjects:

EG 2101 EX	Logic Circuits
EG 2102 EX	Electronic Devices & Circuits II
EG 2103 EX	Electronics Drawing
EG 2104 SH	Engineering Mathematics III
EG 2105 SH	Human Anatomy and Physiology
EG 2106 EE	Electrical Measurements
EG 2107 CT	Computer Programming

Logic Circuits

EG 2101 EX

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

Course description:

This course is specially designed for the students of diploma level who have completed either SLC of equivalent SLC (technical SLC). This course is focused to study, design and applicable by devices/ equipment that are based on digital techniques.

Course objectives:

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

1. Learn design methods for combinational logic circuit,
2. Verify truth tables of basic gates universal gates
3. learn design concert of sequential logic circuits
4. Design problem based / predefined logic based circuits
5.

Course Contents:

Theory

Unit 1. Introduction [2 hrs]

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

Unit 2. Number Systems and Codes [4 hrs]

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

Unit 3. Arithmetic Logic Operations [8 hrs]

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

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

- 10's Complement Subtraction

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

Unit 4. Logic Gates [8 hrs]

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

Unit 5. Boolean Functions and Logic Simplification [9 hrs]

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

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

Unit 6. Combinational Logic Circuits [9 hrs]

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

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

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

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

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

- 8-to-1 Multiplexer
- Multiplexer IC Packages

6.6 Demultiplexers

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

Unit 7. Sequential Logic Circuits [11 hrs]

7.1 Latch and Flip-Flops

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

7.2 Shift-Registers

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

7.3 Counters

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

Unit 8. Digital Displays [3 hrs]

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

Practical

1. Experiments on logic operation and verify with truth tables of basic gates: AND, OR, NOT, NAND, NOR
2. Verify the universal properties of the NAND gate and NOR gate.
3. Experiments on logic operation and verify with truth tables of basic gates: XOR, XNOR Gates.
4. Building logic circuits from logic equations
5. Realize the pulse operation in different logic gates
6. Realize and verify truth tables applying DeMorgan's Theorems
7. Realize and verify truth tables of binary half adder/Subtractor and full adder/Subtractor
8. Realizing the function of decimal to 3-4 bit binary binary encoder
9. Realizing the function of 4 bit binary binary decoder
10. Realizing the function of 4-to-1 multiplexer and 1-to-4 demultiplexer circuits.

11. Realizing the function of latches and flip-flops, RS,D,JK,T flip-flops
12. Realizing the function shift-registers: SISO,SIPO,PISO and PIPO
13. Realizing the function ripple counters
14. Realizing the function synchronous counters
15. Realizing and designing of seven-segment display-decoder logic circuit

References:

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

Electronic Devices and Circuits II

EG 2102 EX

Total: 8 hours/week
Year: II **Lecture: 4 hours/week**
Semester: I **Tutorial: 1 hours/week**
Practical: 3 hours/week
Lab : hours/week

Course description:

This course deals with various electronic devices and circuits, mainly with, DC biasing, Definition and types Hybrid parameters of BJT/FET Analysis of small signal amplifier circuits Analysis of large signal amplifiers Switching circuits Tuned amplifier Oscillator Filters Electronic Power Supplies

Course objectives:

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

1 Explain operation and function of BJT and FET as large and small signal amplifiers with applications.
2 Make simple power supplies and amplifiers and test related circuits.
3 Explain operation and function of various types of oscillators and tuned amplifiers and their applications.

Course Contents:

Theory

Unit 1. DC biasing: Definition and types [6 hrs]

1.1. Fixed, emitter feedback DC biasing – Principles, circuits and characteristics.
1.2. Collector feedback and – independent type DC biasing – Principles, circuits, characteristics and advantages.
1.3. Stabilization of temperature, power supply, leakage current and – spreading effects in amplifier – principles and characteristics.

Unit 2. Hybrid parameters of BJT/FET – Definition, principles circuits and characteristics Feedback System – [8 hrs]

2.1. General, negative and positive feedbacks – Principles, circuits, characteristics and applications.
2.2. Negative feedback system – Types, functional circuits, principles, characteristics and applications.
2.3. Effects of negative feedback on bandwidth, gain, distortion and noise, frequency response etc.
2.4. Practical circuits applied to audio amplifiers – Circuits working principles, characteristics.

Unit 3. Analysis of small signal amplifier circuits – Circuits, analysis and characteristics e.g. gain, Ri, Rout, etc. [4 hrs]

3.1. CB, CE and CC BJT amplifiers
3.2. CS, CG and CD FET amplifiers

Unit 4. Analysis of large signal amplifiers – Circuits, characteristics and applications [8 hrs]

4.1. Class A and class B power amplifiers – Efficiencies and characteristics.
4.2. Class B push - pull and complementary symmetry circuits – Principles, characteristics. E.g. elimination of crossover distortion.

4.3. Power audio amplifiers – Functional circuits, working principles, technical specifications and applications.

Unit 5. Switching circuits – Definition, working principles, characteristics and applications. [6 hrs]

5.1. BJT a switching device
5.2. FET as switching device
5.3. TTL – NOT, NAND and NOR gates
5.4. CMOS and NMOS – NOT, NAND and NOR gates.

Unit 6. Tuned amplifier – Working principles, characteristics and application. [4 hrs]

6.1. Parallel tuned class A and class C amplifiers – Basic circuits, working principles, characteristics (□ □, B and Q – values) and applications.

Unit 7. Oscillator – Principles, characteristics and applications [8 hrs]

7.1. LC – Oscillators – Hartley, Colpitt's, Clapp.
7.2. RC – Oscillators – Phase shift and wienbridge.
7.3. Piezoelectric and ceramic oscillators.
7.4. Amplitude and frequency stability in oscillators – Basic principles and characteristics.

Unit 8. Filters – Basic principles and characteristics and applications. [4 hrs]

8.1. Low Pass Filter – LPF
8.2. High Pass Filter – HPF
8.3. Band - pass Filter – BPF
8.4. Crystal and ceramic filters

Unit 9. Electronic Power Supplies [12 hrs]

9.1. Series DC voltage regulator – functional and working circuits, principles and characteristics.
9.2. Voltage multipliers – Working principles, circuits, characteristics and application.
9.3. Introduction to SMPS – Functional block diagram, working principle characteristics and applications.
9.4. Introduction to DC to DC and DC to AC converters – working principles characteristics and applications.
9.5. IC DC voltage regulators – functional working circuits, characteristics and applications.
- 78XX, 79XX – Fixed IC voltage regulators.
- LM317 and LM337 – Variable IC voltage regulators.

9.6. Overload protection in DCV regulator circuits – Working principles characteristics and applications.

Practical

1 RC coupled amplifier and its frequency response.
2 Effects of negative feedback in AF amplifiers – Gain stability, frequency response, distortion and noise.
3 Class A and class B power amplifiers – Efficiency and distortion (Crossover distortion)
4 LC and RC sine - wave oscillators.
5 LP, BP and HF filter circuits – Cutoff points and frequency response.
6 Class A tuned amplifier – Resonant frequency and bandwidth.
7 Series DC regulated power supply – Voltage regulation factor and current limiting.

References:

1. Electronic Devices and circuits – David A Bell
2. Electronic Devices and circuits - TF Bogart
3. Electronic Devices and circuits - JB Gupta
4. Electronic Devices and circuits - DC kulshrestha
5. Basic Electronic Solid state - B.L. Theraja
6. Electronic Principles - Sanjaya Sharma
7. Electronic Devices - Thomsa L. Floyd
8. Principles of Electronics - Albert Paul Malvino
9. Electronics Vol 1-7 - Harry Mileaf
10. Basic Radio Vol 1-6 - Marvin Tepper

Electronics Drawing

EG 2103 EX

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

Course objectives:
After the completion of this course, students will be able to:
1. Draw basic electronic symbols (standard / freehand)
2. Draw standard block diagrams.
3. Draw circuit diagram.
4. Interpret the circuit diagrams and block diagrams.

Course Contents:

Unit 1. Basic symbols used in electrical and electronics circuits diagrams : [2 hrs]
- 1.1 Fuses, relays, switches, circuit-breakers, motors, generators, transformers, earthings, lamps, tubelites etc.

Unit 2. Basic symbols used in electronic circuits : [2 hrs]
- 2.1 Active components as semiconductor devices transistors PNP/NPN, diodes, SCR, MOSFET, CMOS, JFET, FET, thyristers.
- 2.2 Digital electronic devices such as gates(AND,OR,NOT, NAND, NOR, XOR, XNOR, Flip-Flpos)

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

Unit 4. Layout and schematic drawing of simple electric circuits [2 hrs]
- Light point with one way and two way switches and sockets.
- Two light points with one and two way switches and sockets.

Unit 5. Drawing of simple power supplies. [6 hrs]
- Domestic adopter and its circuits diagram.
- Half wave rectification circuit.
- Full wave rectification circuit.
- Centered tap type.
- Bridge type.
- Three-phase rectification circuit.
- Block diagram of SMPS power supply.

Unit 6. Circuit diagram of simple measuring instruments. [10 hrs]
- 6.1 Multirange voltmeter
- 6.2 Multirange ammeter
- 6.3 Multirange ohmmeter
- 6.4 Conversion of ganvanometer to
  - Voltmeter
  - Ammter

Unit 7. Simple circuit diagram of telephone instruments. [3 hrs]

Unit 8. Block diagram of audio equipments. [7 hrs]

8.1 Audio amplifier using semiconductors.
8.2 MW/SW/FM Radio.
8.3 Cassette player / recorder

Unit 9. Block diagram and circuit diagram of monochrome television receiver. [4 hrs]

Unit 10. Block diagram of a computer monitor. [4 hrs]

Unit 11. Block diagram of basic computer (Input-process-output.) [3 hrs)

Engineering Mathematic III

EG 2104 SH

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

Course description:
This subject consists of five units related to analytical solid geometry, partial differential equations, infinite series, Fourier series, and Fourier integral necessary to develop mathematical background helpful for the understanding and practicing diploma in electronics and information technology engineering.

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

Course Contents:

Unit 1. Analytical Solid Geometry [7 hrs]
- 1.1 Curves in space,
- 1.2 Tangent line, and tangent plane,
- 1.3 Ellipsoid, hyperboloids, and paraboloids,
- 1.4 Projection of areas.

Unit 2. Partial Differential Equations [11 hrs]
- 2.1 Review of Ordinary Differential Equations,
- 2.2 Analysis of P.D.E of 1^{st} and 2^{nd} order,
- 2.3 Linear equations of the 1^{st} order and the general solutions,
- 2.4 P.D.E of 2^{nd} order, its derivation and basic concepts,
- 2.5 Solution of general P.D.E with constant coefficients, complimentary solution and integral solution,
- 2.6 Wave equations

Unit 3. Infinite Series [10 hrs]
- 3.1 Definitions of sequence and infinite series,
- 3.2 Condition for convergence of an infinite series,
- 3.3 Test of convergence, alternating series test,
- 3.4 Power series and its interval of convergence,
- 3.5 Expansion of functions using Taylor's and Maclaurin's theorems.

Unit 4. Fourier Series [8 hrs]
- 4.1 Periodic function,
- 4.2 Trigonometric series,
- 4.3 Fourier series of the functions of period 2p,
- 4.4 Euler's formula,
- 4.5 Fourier series of a function having arbitrary period,
- 4.6 Even and odd functions and their Fourier series,
- 4.7 Half range functions.

Unit 5. The Fourier Integral [9 hrs]

5.1 Fourier integral and inversion formula,

5.2 Frequency and phase spectra,

5.3 Fourier analysis of step and delta function.

References:

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

Human Anatomy and Physiology

EG 2105 SH

Total: 7 hours/week
Year: II **Lecture: 4 hours/week**
Semester: I **Tutorial: 0 hours/week**
Lab: 3 hours/week

Course description:
This course is designed to provide knowledge of Human Anatomy & Physiology required for Biomedical Field. This provides knowledge about the cells, the chemical composition of cells, the buildup of human body from cellular to organ-system level. It includes the various systems of biological environment that are continuously interacting with each other and regulating their functions to an optimized level. This course covers all the anatomical and physiological descriptions of the human body.

Course objectives:
After the completion of this course, students will be able to:
1. Understand the organization of the human body.
2. Describe the various types of systems governing the human body.
3. Explain about the anatomy of various organs and systems.
4. Understand the physiology or the functions of different organs and systems.

Course Contents:

Theory

1.0 Introduction to Human Body: (1 hr)
- 1.1 Body design at structure-function level
- 1.2 Disease mechanism

2.0 Introduction to the Chemistry of Life: Atoms, Molecules & Compounds. Biological, Molecules & Body Fluids: (2 hrs)
- 2.0 Ionic structures of different atoms, biological molecules in relation to body building
- 2.1 Outline: salt-water balance of body
- 2.2 pH mechanism of body fluids. Acidosis & Alkalosis
- 2.3 Body fluids & their control

3.0 The Cells, Tissues & Organization of the Body: (5 hrs)
- 3.1 Structure & function of different types of cells & tissues
- 3.2. Tissue repair & regeneration

4.0 The Skin. Structure, Function & Disorder of Skin: (3 hrs)
- 4.1. Microscopic anatomy of skin
- 4.2. Functional roles of skin
- 4.3. Skin diseases
- 4.4. Mechanism of wound repair

5.0. The Skeleton, Axial Skeleton & Appendicular Skeleton Bones: (6 hrs)
- 5.1 Outline: Human Skeleton axial & appendicular views

5.2 Study of different bone types
5.3 Bone components & histology of bone
5.4 Learning of bone development or ossification of bone
5.5 Bone function
5.6 Anatomy of major skull bones
5.7 Structure, arrangement & function of vertebral, thoracic limb & pelvic bone

6.0. The joint. Types of Joints: (2 hrs)

6.1 Basic structure of joints
6.2 Differentiate the types of joints, fibrous, fixed & in relation to their movement

7.0. The Muscular System: (2 hrs)

7.1. Introduction to different types of muscle
7.2 Outline of muscle functions

8.0. The Special Senses. Hearing & Balance of Ear, Sight & Eye: (6 hrs)

8.1. Structural details of human ear- external ear, middle ear & internal ear
8.2. Outline the functions of ear
8.3. Hearing & balancing functions of the ear
8.4. Brief introduction to diseases of ear
8.5. Structural details of Human eye
8.6. Function details of eye
8.7. Eyesight physiology

9.0 Blood Component. Haemostasis & Thrombosis. Disorders of Blood Coagulation (3 hrs)

9.7. Blood components.
9.8. Revision of blood functions
9.9. Learning of haemostatic mechanisms
9.10. Effect of thrombus formation on blood vessels
9.11. Review of blood coagulation & disorders

10.0 The Cardiovascular System. Blood Vessels, Blood Pressure, Pulse & Circulation of The Blood: (6 hrs)

10.1. Anatomy of heart & blood vessels.
10.2. Blood supply of heart or coronary circulation
10.3. Blood circulation from different organs to the heart & from the heart to different organs
10.4. Outline the heart functions
10.5. Cardiac cycle, cardiac output & blood pressure
10.6. Learning of conduction system of heart
10.7. Brief understanding of heart diseases
10.8. Study of the disorders of blood vessels

11.0. The Respiratory System, Nose, Nasal Cavity, Pharynx, Larynx, Trachea, Bronchi, Lungs and Respiration: (5 hrs)

11.1. Anatomy-physiological relationship of upper respiratory tract
11.2. Structure & functions of Bronchial tree
11.3. Lungs & its topography. Pleura & pleural cavity
11.4. Learning of lung functions
11.5. Mechanism of breathing, types of breathing & control of respiration
11.6. Ventilation & Lung volumes
11.7. Gas transfer & diffusion

12.0. The Digestive System, Oral Cavity. Digestion, Absorption & Metabolism: (6 hours)

12.1. Structure of oral cavity & underlying glands
12.2. Teeth systems, functions & abnormalities of teeth
12.3. Structure of alimentary system
12.4. Functions of stomach, intestine & role of smooth muscle of gut
12.5. Digestion, secretion & absorption capacity of gut
12.6. Structure-function relationship of liver, billiary tract & gall bladder
12.7. Pancreas & its functions

13.0. The Urinary System. Kidney, Ureters, Urinary Bladder, Urethra: (2 hours)

13.1. Topography of Kidneys
13.2. Structure-function relationship of ureter, bladder & urethra
13.3. Control of bladder function

14.0. The Endocrine System. Pituitary, Thyroid, Adrenal, Pancreas, Thymus Gland: (6 hrs)

14.1. Structures-function relationship of Hypothalamus & Pituitary gland
14.2. Thyroid gland & its role in metabolic & electrolyte control of body
14.3. Parathyroid gland & its role in body function
14.4. Pancreas as an Endocrine organ
14.5. Structure of Adrenal glands & their control in the body
14.6. Introduction to Thymus gland

15.0. Reproductive System. Male & Female Reproductive Organs: (5 hrs)

15.1. Structure of female reproductive tract
15.2. Structure-function relationship of Vagina, Uterus and Fallopian Tubes
15.3. Outline the anatomy of ovaries and its functions
15.4. Learning of breast structure and functions
15.5. Structure of male reproductive tract
15.6. Glandular function of male reproductive system
15.7. Prostate gland and its function

Laboratory

1. Study of Systematic relationship of human body
2. Study of structures of Skeletal, cardiac, & smooth muscle cells
3. Study of structures of sense organs
4. Study of Systematic relationship of heart and Cardiovascular System, ECG
5. Study of Systematic relationship of respiratory system, Spirometry
6. Study of Systematic relationship of digestive system
7. Study of Systematic relationship of urinary system
8. Study of Systematic relationship of endocrine system
9. Study of Systematic relationship of reproductive system

References:

1. Anatomy & Physiology in Health & Illness –Anne Waugh & Allison Grant, Ninth Edition
2. Textbook of Physiology, C. Guyton, 6th Edition
3. Atlas of Anatomy, Anne MR Agur, Ninth Edition

Electrical Measurements

EG 2106 EE

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

Course description:
This course deals with the basic fundamentals of measurements. Students will understand and basic principles of various electrical instruments.

Course objectives:
After the completion of this course, students will be able to:
1. Select the importance of measurement in electronic engineering
2. Apply SI units
3. Identify types of electrical measurements & explain their working principle

Course Contents:

Unit 1. Introduction to electrical Measurements [8 hrs]

1.1 Measurement & measurement system
- Measurements
- Measurement terms
- Instrumentation system

1.2 System of international units(SI) & symbols

1.3 Electrical instruments
- Types
- Schematic symbols
- Basic characterstics
- Application

1.4 Extension of Instrument range
- Ammeter shunts
- Construction of shunts
- Voltmeter Multiplier

Unit 2. Galvanometers, Ammeters & Voltmeters [9 hrs]

2.1. Galvanometers
- Galvanometer damping mechanism
- Galvanometer constant
- Galvanometer selection
- Galvanometer shunts
- Vibration Galvanometer
- Ballistic Galvanometer

2.1. Ammeters & Voltmeters
- Types of instruments
- Moving iron instruments
- Moving coil instruments
- Permanent Magnet moving coil (PMMC Instruments)
- Dynamometer type instruments
- Thermal instruments

- Hot wire instruments
- Thermo – couple instruments
- Rectifier type instruments
- Induction type instruments

Unit 3. Measurements of Resistance [7 hrs]

3.1. Classification
3.2. Measurement of low resistance
3.3. Measurement of medium resistance
3.4. Measurement of hig resistance
3.5. Ohm Meters
3.6. AVO meter
3.7. Megger

Unit 4. Measurement of Power [6 hrs]

4.1 Measurement of power using voltmeter & ammeter
4.2 Wattmeter (dynamo type)
- Operation & application

Energy meter (Kwh meter)
- Operation & application

References:

1. J.B .Gupta "A Course in Electronics & Electrical Measurement & Instrument"
2. A.K.Sawhney " A Course in Electrical & Electronics measurement &instrumentation", Dhanpati Rai & Co.(pvt) Ltd

Computer Programming

EG 2107 CT

Total: 6 hour /week

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

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

Lab: 3 hours/week

Course description:

This course deals with the fundamentals of Computer Programming. The students will learn the effective use of the C programming language syntax to develop special programs, and provide I/O control for special applications.

Course objectives:

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

1. Know the basic skills needed in programming
2. Be able to write, compile, debug and run a program in C
3. Understand the uses of all data types in C
4. Understand the use of functions and write functions in C
5. Use different control structures
6. Use Arrays, Strings and Pointers in their programs
7. Use input/output statements in a program.
8. Read/write/search in a file through a C program.

Course Contents:

Theory

Unit 1. Introduction to Computer Program [3 hrs]

- 1.1 What is a program?
- 1.2 What is a programming language?
- 1.3 Steps in Programming
- 1.4 Fundamentals of a Programming Language
- 1.5 Different Programming Techniques
  - Procedural Programming
  - Modular Programming
  - Object Oriented Programming

Unit 2. Problem Solving Using Computer [2 hrs]

- 2.1 Problem Analysis
- 2.2 Algorithm Development and Flowcharts
- 2.3 Coding
- 2.4 Compilation and Execution
- 2.5 Debugging and Testing
- 2.6 Program Documentation

Unit 3. Introduction to C [5 hrs]

- 3.1 Words and Sentences in C language
- 3.2 Alphabets in C
- 3.3 Keywords in C
- 3.4 Rules of forming Words in C language
- 3.5 Data Variables, Data Types and Rules for naming and declaring data variables
- 3.6 Constants
- 3.7 Comments in C
- 3.8 Enumerated Data Types

3.9 Arithmetic Expressions
3.10 Concepts of Header files and Preprocessors

Unit 4. Input and Output [3 hrs]

4.1 Formatted I/O
4.2 Character I/O
4.3 Programming Using I/O

Unit 5. Flow Control Instructions [4 hrs]

5.1 Decision Control Instructions
- If
- If-else
- If-else-if
- Nested if-else
- Conditions

5.2 Loop Control Instructions
- For Loop
- While Loop
- Do While

5.3 Selection Instructions

Unit 6. Functions [5 hrs]

6.1 Why use Functions?
6.2 Components of Function
- Name of a function
- Body of a function
- Local variables of a function
- Parameters or Arguments to a function
- Return Values
- Prototype of a function

6.3 Rules of using a function

Unit 7. Array [4 hrs]

7.1 What is an array?
7.2 Array Declaration
7.3 Array Initialization
7.4 Accessing individual elements of an array
7.5 Two Dimensional Arrays
7.6 Accessing the elements of a two dimensional array
7.7 Passing an array element to a function
7.8 Rules of using an array

Unit 8. Pointers [5 hrs]

8.1 What is a pointer?
8.2 Declaring a Pointer variable
8.3 Initializing a pointer variable
8.4 Using a Pointer Variable
8.5 Pointer Arithmetic
8.6 Why use pointers
- As function arguments (By reference)
- Pointers and array
- Passing an entire array to a function
- Functions returning a Pointer Variable

Unit 9. Strings [4 hrs]

9.1 What are strings?

9.2 String I/O
9.3 String Manipulation Functions

Unit 10. Structures [4 hrs]

10.1 Declaring and Accessing Structure
10.2 Variables Uses of Structures

Unit 11. Filing [4 hrs]

11.1 File Pointer
11.2 Opening a File
11.3 Closing a File
11.4 Seeking in a file

Unit 12. Some Examples of Different systems Applications [2 hrs]

12.1 Various Applications of computer Program
- Applications in Banking
- Library Management System
- Graphics/Gaming

Practical

1. Familiar with Turbo C
2. Input/Output statement
3. Control Statement
   - 3.1. Familiar with if statement
   - 3.2. Familiar with if else, and if else ladder statement
   - 3.3. Familiar with switch, continue, and break statement
   - 3.4. Familiar with while loop
   - 3.5. Familiar with do while loop
   - 3.6. Familiar with for loop
   - 3.7. Familiar with nested loop
4. Familiar with function
5. Arrays & String
   - 5.1. Familiar with Arrays
   - 5.2. Familiar with Strings
6. Structures
   - 6.1. Familiar with Structures
7. Data files
   - 7.1. Familiar with Data files
8. Project

References:

1 Brian W. Keringhan and Dennis M. Ritchie, " The C Programming Language" PHI
2 V. Rajaraman, " Computer Programming in C " PHI
3 Byron S. Gottfried, " Programming with C " McGraw Hill
4 Stephen G. Kochan " Programming in C ", CBS Publishers and distributors
5 Kelly and Pohl, "A book on C " , Benjamin/Cummings

Fourth Semester

Subjects:

EG 2201ME	Basic Mechanics
EG 2202 EX	Electronic Devices and Circuits III
EG 2203 EX	Introduction to Microprocessors
EG 2204 EX	Electronic Instruments & Measurements
EG 2205 EX	Instrumentation & Control
EG 2206 SH	Social Studies
EG 2201 BM	Medical Electronics I
EG 2202 BM	Bio Engineering Materials and Devices

Basic Mechanics

(EG 2201 ME)

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

Course description:
This course is designed to provide the students the knowledge on theoretical and applied field of mechanics as well as introduce the concepts of thermodynamics and heat transfer.

Course objectives:

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

1. Understand the concepts of mechanics and its application to particles, body and fluids.
2. Apply mechanics to study the properties of materials.
3. Get an idea about thermodynamics and heat transfer.

Course Contents:

1. Applied Mechanics [12 hrs]

1.1 Introduction
1.2 Concept of a particle, Rigid body, Principles of forces, Free body diagram, Equilibrium in two dimension
1.3 Distributed forces, Centre of gravity, Centroid of lines, areas and volumes
1.4 Friction and Laws of Friction
1.5 Rectilinear and curvilinear motion of particles; Position, Velocity and acceleration
1.6 Introduction to Kinetics

2. Mechanics of Materials [12 hrs]

2.1 Stress, Strain, Stress-Strain diagram
2.2 Principal Stresses
2.3 Torsion
2.4 Bending of beams, Shearing force, Bending moment, Shearing force and bending moment diagrams

3. Fluid Mechanics [12 hrs]

3.1 Introduction: Definition & Basic Concepts, Fluid classification & properties
3.2 Fluid Pressure & Forces: Pressure at a point in fluid, equation of fluid statics, Pascal's Law, Center of Pressure
3.3 Buoyancy & Floatation: Archimedes principle, Principle of floatation, Meta center, Conditions of equilibrium
3.4 Basics of Fluid Dynamics

4. Introductions to Thermodynamics [9 hrs]

4.1 Introduction, System, Substances & Properties
4.2 First Law of Thermodynamics
4.3 Second Law of Thermodynamics
4.4 Modes of Heat Transfer: Conduction, convection and Radiation

References:

1. Beer F.P & Johnston ER, Vector Mechanics for Engineers
2. Beer F.P & Johnston ER, Mechanics of Materials
3. R.S. Khurmi, Engineering Mechanics
4. R.K. Bansal, Fluid Mechanics
5. P.K. Nag, Engineering Thermodynamics

Electronic Devices and Circuits III

EG 2202 EX

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

Course description:

This course deals with various types of electronic circuits, mainly in IC: Fabrication Technology Operational Amplifiers Components of Practical Opamp Practical opamp circuits Special semiconductor devices and applications Pulse Techniques Pulse waveform generators Noise Introduction to optical electronics

Course objectives:

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

1 Understand basic features of IC devices.
2 Differentiate between IC and discrete devices.
3 Understand and relate the characteristics of pulse circuits.
4 Understand and relate the characteristics of various IC circuits.
5 Identify and relate various types of multivibrators and their characteristics.
6 Understand and relate the characteristics of noise and distortion and their corrections.

Course Contents:

Theory

Unit1. IC: Fabrication Technology [4 hrs]

1.1. Short history, development and present day stage.
1.2. Types of IC, comparison to discrete components.
1.3. Integrated circuits fabrication technology – Thick film, think film, hybrid technologies.
1.4. Integrated resistors, capacitors, diodes, transistors, etc.
1.5. Introduction to CMOS, HMOS, GaAs and VSLI technology.
1.6. Practical ICs: linear and digital, general and special purpose chips.
1.7. IC specifications and data book (74…, 54…, 40... + Linear ICs)

Unit2. Operational Amplifiers – [6 hrs]

2.1. Introduction to IC opamp, basic circuits and symbols, working principles.
2.2. Properties and function of ideal IC opamp.
2.3. Basic applications of opamp:
- Inverting and non – inverting amplifiers.
- Summing and voltage follower amplifiers.
- Integrator and differentiation circuits.
- Filter (LPF, HPF, BPF) circuits.
- Peak detector circuits.

Unit3. Components of Practical Opamp – [6 hrs]

Current sources – Simple, Wilson and Widlar current sources – Principles and characteristics.
Differential amplifier

- Introduction; principles, circuits and characteristics (such as differential and common mode input configurations, voltage gain, input/ output resistances, etc).

Passive and active load differential amplifiers – Principles, circuits and characteristics.

Unit4. Practical opamp circuits– Principles, circuits, characteristics and applications [5 hrs]

- Small signal audio amplifiers
- Tone control and equalizer amplifiers
- Voltage regulator circuits
- RC filters circuits – LPF, HPF, BPF, etc.

Unit5. Special semiconductor devices and applications – Principles, application circuits and characteristics. [8 hrs]

- Seven segment display (LED and LCD lypes)
- GaAs FETs and MESFETS
- Solid state relays
- Optocoupler and isolator devices
- Charge coupled devices
- Photo transistors, solar cells and LEDs
- Hall effect devices
- Power MOSFETS – VMOS and HMOS

Unit6. Pulse Techniques Noise Introduction to optical electronics [5 hrs]

6.1 Types of typical waveforms, composition characteristics (amplitude, rise time, fall time, mark/ space ratio, overshot, ringing, droop, etc)

6.2 Transient response of RC and RL circuits.

6.3 Differentiations and integrations of signals – Simple circuits, examples of produced waveforms, applications.

6.4 Pulse clopping and clamping circuits

Unit7. Pulse waveform generators – Principles, circuits and characteristics and applications. [5 hrs]

7.1 Mulivibrators – Mono, bi and stable circuits

7.2 Schmidth trigger circuits

7.3 Application of pulse generators

Unit8. Noise – Definition, types, characteristics [5 hrs]

8.1 Thermal noise, noise factor, noise figure and noise temperature

8.2 Noise in amplifiers

8.3 Signal to noise ratio – Definition and measurements

8.4 Methods of noise reduction

- Dynamic Noise Limiter (DNL) method
- Dolby System
- dbx System

Unit9. Introduction to optical electronics – Basic working principles and characteristics and applications. [4 hrs]

9.1 Optical fibres, LASER, Receptor

Practical

1. Positive voltage regulator using IC
2. Negative voltage regulator using IC
3. Dual power supply
4. A low voltage regulator using IC273
5. High voltage regulator using IC273
6. Low voltage regulator using current fold back
7. Current boost low voltage regulator
8. Inverting ac amplifier
9. Non-inverting ac amplifier
10. Differential ac amplifier
11. Audio mixer
12. Ten ban octave (graphic) equalizer circuit
13. Low-power amplifier using dual power supplies.
14. Low-power amplifier using a single ended power supply
15. Amplifier IC LM386 with low and high gain
16. Stereo amplifier
17. LM390 amplifier with low voltage gain
18. LM 390 amplifier with high voltage gain
19. TDA 2822 stereo amplifier circuit

References:

1. Electronic Devices and circuits - David A Bell
2. Electronic Devices and circuits - TF Bogart
3. Electronic Devices and circuits - JB Gupta
4. Electronic Devices and circuits - DC kulshrestha
5. Electronic Devices and circuits -
6. Basic Electronic Solid state - B.L. Theraja
7. Electronic Principles - Sanjaya Sharma
8. Electronic Devices - Thomsa L. Floyd
9. Principles of Electronics - Albert Paul Malvino
10. Electronics Vol 1-7 - Harry Mileaf
11. Basic Radio Vol 1-6 - Marvin Tepper

Introduction to Microprocessors

EG 2203 EX

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

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

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

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

Course Contents:

Theory

Unit1. Introduction to Microprocessor [8 hrs]

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

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

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 hrs]

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

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

4.1. 8085 machine cycles and bus timing
- Fetch and execute cycles

- Memory read/write machine cycle
- I/O read/write machine cycle

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

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

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

4.5. Direct memory access

Unit5. 8085 Interrupt processing [6 hrs]

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

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

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

Practical

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

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

References:

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

Electronic Instruments and Measurements

EG 2204 EX

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

Course description:
This course presents an introduction to Electronic instruments and measurement techniques of Electrical and Electronic parameters.

Course objectives:
After the completion of this course, students will be able to:
1. Explain the importance of measurement in electronics engineering.
2. Explain the principle of operation of indicating instruments.
3. Operate Electronic Voltmeter/Ammeter(analog and Digital Type), ohm meter and multi-meter
4. Operate Oscilloscope, Signal generator and TV pattern generator

Course Contents:

Theory

Unit 1. Measurement Basic: [7 hrs]

1.1 System of Units
- Fundamental and derived units
- System International (SI) units

1.2 Measurement parameters
- Accuracy
- Precision
- Sensitivity
- Response time
- Frequency response and Bandwidth

1.3 Error in Measurement
- Probability of errors
- Limiting errors

1.4 Basic principle of indicating instrument
- Torque and deflection of galvanometer
- Permanent magnet moving coil mechanism.

Unit 2. Electronic Voltmeters, Multi-meters and Clamp Meter [14 hrs]

2.1 DC/AC Electronic Analog Voltmeters
- Basic Block Diagram
- Working Principles and Characteristics

2.2 DC/AC Electronic digital Voltmeter
- Basic Block Diagram
- Working Principles and Characteristics

2.3 Electronic Analog multimeter
- Basic Block Diagram
- Working Principles and Characteristics
- Specifications

2.4 Electronic Digital multimeter
- Basic Block Diagram

- Working Principles and Characteristics
- Specifications

2.5 Electronic Clamp meter
- Basic Block Diagram
- Working Principles and Characteristics
- Specifications

Unit 3. Oscilloscope and Display Instruments [6 hrs]

3.1 Basic Block Diagram, Working Principles and Characteristics

3.2 Oscilloscope measurement
- Waveforms
- Voltage and Current
- Time/frequency

3.3 Oscilloscope probes, characteristics (Dual Trace)

3.4 Calibrating procedure of an oscilloscope

3.5 Wave analyzer

3.6 X-Y Plotter

Unit 4. Measurement of semiconductor devices (Discrete and IC) [5 hrs]

4.1 Testing diodes and transistors using multimeter

4.2 Transistor tester
- Basic Principle and Circuit.
- Characteristics

4.3 Testing IC devices

Unit 5. Signal generators (Audio and RF) [3 hrs]

5.1 Operating principle of AF signal generator, characteristics and application

5.2 Operation principle of RF signal generator, characteristics and application

Unit 6. TV pattern Generator [5 hrs]

6.1 Types of Video pattern signal

6.2 TV receiver performance
- Picture geometry
- Resolution
- Color reproduction

Unit 7. Converter [5 hrs]

7.1 Principles of A/D Conversion and D/A conversion

7.2 Simultaneous A/D Converter

7.3 Successive approximation A/D converter

Practical

1. Measurement of average value of a quantity and range of error
2. Estimation of cross error and calculating limiting error
3. Converting multimeter range and measurement of current voltage and resistance
4. AC/ DC current and voltage measurement using CRO
5. Frequency measurement by wave form and Lissajou's method
6. Testing of semiconductor device (discrete and IC) by multimeter
7. Wave analysis using CRO
8. Experiment with A/D converter
9. Testing of video pattern signal

Text books:

1. Electronic Instrumentation and Measurement technique by Heldrick and Cooper PHI, India
2. Barney G.C. "Intelligent Instrumentation " - PHI - 1998.
3. Electronic Instrumentation H.S kalsi, TMC new Delhi

Instrumentation & Control

EG 2205 EX

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

Course description:
This course deals with fundamentals of Instrumentation, measurements of signal and Calibration, Errors, Signal conditioning and data acquisition system.

Course objectives:
After the completion of this course, students will be able to:
1. Provide knowledge of instrumentation.
2. Give knowledge of measurements.
3. Develop skills of instrumentation system.

Course contents:

Theory

Unit 1. Measurement System [4 hrs]

1.1. Introduction
1.2. Measurement system Architecture
- Sensor Dynamics
- Overview of Signal Conditioning

1.3. Errors in Measurements
1.4. Standard used in Measurements
- Electrical Standard
- The Volt
- Resistance
- Current and Charge
- Capacitance
- Inductance

1.5. Time and Frequency Standards
1.6. Physical Standards
- Mass
- Length
- Temperature

Unit 2. Analog Signal Conditioning [8 hrs]

2.1. Introduction
2.2. Differential Amplifier
- Analysis of Differential Amplifier
- Common Mode Rejection Ratio

2.3. Operational Amplifier
- Characteristics of Op Amps
- Non Inverting mode of Operation
- Inverting mode of operation and summer
- Use of op amps in Active filter design

2.4. Instrumentation Amplifier
- Isolation Amplifier
- Auto Zero Amplifier

2.5. Nonlinear analog signal processing Using Op amps
- Absolute Value
- True RMS and DV converter
- Peak Detector

Unit 3. Noise and Coherent Interference In measurements [4 hrs]

3.1. Introduction
3.2. Description of Random Noise in Circuits
3.3. Probability Density Function
3.4. Normal Distribution
3.5. Power Density Spectrum
3.6. Source of Noise in Signal Conditioning
- Noise in Passive Component
- Noise in Active Components

Unit 4. DC Null Method of Measurements [2 hrs]

4.1. Wheat Stone bridge Analysis
4.2. The Kelvin Bridge
4.3. Potentiometer

Unit 5. AC Null Measurement [4 hrs]

5.1. Inductor Equivalent Circuits
5.2. Capacitor Equivalent Circuits
5.3. AC operation of Wheatstone bridge
5.4. AC Bridge
- The Resistance Ratio Bridge
- The Parallel C Bridge
- The Wine Bridge
- The Maxwell Bridge
- The Owen Bridge

Unit 6. Sensor Mechanism [6 hrs]

6.1. Input Sensor mechanism
6.2. Resistive Sensor
- Resistive Temperature Sensor
- Resistive Strain Gauge
- Resistive Relative humidity sensor

6.3. Voltage generating Sensor
- Thermocouple and Thermopiles
- Piezoelectric Transducer
- Hall Effect sensor

6.4. Magnetic Coupling Sensor
6.5. Fiber Optic Sensor
6.6. Electrochemical Sensor (pH sensor)
6.7. Mechano-Optical Sensor (Optical Coding Disc)

Unit 7. Application of Sensor to Physical Measurement [6 hrs]

7.1. Measurement of Angular Acceleration (Servo Angular Accelerometer)
7.2. Measurement of Angular Velocity (Tachometer, Gyroscope)
7.3. Measurement of Angular Displacement (Gyroscope, Shafts)
7.4. Measurement of Linear Acceleration (Linear Accelerometer)
7.5. Measurement of Linear Velocity (Hot Wire and hot Film Anemometer, Measuring Fluid Velocity)
7.6. Measurement of Linear Displacement (Measurement of Linear Position)
7.7. Measurement of Torque and Force
7.8. Pressure Measurement (High pressure Sensor, Low Pressure Sensor)
7.9. Temperature measurement (Mechanical Temperature Sensor, Electrical and

7.10. Electronic Temperature sensor)

Unit 8. Basic Electrical Measurement [4 hrs]

8.1. DC Voltage measurement
- Electronic DC Voltmeter
- Electromechanical DV Voltmeter

8.2. Measurement of Electric Field and Potential of Charge Surface

8.3. DC Current measurement
- Electronic DC Ammeter
- Electromechanical DV Ammeter

8.4. AC Voltage measurement
- Electronic AC Voltmeter
- Electromechanical AC Voltmeter

8.5. Measurement of Electric Field and Potential of Charge Surface

8.6. Phase Measurement

8.7. Measurement of Frequency and Period (Time)

8.8. Measurement of Resistance, Capacitance and Inductance

Unit 9. Digital Interface in Measurement [5 hrs]

9.1. The Sampling theorem

9.2. Digital to analog converters

9.3. Analog to Digital Converters
- Successive approximation
- Dual slope
- Flash Converter

9.4. Serial Data Communication
- The RS 232 interface
- The RS 422 Interface

9.5. Data transmission in Optical Fiber

Unit 10. Data Acquisition Systems [2 hrs]

10.1. Components of Analog and Digital Data Acquisition System

10.2. Use of Data Acquisition Systems

10.3. Modern trends in data acquisition system

Laboratory

Lab 1	Basic of instrumentation Ammeter, Voltmeter and measurement
Lab 2, 3	Conversion of physical variables into electrical signal
Lab 4	Signal conditioning using active devices or OpAmp
Lab 5, 6	Measurement of physical variables using various Bridges
Lab 7	Error measurements in instrumentation system
Lab 8	Observation of interference in instrumentation and their remedy
Lab 9	Transmission of signal in different mediums
Lab 10, 11	Conversion of analog signal into digital and digital into analog signal
Lab 12, 13	Field visit to observe the instrumentation system

References:

1. Robert B. Northrop, "**Introduction to Instrumentation and Measurements"** CRC Press LLC, 2005
2. A.D. Helfrick and W.D. Cooper, **"Modern Electronic Instrumentation and Measurement Techniques"**, Prentice Hall of India, 1996
3. C.S. Rangan, G.R. Sarma, and V.S.V. Mani, "**Instrumentation Devices and Systems",** Tata McGraw Hill, India, 1992
4. A.K. Sawhney, "**A Course in Electronic Measurements and Instrumentation**", Dhanpat Rai and Sons, India, 1998

सामाजिक अध्ययन

(EG 2206 SH)

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

कोर्षको परिचय

यस विषयमा विद्यार्थीहरूले सामाजिक विशेषताहरू, मानव र समाजसंग भएका विभिन्न सम्बन्धहरू, सामाजिक तथा साँस्कृतिक परिवर्तन सम्बन्धी कार्यहरू, वातावरण र पर्यावरण, समाजसेवा र सामुदायिक विकास एकाईहरू, सामाजिक अनुसन्धान, गांमीण श्रोतहरू, नेपालको उत्पत्ति नेपालका कुराहरू र आर्थिक अवस्था, पररा्ष्ट्रनीति तथा शासन व्यवस्था र जनसंख्या शिक्षासंग सम्बन्धित इकाईहरू समावेश गरिएका छन् ।

कोर्षको उद्देश्य :

यस पाठ्यांशको अध्ययनबाट विद्यार्थीहरूले निम्नलिखित कुरा सक्नेछन्:-

१ सामाजिक विशेषताहरूको व्याख्या गर्न,
२ मानव र समाजसंग भएका विभिन्न सम्बन्धहरूको चर्चा गर्न,
६ सामाजिक अनुसन्धानका कार्य गर्न,
७ गांमीण श्रोतहरू पहिचान गर्न,
७ नेपालको उत्पत्ति नेपालको आर्थिक अवस्था, पररा्ष्ट्रनीति तथा शासन व्यवस्थाको व्याख्या गर्न
८ जनसंख्या शिक्षाको वयान गर्न,

पाठ्यांशको विषयवस्तु

१. सामाजिक विज्ञान (Social Science)
   (क) समाजशास्त्र र ग्रामीण र समाजशास्त्रको परिचय
   (ख) समाजशास्त्रको प्रकृति र वैज्ञानिक पद्धति
   (ग) सामाजिक विज्ञान र भौतिक विज्ञान बिचको अन्तर
   (घ) विज्ञान र इन्जिनीयरिङ्ग
   (ङ) विज्ञान र प्रविधि
   (च) विज्ञान र धर्म
   (छ) विज्ञान र समाज
२. मानव र समाज (Man and Society)
   (क) समाज, संस्कृति र व्यक्तित्व, बानी, परम्परा र फेशन
   (ख) जाति, भाषा, धर्म, पेशा, रहनसहन
   (ग) सामाजिक वर्ग व्यवस्था
   (घ) समाजमा महिलाहरुको स्थिति
३. सामाजिक तथा साँस्कृतिक परिवर्तन (Social Cultural Changes)
   (क) सामाजिक तथा साँस्कृतिक परिवर्तनका अर्थ
   (ख) सामाजिक तथा साँस्कृतिक परिवर्तनका सिद्धान्तहरु
   (ग) सामाजिक परिवर्तनका विशेषताहरु
   (घ) सामाजिक तथा साँस्कृतिक परिवर्तनका कारक तत्वहरु

(ङ) औद्योगीकरण र सामाजिक परिवर्तन
(च) ग्रामीण सामाजिक परिवर्तन
(छ) औद्योगिक र ग्रामीण समाजका लक्षणहरु
(ज) शहरीकरण

४. वातावरण र पर्यावरण (Environment and Ecology)
(क) वातावरण र पर्यावरणको अर्थ
(ख) वातावरण पर्यावरण संरक्षणको आवश्यकता र महत्व
(ग) वातावरण र कानुनको सामान्य इतिहास

५. समाज सेवा र सामुदायिक विकास (Social Services and Community Development)
(क) सामुदायिक विकास परियोजनाको अर्थ र उद्देश्य
(ख) सामुदायिक विकास कार्यक्रम
(ग) जनसहभागिता र सामुदायिक विकास
(घ) समाज सेवाको अर्थ, क्षेत्र र उद्देश्य
(ङ) सामाजिक कार्यकर्ताको अर्थ, प्रकार, गुण र भूमिका

६. सामाजिक अनुसन्धान (Social Research)
(क) परिभाषा, प्रकृति, उद्देश्य र प्रकार
(ख) सामाजिक अनुसन्धानका प्रेरकर्ताहरु
(ग) सामाजिक अनुसन्धानका प्रमुख चरण

७. ग्रामीण श्रोतहरु (Rural Resources)
(क) मानवशक्ति
(ख) जलश्रोत
(ग) भूमि
(घ) जनसम्पदा
(ङ) खनिजशक्ति
(च) सौर्यशक्ति
(छ) वायुशक्ति

८. नेपाल शब्दको उत्पत्ति (Origin of Nepal Word)

९. विश्व मानचित्रमा नेपाल (Nepal in the World Map)

१०. आर्थिक अवस्था (Economic System)
(क) कृषि, व्यापार, उद्योग, यातायात र सञ्चार
(ख) आर्थिक व्यवस्थाका विशेषताहरु
मिश्रित अर्थ व्यवस्था, साझा, योजनावद्ध विकास, कृषिजन्य अर्थ व्यवस्था

११. परराष्ट्र नीति (Foreign Policy)
(क) नेपाल असंलग्न परराष्ट्र नीतिको अर्थ
(ख) नेपालको परराष्ट्र नीतिका विशेषताहरु
(ग) नेपाल भारत सम्बन्ध
(घ) नेपाल चीन सम्बन्ध
(ङ) संयुक्त राष्ट्र संघ र नेपाल
(च) सार्क र नेपाल

१२. शासन र व्यवस्था (Rulling System)
(क) व्यवस्थापिका
(ख) कार्यपालिका
(ग) न्यायपालिका
(घ) संविधान
(ङ) नेपाल अधिराज्यको संविधान र यसका विशेषताहरु

(च) विकेन्द्रीकरण, महत्व, आवश्यकता र विशेषताहरु

१३. जनसंख्या शिक्षा (Population Education)

(क) जनसंख्या शिक्षाको परिचय र विषयवस्तु

(ख) जनसंख्या शिक्षँकको उद्देश्यहरु

(ग) जनसंख्याको आकार, संरचना, वितरण, वृद्धि, प्रभाव र नियन्त्रण

सन्दर्भ सामग्रीः

१. आधारभूत समाजशास्त्र तथा मानवशास्त्र, कमलराज शर्मा, देवी शर्मा, पोखरा ।

२. अर्थशास्त्रका तत्वहरू, सावित्री श्रेष्ठ, अक्षलोक प्रकाशन, काठमाडौं, दोश्रो संस्करण ।

३. अर्थशास्त्रका सरल सिद्धान्त, ईश्वरमान श्रेष्ठ, अक्षलोक प्रकाशन, काठमाडौं ।

४. अर्थशास्त्र, मुरारीमोहन जोशी, कृष्णदेव यादव, नेशनल बुक सेण्टर, काठमाडौं ।

५. महत्वपूर्ण राजनीतिक शब्दज्ञान, सिद्धिश्वरमान श्रेष्ठ, अक्षलोक प्रकाशन, काठमाडौ, नवौं संस्करण २०६३ ।

६. मुद्रा, बैङ्किङ्ग, राजश्व, अन्तरराष्ट्रिय व्यापार तथा नेपालको अर्थशास्त्र, प्रा.महेश्वरमान श्रेष्ठ, रत्न पुस्तक भण्डार, काठमाडौं ।

७. नेपाल परिचय, सावित्री श्रेष्ठ, सिद्धिश्वरमान श्रेष्ठ, निरन्तर प्रकाशन, काठमाडौं, तेस्रो संस्करण ।

८. राजनीति शास्त्रको परिचय सिद्धिश्वरमान श्रेष्ठ, निरन्तर प्रकाशन, काठमाडौं, दोस्रो संस्करण ।

९. सामाजिक अभियान, प्रा.राजेन्द्रप्रसाद अधिकारी, सह-प्राध्यापक सिद्धिश्वरमान श्रेष्ठ, अक्षलोक प्रकाशन, काठमाडौं तेश्रो संस्करण, २०६३ ।

Medical Electronics I

EG 2201 BM

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

Course description:
This course deals with the basic fundamentals of Medical Electronics. Students will understand basic concepts, principles of various medical instruments especially bio-potential signal measuring techniques.

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

1. Understand the importance of the sensors and their principles in the medical electronic.
2. Explain the origin of bio-potentials
3. Describe the medical signal processing and transmission.

Course Contents:

Theory

Unit1. Review of physics in electronics [4 hrs]

1.1 What is physics in electronics?
1.2 Application of electronics
1.3 Modern trends in electronics
1.4 S.I units

Unit2. Electrical principles, current and voltage sources [6 hrs]

2.1 Sources of electrical power
2.2 Internal impedance of source
2.3 Concept of voltage and current sources
2.4 Equivalence between voltage source and current source
2.5 Usefulness of the concept of voltage and current sources in electronics

Unit3. Electronic tube, characteristics and applications [4 hrs]

Vacuum tube
Vacuum diodes
Use of vacuum diodes in rectifiers
Vacuum triode
Tetrode tube
Pentode tube

Unit4. Basic concepts of medical electronics and its instruments [10 hrs]

4.1 Terminology of medicine and medical devices
4.2 Generalized medical instrumentation system
4.3 Alternative operational modes
4.4 Medical measurement constraints

- Classification of biomedical instruments
- Interfering and modifying inputs
- Compensation techniques
- Inherent insensitivity
- Negative feedback
- Signal filtering

- Opposing inputs

4.5 Biostatics
4.6 Generalized static characteristics
4.7 Generalized dynamic characteristics
- Transfer functions
- Zero-order instrument
- First- order instrument
- Second- order instrument
- Time delay

4.8 Design criteria
4.9 Commercial medical instrumentation development process
4.10 Regulation of medical devices

Unit5 Introduction to the origin of bio-potentials [4 hrs]

5.1 Origin of electricity in biological system
5.2 Bioelectric phenomenon
5.3 Electronic in medical science
5.4 Electrode theory

Unit6 Basic sensors and principles [10 hrs]

6.1 Displacement measurements
6.2 Resistive sensors
6.3 Bridge circuits
6.4 Inductive sensor
6.5 Capacitive sensors
6.6 Piezoelectric sensors
6.7 Temperature measurements
6.8 Thermocouples
6.9 Thermistors
6.10 Fiber-optic temperature sensors
6.11 Optical measurements
6.12 Radiation sources
6.13 Geometrical and fiber optics
6.14 Optical filters
6.15 Radiation sensors
6.16 Optical combinations

Unit7. Basic medical signal processing and transmission (7 hrs)

7.1 Basic op-amp characteristics
7.2 Instrumentation amplifier
7.3 Biomedical pre-amplifier and power amplifiers
7.4 Signal amplification, attenuation, integration, differentiation, network isolation and wave shaping
7.5 Effects of noise, analog filtering, digital filtering

Practical

1. Experimental works on current and voltage sources
2. Simplified electrocardiography recording system
3. First-order and second-order instrument
4. Design process for basic medical electronics
5. Resistive sensors design, bridge circuits design
6. Piezoelectric materials and study of piezoelectric sensors design
7. Stationary chopped-beam radiation thermometer
8. Instrumentation amplifier design
9. Bio-potential sources and its measurements

10. Study of different types of electrodes

References:

1. John G. Webster, Medical Instrumentation, Application and Design: Third edition, John Wiley and sons, New York
2. Leslie Cromwell, Bio medical Instrument and measurements, Prentice Hall, Inc, Englewood cliffs
3. Len Jones, Basic Electronics, Cambridge University Press
4. N.N bhargava, Basic Electronics and Linear Circuits, Technical Teachers Training Institute, Tata Mc Graw Hill
5. Onkar N. Pandey, Bio medical Electronics and Instrumentation, S.K. Kataria and sons, Publishers of Engineering and Computer books

Bio-engineering Materials and Devices

EG 2202 BM

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

Course description:
This course provides knowledge about the various implantable devices and the components that are used in those devices. Ranging from polymers (plastic, glass and ceramics) to metals and composites their properties appropriate to application site and duration along with the device type to be used are covered in this course. It introduces various devices which are implanted into the human body during different abnormalities. It also focuses on the testing of biomaterials and the conditions they can degrade in biological environment.

Course objectives:
After completion of this course, students will be able to:
1. Learn about different materials used in biomedical field.
2. Explain about different implantable devices that are being used.
3. Know the properties of various materials that are suitable for implantation within the human body.
4. Learn about surface modification techniques of various biomaterials.

Course contents:

1.0 Properties of Materials: (6 hrs)
- 1.1. Introduction.
- 1.2. Bulk properties of materials.
- 1.3. Surface properties of materials.
- 1.4. Measurement techniques.

2.0 Introduction to Bio-materials: (1 hrs)
- 2.1. Biomaterial science: An interdisciplinary course.
- 2.2. Classes of materials used in medicine.

3.0 Metals: (4 hrs)
- 3.1. Structure, chemistry, mechanical properties and applications of various metals relating to biomaterials.
- 3.2. Steps in fabrication of implants.
- 3.3. Different metals and alloys used in implants.

4.0 Polymers: (4 hrs)
- 4.1. Types of polymers used in medicine
- 4.2. Molecular weight and synthesis.
- 4.3. Solid state polymers and copolymers.

5.0 Bioresorbable and Bioerodible Materials: (5 hrs)
- 5.1. Types of degradable implants.
- 5.2. Currently available degradable implants.

5.3. Physical mechanisms of bio-erosion.
5.4. Mechanism of chemical degradation.
5.5. Factors influencing the rate of bio-erosion.
5.6. Prosthesis for drug delivery

6.0 Ceramics, Glasses and Composites: (4 hrs)

6.1. Structure, chemistry and properties of ceramics and glasses used in medical devices.
6.2. Types of bio-ceramics.
6.3. Bioactive glasses and glass ceramics.

7.0 Natural Materials: (3 hrs)

7.1. Different types of natural materials used as biometerials
7.2. Structure of native collagen.
7.3. Modification of collagen.

8.0 Composites: (4 hrs)

8.1. Definition of composites.
8.2. Reinforcing systems and matrix.
8.3. Mechanical and physical properties of composites.

9.0 Implantable Devices (10 hrs)

9.1. THR
9.2. Heart valve
9.3. Dental Implants
9.4. Pacemaker
9.5. Ventricular Assist Device
9.6. Heart Valves
9.7. Urethral catheter and stents
9.8. Artificial urinary sphincter and bladder

10.0 Plastic Surgery (4 hrs)

10.1. Overview of biomaterials used in plastic surgery
10.2. Aesthetic Surgery

11.0 Surface modification of biomaterials (4 hrs)

11.1. Necessity of surface modification general principles.
11.2. Methods for modifying the surfaces of materials for enhancing biological interactions.
11.3. Plasma treatments.

12.0 Testing of Biomaterials: (5 hrs)

12.1. Introduction.
12.2. In vitro assessment of tissue compatibility, background concepts.
12.3. In vivo assessment of tissue compatibility.
12.3.1. Implant sites.
12.3.2. Surgical protocol and form of implants, controls.
12.3.3. Evaluation of tissue reaction.

13.0 Degradation of Materials in Biological Environment:: (6 hrs)

13.1. Introduction
13.2. Introduction to chemical and biochemical degradation of polymers.
13.3. Degradation effects of biological environment on metals and ceramics.
13.4. Corrosion.

13.5. Mechanical breakdown in the biological environment.
13.6. Pathologic calcification of biomaterials, prevention of calcification.

References:

1. “Biomaterials Science”, Ed by Buddy Ratner et. al, Academic Press, 1996
2. “Implantation Biology”, Ed. Ralph Greco, CRC Press Inc.

Third Year
(Fifth and Sixth Semesters)

Fifth Semester

Subjects:

EG3101BM	Introduction to Bio-Mechanics
EG3102BM	Medical Electronics II
EG3103BM	Medical Imaging Technology
EG3104BM	Bio-Medical Instrumentation I
EG3103EX	Elective I 1. Data Communication 2. Embedded System Design
EG3105BM	Bio-Medical Equipment Maintenance I
EG3106BM	Project I

Introduction to Biomechanics
(EG 3101 BM)

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

Course description:
This course is designed to impart knowledge on application of mechanics to human body.

Course objectives:
After the completion of this course, students will be able to:
1. Calculate forces in different joints.
2. Understand the mechanical properties of hard and soft tissues.
3. Familiarize with different bio-fluids and study the behavior of blood as a bio-fluid.

Course Contents:
1. **Introduction** **[1 hr]**
    - 1.1 Definition and Scope
2. **Forces in Joints** **[10 hrs]**
    - 2.1 Joint movement terminology
    - 2.2 Classification of joints
    - 2.3 Forces in elbow, hip, knee, spine
3. **Mechanics of Hard Tissue** **[12 hrs]**
    - 3.1 Composition and structure of bone tissue
    - 3.2 Bone growth and development
    - 3.3 Mechanical properties of bone
    - 3.4 Fracture healing
4. **Mechanics of Soft Tissue** **[10 hrs]**
    - 4.1 Functions & mechanical properties of Ligaments and Tendons
    - 4.2 Collagen
    - 4.3 Elastin
5. **Bio-fluid Mechanics** **[12 hrs]**
    - 5.1 Introduction to Biofluids
    - 5.2 Basics of blood rheology
    - 5.3 Measurement of blood pressure
    - 5.4 Measurement of blood flow

References:

1. Basic Biomechanics, Susan J Hall
2. Skeletal Tissue Mechanics, Martin, Burr& Sharkey

Medical Electronics II

EG 3102 BM

Year: III **Total: 7 hrs/week**

Lecture: 3 hours/week

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

Practical:

Lab: 3 hours/week

Course description:

This course deals with the fundamentals of pneumatics, acoustics and related mechanical and measurement applications in biomedical field. Students will understand basic principles of transducer and physiological transducers and other communication circuits for medical electronics.

Course objectives:

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

1. Describe the uses of various pneumatics, acoustics and related mechanical and measurement applications in biomedical field.
2. Explain the operating principles of various types of transducer for using in the biomedical field.
3. Describe the blood pressure and sound measurements
4. Check, testing of flow and volume of blood.

Course Contents:

Theory

Unit 1. Man- Instrument system [5 hrs]

1.1 Physiological system of the body
1.2 Biometrics
1.3 Man-instrument system
1.4 Components of man-instrument system
- Subject
- Stimulus
- Transducers
- Signal conditioning equipments
- Display units
- Recording and data transmission
- Data storage

Unit 2. Basic communication circuits for medical equipments [6 hrs]

2.1 Audio and radio frequency circuits
2.2 Modulation and demodulation circuits
2.3 Transmitting and Receiving circuits
2.4 Transmitting and receiving radio waves, pulse and digital circuitry
2.5 Frequency converters and mixers

Unit 3. Review of hydraulics, pneumatics, acoustics and related mechanical and measurement applications [10 hrs]

3.1 Functions of components of instrumentation system transduction, signal processing, signal transmission output indication
3.2 Need for electrical, electronics, pneumatic and hydraulic working media systems and conversion devices
3.3 Analog and digital systems

3.4 Static performance parameters: accuracy, precision, sensitivity, resolution and linearity
3.5 Dynamic performance parameter: response time, frequency response and bandwidth
3.6 Error in measurement
3.7 Statistical analysis of errors in measurement

Unit 4. Operating principles of transducer [12 hrs]

4.1. Measurement of electrical variable voltage, current, resistance, frequency, inductance and capacitance

4.2. Resistive, capacitive, inductive transducers

4.3. Signal display methods

4.4. Measurement of mechanical variables, displacement strain, velocity, acceleration and vibration

4.5. Measurement of bio-physical variables, blood pressure and myoelectric potentials

4.6. Measurement of process variables, temperature, pressure, level, fluid flow, chemical constituents in gases or liquids, pH and humidity

4.7. Physiological Transducers
- Transducer in general
- Active and passive transducers
- Pressure transducer
- Catheter-tip pressure transducer
- Intracranial pressure transducer

Unit 5. Blood Pressure and sound [6 hrs]

5.1 Direct measurements
5.2 Dynamic properties of pressure measurement systems
5.3 Measurement of system response
- Transient step response
- Sinusoidal frequency response

5.4 Bandwidth requirements for measuring blood pressure
5.5 Systems for measuring venous pressure
5.6 Heart sounds
- Mechanism and origins
- Stethoscopes

5.7 Indirect measurements of blood pressure

Unit 6. Measurement of flow and volume of blood [6 hrs]

6.1 Indicator- dilution method that uses continuous infusion
- Concentration
- Fick technique

6.2 Electromagnetic flow meters
- Principle
- DC flow meter
- AC flow meter
- Probe design

6.3 Ultrasonic flow meters
- Transducers
- Transient-time flow meter
- Continuous wave Doppler flow meter

Practical

1. Demonstration and orientation of man-instrument system
2. Transmitting and receiving radio waves, pulse and digital circuitry and their analysis
3. Statistical analysis of errors in measurement
4. Study of different types of transducers, their identification and applications in medical electronics
5. Direct and indirect measurements of blood pressure
6. Heart sound measurement and devices.
7. Case study of Doppler ultrasonic blood flow meter
8. Case study and design of intracranial pressure transducer

References:

1. John G. Webster, Medical Instrumentation, Application and Design: Third edition, John Wiley and sons, New York
2. Leslie Cromwell, Bio medical Instrument and measurements, Prentice Hall, Inc, Englewood cliffs
3. Onkar N. Pandey, Bio medical Electronics and Instrumentation, S.K. Kataria and sons, Publishers of Engineering and Computer books
4. S. Wolf and R.F Smith, Students reference Manual for electronic Instrumentation Laboratories, Prentice Hall.

Medical Imaging Technology

EG 3103 BM

Year: III **Total: 7 hrs/week**
Semester: I **Lecture: 4 hrs/week**
Tutorial:
Practical: 3 hrs/week
Lab:

Course description:
This course is designed to provide the students with the basic knowledge of equipment and technology used in the field of medical imaging

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

1. Describe the production, interaction and biological effects of x-rays
2. Explain the working principle of major radiological equipment
3. Explain the photographic process involved in producing a radiograph
4. Explain the working principle of digital imaging equipment

Course Contents:

Theory

Unit 1 Introduction **(3 hrs)**

- Introduction to medical imaging technology
- Atomic structure
- Electromagnetic radiation

Unit 2 X-rays **(7 hrs)**

- Historical background
- Production of X-rays
- Factors affecting x-ray emission
- Basic interaction of X-rays with matter
- Control of scattered radiation

Unit 3 X-ray Equipment **(15 hrs)**

- X-ray tubes
- Filters, beam restrictors
- Exposure factors and their control in an X-ray circuit
- Portable X-ray machines
- Fluoroscopic imaging
- Mammographic equipment
- Radiation protection

Unit 4 Radiographic Photography **(15 hrs)**

- X-ray films
- Intensifying screens
- X-ray cassettes
- X-ray film processing
- Sensitometry

- Radiographic Image

Unit 5 Introduction to Digital Imaging Technology (20 hrs)

- Digital Image
- Computed Radiography (CR)
- Direct Radiography (DR)
- Digital Fluoroscopy (DF)
- Computed Tomography (CT)
- Magnetic Resonance Imaging (MRI)
- Ultrasonography (USG)

Practical

1. Practical demonstration of functioning of an x-ray machine and different parts of an x-ray machine and its accessories
    a. Control panel and its different components
    b. X-ray tube
    c. High Tension Tank
    d. X-ray table
    e. Tube stand and column
    f. Vertical bucky/chest stand

2. Demonstration of Dark-room procedures, x-ray films, intensifying screen and equipments used in the darkroom
    a. X-ray film handling in the dark room
    b. X-ray cassettes and intensifying screens
    c. Manual processing system (Processing tank, film hangers, safelight)
    d. Automatic processor

3. Demonstration of CR/DR, USG, CT Scanner, MRI machine
    a. CR Cassettes
    b. CR Reader
    c. Film Printer
    d. X-ray films for digital Imaging
    e. USG machine (USG Transducer)
    f. CT Scan console
    g. CT gantry and other accessories
    h. MRI console
    i. MRI Scanner and its components
    j. RF Coils

4. X-ray exposure test with intensifying screens
5. Safelight test
6. Light beam and x-ray beam congruence test
7. Screen film contact test

References:

1. D N Chesney & M O Chesney. X-ray equipment for student radiographers
2. Peter Carter et al, Chesney's Equipment for student radiographers, Blackwell science
3. Penelope Allisy-Roberts and Jerry Williams, Farr's Physics for Medical Imaging, Saunders, Elsevier

Biomedical Instrumentation I

EG 3104 BM

Year: III
Semester: I

Total: 7 hrs
Lecture: 3 hrs
Tutorial: 1 hr
Practical:
Lab: 3 hrs

Course description:
This course is designed to present the basic concepts of medical instruments, design analysis of various types of medical instruments currently using in medical, clinical and hospital field. This course deals with study, design, uses and applications of advanced biomedical equipments.

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

1. Describe the uses of various kinds of biopotential electrodes.
2. Explain the uses and applications of different physiological transducers
3. Perform checking, maintenance, diagnosis and testing of various medical instruments

Course Contents:

Theory

Unit 1. Biomedical Engineering **(2 hrs)**

- 1.1 Introduction
- 1.2 Biometrics
- 1.3 Man-instrument system
- 1.4 Components of man-instrument system
  - Subject
  - Stimulus
  - Transducers
  - Signal conditioning equipments
  - Display
  - Recording and data transmission
  - Data storage
- 1.5 Physiological system of the human body

Unit 2. Biomedical system **(4 hrs)**

- 2.1 Bioelectric potential
- 2.2 Resting potential
- 2.3 Action potential
- 2.4 Propagation of action potential
- 2.5 Biological signals
- 2.6 Electrodes
- 2.7 Biopotential electrodes
- 2.8 Microelectrodes
- 2.9 Sin surface electrodes

Unit 3. Physiological Transducers **(4 hrs)**

3.1 Active transducers

3.2 Passive transducers

- Passive transducers using resistive elements
- Passive transducers using inductive elements
- Passive transducers using capacitive elements

3.3 Transducers for biomedical applications

Unit 4. Measuring and monitoring system **(8 hrs)**

4.1 Electrocardiograph (ECG)

- The electrocardiogram
- The electrocardiographic diagnosis
- ECG lead configurations
- Computer aided electrocardiograph analysis

4.2 Electroencephalograph (EEG)

- EEG electrode configurations
- EEG recording techniques
- Practical; details of EEG

4.3 Electromyograph (EMG)

- Electromyographic recording techniques
- Different muscle related diseases

Unit 5. Diagnostics and Imaging Instruments **(8 hrs)**

5.1 Principle of ultrasonic measurement

5.2 Ultrasonic imaging system

5.3 X-Ray and radio instruments

- Basic definition of radiology
- X-ray tubes
- Block diagram of x-ray machine
- Biological effects of x-rays

5.4 CAT scan machine

5.5 Nuclear magnetic resonance Imaging system

Unit 6. Patient monitoring system and biotelemetry **(8 hrs)**

6.1 ECG Monitoring

6.2 B.P monitoring

6.3 ICU monitoring instruments

6.4 Biotelemetry for general use

6.5 The components of a biotelemetry system

6.6 Design of a system.

6.7 Multichannel system

6.8 Frequency modulation techniques in telemetry link

6.9 Real time processing

6.10 Telemetry in operating room

6.11 Sports physiology studies through telemetry

Unit 7. Therapeutic and prosthetic devices **(5 hrs)**

7.1 Cardiac pacemakers and other electric stimulators

7.2 Defibrillators

7.3 Hemodialysis

7.4 Lithotripsy

7.5 Ventilators

7.6 Therapeutic applications of the laser

Unit 8. Blood flowmeters and Oximeters **(6 hrs)**

8.1 Electromagnetic Blood Flowmeter

8.2 Types of Electromagnetic Blood Flowmeter

8.3 Ultrasonic Blood Flowmeter
8.4 Blood Flow estimation by Radiographic method
8.5 Oximetry
8.6 Pulse Oximeter
8.7 Skin Reflectance Oximeter

Practical

1. Study on anatomy and physiology system of the body
2. Design study of different types of electrodes used in medical electronics
3. Case study of physiological transducers and design
4. Study of intracranial pressure transducer
5. Computer aided ECG analysis and their recording techniques
6. Practical details of EEG machine
7. Practical details of EMG machine
8. Diagnostic X-ray machine and uses
9. Diagnostic ultrasound machine and their applications
10. Study and orientation of CT and MRI machines
11. Design study of telemetry system in ICU department of the hospital
12. Study of different Therapeutic devices

References:

1. John G. Webster, Medical Instrumentation, Application and Design: Third edition, John Wiley and sons, New York
2. Leslie Cromwell, Bio medical Instrument and measurements, Prentice Hall, Inc, Englewood cliffs
3. Onkar N. Pandey, Bio medical Electronics and Instrumentation, S.K. Kataria and sons, Publishers of Engineering and Computer books

Data Communication

Elective I (EG 3103 EX)

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

Course description:
This course deals with the introduction to telephone network, different types of transmission system and media, concepts of multiplexing and multiple access techniques, principles of pulse code **modulation, and different types of switching techniques and systems.**

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

1 Introduce telephone network,
2 Introduce different types of transmission system,
3 Conceptualize multiplexing and multiple access techniques of telephone network,
4 Describe the principles of pulse code modulation,
5 Describe different types of switching techniques and systems.

Course Contents:

Theory

1. Introduction (4 hrs)
- 1.1 Public-switched telephone network (PSTN)
- 1.2 Network topology, central office switch
- 1.3 Subscriber telephone, subscriber loop, telephone conversation
- 1.4 Hierarchical networks

2. Transmission (6 hrs)
- 2.1 Comparison between analog and digital transmission
- 2.2 Transmission media (twisted pair, coaxial cable, optical fiber, radio and microwave)
- 2.3 Transmission impairments (distortion, noise, interference, crosstalk, echo, singing, jitter)

3. Multiplexing and multiple access techniques (10 hrs)
- 3.1 Multiplexing and concentration, space-division multiplexing (SDM)
- 3.2 Time-division multiplexing (TDM)
- 3.3 Frequency division multiplexing (FDM)
- 3.4 Wavelength-division multiplexing (WDM)
- 3.5 Frequency division multiple access (FDMA)
- 3.6 Time-division multiple access (TDMA)
- 3.7 Code-division multiple access (CDMA)
- 3.8 Space-division multiple access (SDMA)
- 3.9 ALOHA, slotted-ALOHA, CSMA/CD

4. Pulse code modulation (PCM) (10 hrs)

4.1 PCM generation, companding in PCM,
4.2 μ-law and A-law
4.3 PCM transmission format (T1, and E1 lines)
4.4 Frame and multiframe, frame and multiframe alignment strategy
4.5 Line codes (AMI, HDB3 and B8ZS)
4.6 Higher order PCM, plesiochronous digital hierarchy (PDH), synchronous digital hierarchy (SDH) and SONET

5. Switching techniques and system (10 hrs)

5.1 Message switching
5.2 Packet switching
5.3 Circuit switching
5.4 Manual switching
5.5 Electro mechanical switching
5.6 Electronic switching
5.7 Stored control program
5.8 Space-division switching
5.9 Time-division switching
5.10 Space-time division switching
5.11 Multiple stage switching
5.12 Digital cross connect
5.13 Private branch exchange

6. Background Study (5 hrs)

6.1 Introduction and necessity of computer networking
6.2 Different types of multiplexing: Simplex, Duplex, Half Duplex

Practical

Practical will be covering all the chapters mentioned above. The students should visit the communication related company and prepare the report.

Text books:

1. Stallings, W. *Data Communication and Computer Networks*, Seventh Edition, New Delhi: Prentice-Hall of India Limited, 2004Behrouz A Forouzan, “Data Communication and Networking”, Tata McGraw-Hill, 2008

References:

1. William Stallings, “Data and Computer Communications”, Pearson Education, 2008.
2. Rajneesh Agrawal and Bharat Bhushan Tiwari, “Data Communication and Computer Networks”, Vikas Publishing house Ltd. , 2005.
3. Tomasi Wayne, “Introduction to Data Communications and Networking”, Pearson Education, 2007.

Embedded System Design

Elective I (EG 3103 EX)

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

Course description:
This course is designed to provide the knowledge about designing the embedded system. It imparts knowledge and skills Compiling and debugging, Device interfacing, Memory organization and Interrupt.

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

1. Understand the concept of embedded system
2. Learn compiling and debugging system using software
3. Learn device interfacing system
4. Know about memory organization
5. Describe interrupts and interrupt service routines

Course Contents:

Theory

1. Introduction to Embedded System **(5 hrs)**

- Embedded systems descriptions, definitions, and vocabulary.

- Embedded system design considerations and requirements, processor selection and tradeoffs.
- Overview of board development process, wire wrapping, soldering
- Microprocessor/microcontroller architectures and instruction sets, 8051 architecture, busses.

2. Compiling and Debugging **(15 hrs)**

- Design cycle, planning a development project, derivation of requirements, tradeoffs.
- 8051 instruction set, ASM51 assembler and Emily52 simulator. Code development process.
- MICRO-C and SDCC cross compilers, Emily52 simulator, makefiles, and tools.
- Monitors, in-circuit emulators, debuggers, monitors, software engineering, debugging using software.
- MICRO-C variables, bit operations, pointers.
- Examples of assembly code, discussion of mnemonics, calculation of execution time.
- Device programmers, EPROM emulators, Intel hex records and Motorola S-records.
- Schematics and wiring diagrams, recommended practices, CAD tools.
- Cross-assemblers, cross-compilers, linkage editors, disassemblers, other software tools.

*3. **Device Interfacing*** **(15 hrs)**

- Microcontroller peripherals, selection and interfacing. Core component circuitry (µP, ROM, RAM).
- 8051 timing diagrams, program read, data read, data write.
- Debugging using logic analyzers, state and timing information.
- Serial communication, RS-232/485, line drivers/receivers, charge pumps, terminal emulation, USB.
- Port pin structure. Controlling port pins in asm. User interface design, Driving LEDs, LCD
- Analog-to-Digital Converters (ADCs), Digital-to-Analog Converters (DACs).
- Motor control, stepper motors, DC motors, PWM, H-Bridges. Case study: hard disk drive.

*4. **Memory organization*** **(5hrs)**

- Timing requirements, propagation delay, setup, hold, rise/fall times, timing analysis. Clock skew.
- Memory selection and interface, SRAM, NVRAM, DRAM, EPROM, EEPROM, Flash.

- Memory maps, decoding logic, glue logic, programmable logic (PALs, FPGAs).
- Switch debouncing in hardware and firmware, keypad decoding.

5. ***Interrupt*** **(5 hrs)**

- 8051 timers/counters. Interrupts and Interrupt Service Routines (ISRs).
- Interrupts in C.

Laboratory

Lab #1: Basic microcontroller hardware, 8051 assembly, simulator.

Lab #2: Decode logic, EPROM, basic user I/O, timer ISRs and assembly.

Lab #3: SRAM, RS-232, monitor/debugger, assembly, intro to 8051 C.

Lab #4: EEPROM, LCD, and C programming.

Final Project/Lab #5: Student's choice.

Text books:

1. Rajkamal, ‘Embedded System – Architecture, Programming, Design’, Tata McGraw Hill, 2003
2. Daniel W. Lewis ‘Fundamentals of Embedded Software’, Prentice Hall of India, 2004.

References:

1. David E. Simon, ‘An Embedded Software Primer’, Pearson Education, 2004.
2. Frank Vahid, ‘Embedded System Design – A Unified hardware & Software Introduction’, John Wiley, 2002.
   Sriram V. Iyer, Pankaj Gupte, ‘Embedded Real Time Systems Programming’, Tata McGraw Hill, 2004.
3. Steve Heath, ‘Embedded System Design’, II edition, Elsevier, 2003.

Biomedical Equipment Maintenance I

EG 3105 BM

Year III
Semester I

Total : 5 hrs/week
Lecture : 2 hrs/week
Tutorial : 0 hrs/week
Practical:
Lab : 3 hrs/week

Course description:
This course deals with overall introduction, basic principle of operating and controlling according to types and technology of instruments, block diagram, circuit diagram, concept diagram, flow diagram, testing of unit and its fault finding, servicing and maintenance, calibration and adjustment, performance validation, modification, assembling and dissembling idea of each spare parts, installation techniques, preventive maintenance techniques and safety handling and operation of biomedical instruments.

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

1. Explain the basic operating principle and controlling mechanism based on various types and technology of various Explain the basic operating principles of various medical devices.
2. Describe the uses of various kinds of medical equipments.
3. Know about the various preventive techniques to prevent medical equipments from failure.
4. Perform operational validation and calibration of various biomedical equipments.
5. Perform checking, maintenance, diagnosis and testing of various medical instruments.

Hospital laboratory and medical research laboratory instruments:

Before doing these practical student should know the basic safety and handling of all biomedical maintenance tools.

Course Contents:

Theory

Unit 1. Incubator / Laboratory oven (2 hrs)

1.1 General operation and its controlling mechanism
1.2 Types of Instruments
- General incubator
- Portable incubator (battery operated)
- Refrigerated incubator

Unit 2. CO_2 incubator (2 hrs)

2.1 General operation and its controlling mechanism.
2.2 Types of instruments
- **CO_2** incubator (Based on TC sensor)
- **CO_2** incubator (Based on IR sensor)

Unit 3. Biosafety cabinet / laminar air flow (2 hrs)

3.1 General operation and its controlling mechanism.
3.2 Types of instruments

- Class 1
- Class 2
- Class 3
- Laminar air flow (Horizontal/Vertical flow),
- Clean bench type

Unit 4. Flame photometer **(2 hrs)**

4.1 General operation and its controlling mechanism.
4.2 Types of instruments

- Simple type (analog)
- Digital type of automatic filter selection
- Manual igniting type
- Auto igniting type

Unit 5. Elisa reader:- **(2 hrs)**

5.1 General operation and its controlling mechanism.
5.2 Types of instruments

- Well only (Single well; 8 well)
- Well type (96 well)
- Manual type
- Automatic with well washer (Elisa plate washer)

Unit 6. Centrifuge machine **(2 hrs)**

6.1 General operation and its controlling mechanism.
6.2 Types of instruments:-

- Simple
- Micro
- Refrigerated
- Continuous flow

Unit 7. VDRL shaker **(2 hrs)**

7.1 General operation and its controlling mechanism
7.2 Types of instruments

- Tapped resistor control type
- Electronic regulator type
- Microprocessor based control type

Unit 8. Digital colorimeter **(1 hr)**

8.1 General operation and its controlling mechanism.
8.2 Types of instruments

- Manual filter selection and manual zero setting types
- Auto filter and zero adjustment type

Unit 9. Digital balance used in laboratory **(1 hr)**

9.1 General operation and its controlling mechanism.
9.2 Types of instruments
- Strain gauge type
- MFR type

Unit10. Biochemistry analyzer (1 hr)
10.1 General operation and its controlling mechanism.
10.2 Types of instruments
- Semi auto type
- Fully automatic type

Unit 11. Advance microscopy and Imaging devices (2 hrs)
11.1 General operation and its controlling mechanism.
11.2 Types of instruments
- Simple (Monocular)
- Binocular
- Trinacular
- Inverted
- Fluorescence type

Unit 12. Autoclave (1 hr)
12.1 General operation and its controlling mechanism
12.2 Types of instruments
- Vertical
- Horizontal
- Electric and non electric type

Unit 13. PH meter (2 hrs)
13.1 General operation and its controlling mechanism
13.2 Types of instruments
- Analog types
- Digital types
- Manual calibration
- Auto calibration with automatic temperature compensation type.

Unit 14. Refrigeration system (3 hrs)
14.1 General operation and its controlling mechanism.
14.2 Vapor Compression Refrigeration system (VCRS)
14.3 Main components of VCRS
- Compressor
- Condenser
- Expansion device
- Evaporator

14.4 Types
- Positive temperature Maintaining

- Negative temperature Maintaining

Unit 15. Water bath (1 hr)

15.1 General operation and its controlling mechanism.

15.2 Types of instruments

- Thermostatic (analog)
- Digital system with water stirrer

Unit 16. Water purification plant for hospital (2 hrs)

16.1 General operation and its controlling mechanism

16.2 Types of instruments

- Glass distillation :- single, double, triple distillation
- Cartilage type :- 3stage ,5 stage (15 mega ohms Ultra pure grade water type)

Unit 17. Laboratory temperature maintaining system by Air Conditioner (2 hrs)

17.1 Concept of its operation and controlling mechanism.

17.2 General Servicing of Air conditioner

17.3 Testing of discharge and suction pressure

17.4 Leakage Testing in A.C.

Practical

Unit 1. Lab work

Study of circuit diagram /block diagram /concept diagram/ flow diagram, Fault finding and diagnosis, assembling dissembling and testing of each spare part, Calibration and modification techniques of the following equipment:

Laboratory oven/Incubator, Biosafety Cabinet/laminar flow, Flame photometer, Elisa reader, Centrifuge machine, Centrifuge machine, VDRL shaker, Microscope, Digital colorimeter, Autoclave, Medical Refrigerator/ Deep freezer, Water purification plant for hospital and Laboratory temperature maintaining system by Air Conditioner

Unit 2. Hospital exposure

Students should also visit various hospitals to gain the knowledge and skills of various biomedical instruments for operational training

References:

1. A Handbook of Biomedical Instrumentation - RS Khandapur

Project I

EG 3106 BM

Year: III
Semester: I

Total: 4 hrs/week
Lecture:
Lab:
Practical: 4 hrs/week

Final Presentation: 2 hours

COURSE OBJECTIVES: The objective of this project work is to give knowledge on project planning, researching, designing, reporting and presentation skill. Student should plan and complete an individual biomedical engineering design project under the supervision of teacher and prepare project reports

Procedures:

1.0 A detailed project proposal not exceeding 10 double-spaced pages submitted to the concerned department within two weeks of the start of the project course, the department then will consult possible supervisor for approval of proposal. This proposal will be evaluated by the supervisor. This proposal carries the 10% of project final marks and this mark will be given by the project supervisor.

2.0 A mid-term progress report not exceeding 12 double-spaced pages shall be submitted before the end of the 8th week of the term. An oral presentation will take place during the 9th week of term. This mid-term written and oral reports will account for 25% of the final marks.

3.0 Final report minimum of 25 double-spaced pages will be submitted at the end of the 15th week of the term. This report will be evaluated by the project supervisor. This report carries 40% of final marks.

4.0 An oral presentation of the final report is to be conducted during the 16th week of the term by a panel of internal examiner. The oral defence carries 25% of the final marks.

Sixth Semester

Subjects

EG3201 BM	Medical Electronics III
EG3202 BM	Bio-Medical Instrumentation II
EG3203 BM	Bio-Medical Equipment Maintenance II
EG3204 BM	Elective II 1. Cardio-Vascular and ICU Equipment 2. Medical Laboratory and Ophthalmic Equipment 3. Medical Imaging Equipment
EG3201 BM	Entrepreneurship Development
EG3205 BM	Project II

Medical Electronics III

EG 3201 BM

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

Course description:
This course is continuation of Medical Electronics-II with emphasis on advanced systems and design, case studies on different bio amplifiers and sensors using in medical electronics.

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

1. Describe the uses of various kinds of bio-potential electrodes
2. Explain the operation of various kinds of bio-potential signals from the human body.
3. Explain the operation of different types of chemical sensors.

Course Contents:

Theory

Unit 1. Amplifiers and signal processing [10 hrs]

1.1 Ideal op amps
1.2 Inverting amplifiers
- Circuit
- Equation
- Lever analogy
- Input-output characteristics
- Summing amplifier

1.3 Non inverting amplifiers
1.4 Differential amplifiers
- One-op-amp differential amplifier
- Three-op-amp differential amplifier

1.5 Comparators
1.6 Rectifiers
1.7 Logarithmic amplifiers
1.8 Integrators
1.9 Differentiators
1.10 Active filters
- Low-pass filter
- High-pass filter
- Band pass filter

1.11 Frequency response
- Open-loop gain
- Closed-loop gain
- Loop gain
- Gain-bandwidth product
- Slew rate

1.12 Offset voltage

1.13 Bias current
1.14 Input and output resistance
1.15 Phase-sensitive demodulators
1.16 Microcomputers in medical instrumentation

Unit 2. The origin of bio potentials [12 hrs]

2.1 Electrical activity of excitable cells
2.2 Volume conductor fields
2.3 Functional organization of the peripheral nervous system
2.4 The Electroneurogram (ENG)
- Field potentials of sensory nerves
- Motor nerve conduction velocity
- Reflexly evoked field potential

2.5 The Electromyogram (EMG)
2.6 The Electrocardiogram (ECG)
- Anatomy and function of the heart
- Electrical behavior of cardiac cells
- The ventricular cell
- Ventricular activation
- Body surface potentials
- Normal and abnormal cardiac rhythms
- Arrhythmias

2.7 The Electroretinogram (ERG)
- Anatomy of vision
- Electrophysiology of eye
- Spatial properties of ERG
- The electrooculogram (EOG)

2.8 The electroencephalogram (EEG)
- Introduction to the anatomy and function of the brain
- Bioelectric potentials from the brain
- The clinical EEG

Unit 3. Biopotential Electrodes [8 hrs]

3.1 The electrode –electrolyte interface

3.2 Polarization

3.3 Polarizable and nonpolarizable electrodes
- The silver/silver chloride electrode

Electrode behavior and circuit models
The electrode-skin interface and motion artifacts
Body surface recording electrodes
- Metal plate electrodes
- Suction electrodes
- Floating electrodes
- Flexible electrodes
- Internal electrodes

Microelectrodes
- Metal electrodes
- Supported metal microelectrodes
- Micropipet electrodes
- Electrical properties of microelectrodes

Electrodes for electric stimulation of tissue
Practical hints in using electrodes

Unit 4. Biopotential Amplifiers [10 hrs]

4.1 Basic requirements
4.2 The Electrocardiograph
- Functional blocks of the electrocardiograph

4.3 Problems frequently encountered
- Frequency distortion
- Saturation or cutoff distortion
- Ground loops
- Open lead wires
- Artifacts from large electric transients
- Interferences from electric devices
- Other sources of electric interference

4.4 Transient protection
4.5 Common mode and other interference reduction circuits
- Electric and magnetic field pick up
- Driven right leg system

4.6 Amplifiers for other biopotential signals
- EMG amplifier
- Amplifiers for use with glass micropipette intracellular electrodes
- EEG Amplifiers

4.7 Example of a biopotential preamplifier
4.8 Other biopotential signal processors
- Cardiotachometers
- Electromyogram integrators
- Evoked potentials and signal averagers

4.9 Cardiac monitors
4.10 Biotelemetry

Unit 5. Chemical Biosensors [5 hrs]

5.1 Electrochemical sensors
- Measurement of Ph
- Measurement of Pco2
- The Po2 electrode

5.2 Blood gas and acid base physiology
5.3 Chemical fibrosensors
- Optical measurement of pH
- Optical pH sensor
- Optical Pco2 sensor
- Optical Po2 sensor
- Design of an intravascular blood gas monitoring system
- System design considerations
  - Blood gas probe design
  - Mechanical design considerations
  - Instrument design
  - Calibration device

5.4 Ion sensitive field effect transistor (ISFET)
5.5 Immunologic ally sensitive field effect transistor (IMFET)
5.6 Non invasive blood gas monitoring
- Skin characteristics
- Pulse oximetry

Practical

1. Functional operation of a phase sensitive demodulator
2. Functional organization of the peripheral nervous system
3. Recording of action potential of an nerve axons
4. Study of anatomy of heart, brain, eye and muscles
5. Equivalent circuit for a biopotential electrode in contact with an electrolyte
6. Practical study of skin surface, micropipette, needle and micro electrodes
7. Practical hints in using electrodes in medical field
8. Computer based ECG machine, design study, Electrodes configurations
9. Design of a biopotential preamplifier
10. Practical on EEG and EMG machines
11. Study of Biotelemetry system with monitoring system

References:

1. John G. Webster, Medical Instrumentation, Application and Design: Third edition, John Wiley and sons, New York
2. Leslie Cromwell, Bio medical Instrument and measurements, Prentice Hall, Inc, Englewood cliffs

Biomedical Instrumentation II

EG 3202 BM

Year: III
Semester: II

Total: 7 hrs/week
Lecture: 3 hrs/week
Tutorial: 1 hr/week
Practical:
Lab: 3 hrs/week

Course description:
This course is designed to present the basic concepts of medical instruments, design analysis of various types of medical instruments currently using in medical, clinical and hospital field. This course deals with study, design, uses and applications of advanced biomedical equipments.

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

1. Describe the uses of various kinds of cell counters and Analyzers
2. Explain and introduce of various therapy instruments
3. Perform Checking, maintenance, diagnosis and testing of various medical and analytical instruments
4. Maintain electrical hazards and safety of different medical equipments

Course Contents:

Theory

Unit 1. Blood Cell Counters **(2 hrs)**

1.1 Introduction
1.2 Types of Blood Cells
1.3 Method of Cell Counting
1.4 Coulter Counter
1.5 Differential counting of Cells

Unit 2. Biomedical Blood Gas Analyzers **(4 hrs)**

2.1 Acid base Balance
2.2 Blood Ph Measurement
2.3 Blood pO2 Measurement
2.4 Blood pCo2 Measurement
2.5 A Complete Blood Gas Analyzer

Unit 3. Audiometers and Hearing Aids **(4 hrs)**

3.1 Hearing Aids
- Mechanism of Hearing
- Basic Audiometer
- Pure Tone Audiometer and Speech Audiometer

3.2 Calibrations of Audiometers

Unit 4. Physiotherapy and Radiotherapy Equipment **(8 hrs)**

4.1 High Frequency Heat Therapy
4.2 Short wave Diathermy
4.3 Microwave Diathermy
4.4 Ultrasonic Therapy Unit
4.5 Electro diagnostic and Therapeutic Apparatus

4.6 Nuclear Medicine Machine
4.7 Cobalt-60 Machine
4.8 Use of High Voltage X-ray Machine
4.9 Linear Accelerator Machine

Unit 5. Laboratory Based Various Diagnostic Instruments (12 hrs)

5.1 Principle of Colorimeter and Spectrophotometer
5.2 Fluorimeter
5.3 Centrifuge
5.4 Electrophoresis
5.5 Microscopy
5.6 pH Meter
5.7 Chromatography
5.8 Flame Photometer
5.9 Selective ion Electrodes based Electrolytic Analyzer
5.10 Auto Analyzer

Unit 6. Surgical Instruments (3 hrs)

6.1 Principal of Surgical Diathermy
6.2 Surgical Diathermy Machine

Unit 7. Principle and Operation of Various Biomedical Materials and Devices (5 hrs)

7.1 Orthopedic Instruments
7.2 Cardiovascular

Unit 8. Electrical safety of Medical Equipment (7 hrs)

8.1 Introduction
8.2 Physiological effects of electricity
8.3 Leakage currents
8.4 Physiological effects due to magnetic fields
8.5 Safety code for the electro-medical equipments
8.6 Basic approaches to protection against shock
8.7 Safety Aspects in Electro surgical Units
8.8 Protection of the hospital equipments
- Grounding system
- Distribution of electric power
- Isolated power system
- Ground fault circuit interrupter
- Protection: Equipment design
- Test of electrical appliances

Practical

1. Design Study of Different types of analytical lab equipment
2. Orientation of different types of audiometer system in Hospital
3. Demonstration of Surgical Instruments
4. Design Study of physiotherapy instruments
5. Study and orientation of Radiotherapy Machine
6. Design and case study of electrically safety medical Instruments

References:

1. John G. Webster, Medical Instrumentation, Application and Design: Third edition, John Wiley and sons, New York
2. Leslie Cromwell, Bio medical Instrument and measurements, Prentice Hall, Inc, Englewood cliffs
3. Onkar N. Pandey, Bio medical Electronics and Instrumentation, S.K. Kataria and sons, Publishers of Engineering and Computer books
4. Handbook of Biomedical Instrumentation, R.S Khandpur, Tata McGraw Hill

Biomedical Equipment Maintenance II

EG 3203 BM

Year: III

Semester II

Total: 7 hrs/week
Lecture : 2 hrs/week
Tutorial : 1 hrs/week
Practical:
Lab: 4 **hrs/week**

Course description:
This course deals overall introduction, basic principle of operating and controlling according to types and technology of instruments, block diagram, circuit diagram, concept diagram, flow diagram, testing of unit and its fault finding, servicing and maintenance, calibration and adjustment, performance validation, modification, assembling and dissembling idea of each spare parts, installation techniques, preventive maintenance techniques and safety handling and operation of biomedical instruments.

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

1. Explain the basic operating principle and controlling mechanism based on various types and technology of various Explain the basic operating principles of various medical devices.
2. Describe the uses of various kinds of medical equipments.
3. Know about the various preventive techniques to prevent medical equipments from failure.
4. Perform operational validation and calibration of various biomedical equipments.
5. Perform checking, maintenance, diagnosis and testing of various medical instruments.

Course Contents:

Theory

Unit 1. Sphygmomanometer (2 hrs)

1.1 General operation and its controlling mechanism.
1.2 Types of instruments:-
- Mercury type
- Dial gauge type
- Digital with manual pumping
- Digital with auto pumping and auto pulse rate type

Unit 2. X ray machine (2 hrs)

2.1 General operation and its controlling mechanism
2.2 Types of instruments
- Analog control panel type
- Digital control panel type
- Concept of C.R.
- Concept of D.R.

Unit 3. Suction aspirator (2 hrs)

3.1 General operation and its controlling mechanism.
3.2 Types of instruments**:-**
- Manual suction type (Hand or foot operated) non electric
- Electric type :- Simple analog type, digital flow control type

Unit 4. Oxygen concentrator (1 hr)

4.1 General operation and its controlling mechanism.

4.2 Types of instruments

- Simple Handy type
- Large capacity with fully automatic type
- Microprocessor based

Unit 5. Anesthesia machine (1 hr)

5.1 General operation and its controlling mechanism.

5.2 Types of instruments

- Analog hand control type
- Digital with semi automatic , fully automatic

Unit 6. ECG machine (1 hr)

6.1 General operation and its controlling mechanism.

6.2 Types of instruments

- Analog control with manual operated type
- Digital auto lead selector with data recording type

Unit 7. Nebulizer pump (1 hr)

7.1 General operation and its controlling mechanism

7.2 Types of instruments**:-**

- Portable
- Heavy duty large compressor type

Unit 8. Ultrasound machine (2 hrs)

8.1 Basic theory of operation and its controlling mechanism

8.2 Hospital visit for demonstration.

8.3 Types of instruments

- portable
- Non portable

Unit 9. Hemodylysis machine (2 hrs)

9.1 General operation and its controlling mechanism.

9.2 Types of instruments

- Basic type
- Advance with digital control type

9.3 Mechanism of Dialyzer

Unit 10. Endoscopies (1 hr)

10.1 General operation and its controlling mechanism.

10.2 Types of instruments

- Simple portable
- Advance with fully auto control

Unit 11. Ventilator machine (1 hr)

11.1 General operation and its controlling mechanism.

11.2 Types of instruments

- Analog control with manual operated type
- Digital control type

Unit 12. Defibrillator (1 hr)

12.1 General operation and its controlling mechanism.

12.2 Types of instruments

- Analog control type
- Digital control type

Unit] 13. Dental set equipment (1 hr)

13.1 General operation and its controlling mechanism.

13.2 Types of instruments

- Mechanical tools type
- Electric operated tools type

Unit 14. TMT machine (1 hr)

14.1 General operation and its controlling mechanism

14.2 Types of instruments

- Analog control with manual operated type
- Digital control type

Unit 15. Phototherapy instruments:- (4 hrs)

15.1 General operation and its controlling mechanism.

15.2 Types of instrument

- Mechanical types of instrument
- Electric control type
- Programmable control type

15.2 Circuit diagram /block diagram /concept diagram/ flow diagram

fault finding and diagnosis , assembling , dissembling and testing idea of each spare

Unit 16. OT Equipment (2 hrs)

16.1 General concept of OT lights

16.2 Types of instruments

- Fixed intensity
- Electric control type
- Electronic control type

Unit 17. Lithotripter (1 hrs)

17.1 General concept of lithotripter machine

17.2 Lithotripsy Circuit diagram /block diagram /concept diagram/ flow diagram

Unit 18. CT SCAN (1 hr)

17.1 General operation and its controlling mechanism

Unit 19. MRI (1 hr)

17.1 General operation and its controlling mechanism

Practical

Unit 1. Lab work

Study of circuit diagram /block diagram /concept diagram/ flow diagram, Fault finding and diagnosis, assembling dissembling and testing of each spare part, Calibration and modification techniques of the following equipment:

Sphygmomanometer, X ray machine, Suction aspirator, Oxygen concentrator, Anesthesia machine, ECG machine, Nebuliser pump, Ultrasound machine, Hemodylysis machine, Endoscopies, Ventilator machine, Defibrillator, Dental set equipments, TMT machine, Phototherapy instruments, CT SCAN, MRI, OT Equipment and Lithotripter

Unit 2. Hospital Exposure

Students should also visit various hospitals to gain the knowledge and skills of various biomedical instruments for operational training.

References:

1. A Handbook of Biomedical Instrumentation - RS Khandapur

Cardio-Vascular and ICU Equipment

Elective II (EG3204BM)

Year: III
Semester: II

Total : 7 hrs/week
Lecture: 3 hrs/week
Tutorial: 1 hr/week
Practical:
Lab: 3 hrs/week

Course description:
To present the basic concepts of medical instruments, design analysis of various types of medical instruments currently using in medical, clinical and hospital field. This course deals with study, design, uses and applications of advanced biomedical equipments.

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

1. Describe the uses of Defibrillators
2. Explain and introduction of Various Drug Delivery System
3. Check, maintenance, diagnosis and testing of Anesthesia and Ventilators
4. Design Concept of various Patient Monitoring and Central Monitors

Course Contents:

Theory

Unit 1. Cardiac Pacemakers **(6 hrs)**

1.6 Introduction
1.7 Need for Cardiac Pacemaker
1.8 Implantable Pacemaker
1.9 Development in Implantable Pacemakers
1.10 Pacing System Analyzer

Unit 2. Cardiac Defibrillators **(4 hrs)**

2.6 Introduction
2.7 Need for a Defibrillator
2.8 DC Defibrillator
2.9 Implantable Defibrillators
2.10 Cardioverter Defibrillator

Unit 3. Cardiac Output Measurement **(4hrs)**

3.1 Indicator Dilution Method
3.2 Dye Dilution Method
3.3 Measurement of Continuous Cardiac Output Derived from the Aortic Pressure Waveform
3.5 Impedance Technique
3.6 Ultrasound Method

Unit 4. Pulmonary Function Analyzers **(8 hrs)**

4.10 Introduction
4.11 Pulmonary Function Measurements
4.12 Spirometry
4.13 Pneumotachometers
4.14 Measurements of Volumes
4.15 Pulmonary Function Analyzers
4.16 Respiratory Gas Analyzers

Unit 5. Ventilators **(10 hrs)**

5.1 Mechanism of Respiration
5.2 Artificial Ventilation
5.3 ICU Ventilators
5.4 Types of Ventilators
5.5 Ventilators Terms
5.6 Classification of Ventilators
5.7 Pressure Volume flow Diagrams
5.8 Modern Ventilators
5.9 High Frequency Ventilators
5.10 Humidifiers, Nebulizers and Aspirators

Unit 6. Anaesthesia Machines **(4 hrs)**

6.1 Need for Anesthesia
6.2 Anesthesia Machine
6.3 Electronics in Anesthesia Machine

Unit 7. Automated Drug Delivery System **(3 hrs)**

7.1 Infusion Pumps
7.2 Components of Drugs Infusion Systems
7.3 Examples of Typical Infusion Pumps

Unit 8. Patient Monitoring Systems **(6 hrs)**

8.1 Introduction: System Concept
8.2 Cardiac Monitor
8.3 Bed side ICU Patient Monitoring Systems
8.4 Central Monitors
8.5 Cardiac Arrythmia Monitors
8.6 Ambulatory Monitoring Instruments
8.7 Methods of Monitoring Foetal Heart Rate

Practical

1. Design Study of Different types of Pace makers and Defibrillators
2. Orientation of different types of Drugs Delivery Systems
3. Demonstration of Ventilators Machine
4. Demonstration of Anesthesia Machine
5. Study and orientation of Patient Monitoring Systems
6. Design and case study of Central Monitors

References:

1. John G. Webster, Medical Instrumentation, Application and Design: Third edition, John Wiley and sons, New York
2. Leslie Cromwell, Bio medical Instrument and measurements, Prentice Hall, Inc, Englewood cliffs
3. Onkar N. Pandey, Bio medical Electronics and Instrumentation, S.K. Kataria and sons, Publishers of Engineering and Computer books
4. Handbook of Biomedical Instrumentation, R.S Khandpur, Tata McGraw Hill

Medical Laboratory and Ophthalmic Equipment

Elective II (EG 3204 BM)

Year: III
Semester: II

Total : 7 hrs
Lecture: 3 hrs
Tutorial: 1 hr
Practical:
Lab: 3 hrs

Course description:
To present the basic concepts of medical instruments, design analysis of various types of medical instruments currently using in medical, clinical and hospital field. This course deals with study, design, uses and applications of advanced biomedical equipments.

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

1. Describe the uses of Diagnostic Laboratory Equipments
2. Explain and introduction of various Clinical Based Laboratory Instruments
3. Check, maintenance, diagnosis and test of Blood Gas Analyzer and Cell Counter
4. Design Concept of various Ophthalmology Instruments

Course Contents:

Theory

Unit 1. Diagnostic Laboratory Instruments (2 hrs)

1.6 Introduction
1.7 Principle of Colorimetry and Spectrophotometry
1.8 Colorimeter and Spectrophotometer
1.9 Mass Spectrophotometer

Unit 2. Clinical Laboratory Equipment (4hrs)

2.10 Medical Diagnosis with Chemical Tests
2.11 Automated Biochemical Analysis Systems
2.12 Clinical Flame Photometer

Unit 3. Laboratory Based Instrumental Methods of Analysis (12 hrs)

3.1 The Ultracentrifuge
3.2 Fluorimeter
3.3 UV Absorption Spectroscopy
3.4 Electron Spin Resonance Spectroscopy
3.5 NMR Spectro- Microscopy
3.6 Microscopy
3.7 Chromatography
3.8 X-Ray Crystallography
3.9 Selective ion Electrodes based Electrolytic Analyzer
3.10 Auto Analyzer

Unit 4. Blood Gas Analyzers and Blood Cell Counters (10 hrs)

4.1 Principle of Measurements of Blood Gas Analyzers
4.2 Clinical Applications of Blood Gas Analyzers

4.3 A Complete Blood Gas Analyzer
4.4 Methods of Blood Counting
4.5 Types Of Blood Cells
4.6 Coulter Counter
4.7 Micro Cell Counters

Unit 5. Measuring and Monitoring System of Eye (5hrs)

5.1 Anatomy of Vision
5.2 Origin of Bioelectric signals
5.3 Electrodes for ERG
5.4 Electrodes for EOG
5.5 Electrophysiological Tests
5.6 Electroretinogram
5.7 Electrooculogram
5.8 Eye Pressure

Unit 6. Ophthalmology Instruments (10 hrs)

1. Ophthalmoscope
2. Direct Ophthalmoscopy
3. Indirect Ophthalmoscopy
4. Retinoscope
5. Keratometer
6. Intraocular Pressure
7. Tonometer for Eye Pressure Measurement
8. Identation Tonometer
9. Applanation Tonometer

Unit 7. Advanced Method in Ophthalmology (2hrs)

7.1 Ultrasound in Ophthalmology
7.2 Components of a Typical Laser System in Ophthalmology

Practical

1. Design Study of Blood Gas Analyzer and Cell Counter
2. Orientation of different types of Laboratory Based Instruments and their Analysis
3. Demonstration of Electrodes for Bio potential signals of Eye
4. Demonstration of ERG and EOG
5. Study and orientation of different Ophthalmoscopes
6. Design and case study of Retinoscope and Keratometer

References:

1. John G. Webster, Medical Instrumentation, Application and Design: Third edition, John Wiley and sons, New York
2. Leslie Cromwell, Bio medical Instrument and measurements, Prentice Hall, Inc, Englewood cliffs
3. Onkar N. Pandey, Bio medical Electronics and Instrumentation, S.K. Kataria and sons, Publishers of Engineering and Computer books
4. Handbook of Biomedical Instrumentation, R.S Khandpur, Tata McGraw Hill

Medical Imaging Equipment

Elective-II (EG 3204 BM)

Year: III
Semester: II

Total : 7 hrs
Lecture: 3 hrs
Tutorial: 1 hr
Practical:
Lab: 3 hrs

Course description:
To present the basic concepts of medical instruments, design analysis of various types of medical instruments currently using in medical, clinical and hospital field. This course deals with study, design, uses and applications of advanced biomedical equipments.

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

1. Describe the uses of Digital Imaging Equipment
2. Explain and introduction of various Diagnostic Imaging Equipment
3. Check, maintenance, diagnosis and test of X-Ray, Ultrasound machine
4. Design Concept of CT- Scan, MRI, Gamma Camera.

Course Contents:

Theory

Unit 1. X-Ray Equipment **(6 hrs)**

1.1 X-ray tubes
1.2 X-ray control and indicating equipment
1.3 Filters and grids
1.4 Different types of X-ray equipment (portable, fluoroscopy, mammography etc.)

Unit 2. Digital Imaging Equipment **(3hrs)**

2.1 Introduction
2.2 Digital Radiography
2.3 PACS (Picture Archiving and Communicating System)

Unit 3. Computer Tomography (CT): **(8 hrs)**

3.1 Basic Principles of CT
3.2 Generation of CT
3.3 System Components
3.4 Recent Advances in CT

Unit 4. Magnetic Resonance Imaging (MRI): **(15 hrs)**

4.1 Fundamental Concepts
4.2 Principles of Parameters or MRI
4.3 Basic Principles of MR Imaging and Related Parameters
4.4 Contrast Enhanced MRI
4.5 Artifacts in MRI
4.6 MR Scanners

4.7 Clinical Application

Unit 5. Ultrasonography (USG): (10 hrs)

5.1 Physics of Ultrasound
5.2 Construction and Properties of Ultrasound Transducer
5.3 Ultrasonic Beam
5.4 Modes of Ultrasound Imaging
5.5 Doppler Ultrasound
5.6 Clinical Application
5.7 Contrast Media in Ultrasound Imaging
5.8 Recent Advances in Ultrasonic Equipment
5.9 Biological Effects of Ultrasound

Unit 6. Nuclear Medicine Equipment (3hrs)

6.1 Cobalt 60 Machine
6.2 Medical Linear Accelerator Machine
6.3 Gamma Camera

Practical

1. Design Study of Ultrasound Machines
2. Orientation of different types of Diagnostic Imaging Equipment
3. Demonstration of CT-Scan and MRI Machine
4. Demonstration of Gamma Camera
5. Study and orientation of different types of X-Ray Machines
6. Design and case study of CT-Scan and MRI Machine

References:

1. John G. Webster, Medical Instrumentation, Application and Design: Third edition, John Wiley and sons, New York
2. Leslie Cromwell, Bio medical Instrument and measurements, Prentice Hall, Inc, Englewood cliffs
3. Onkar N. Pandey, Bio medical Electronics and Instrumentation, S.K. Kataria and sons, Publishers of Engineering and Computer books
4. Handbook of Biomedical Instrumentation, R.S Khandpur, Tata McGraw Hill

Entrepreneurship Development

EG 3201 SH

Year: III
Semester: II

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

Course description:

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

Course objectives:

After completion of this course students will be able to:

1. Understand the concept of business and entrepreneurship
2. Explore entrepreneurial competencies
3. Analyze business ideas and viability
4. Learn to formulate business plan with its integral components
5. Manage small business

Course contents:

Theory

Unit 1: Introduction to business & entrepreneurship (9 hrs)

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 hrs)

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 hrs)

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 hrs)**

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 hrs)**

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

Practical

Unit 1: Overview of business & entrepreneurship **(2 hrs)**

1. Collect business information through interaction with successful entrepreneur

Unit 2: Exploring and developing entrepreneurial competencies **(2 hrs)**

1. Generate innovative business ideas

Unit 3: Product or service identification and selection **(2 hrs)**

1. Analyze business ideas using SWOT method

Unit 4: Business plan formulation **(22 hrs)**

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 hrs)**

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

Text books:

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

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

Reference book:

Entrepreneur's Handbook, Technonet Asia, 1981.

Project-II

EG 3205 BM

Year: III
Semester: II

Total: 8 hrs
Lecture:
Tutorial:
Practical: 8 hrs
Lab:

Final Presentation: 2 hours

COURSE OBJECTIVES: The objective of this project work is to give knowledge on project planning, researching, designing, reporting and presentation skill. Student should plan and complete an individual biomedical engineering design project under the supervision of teacher and prepare project reports

Procedures:

1.0 A detailed project proposal not exceeding 10 double-spaced pages submitted to the concerned department within two weeks of the start of the project course, the department then will consult possible supervisor for approval of proposal. This proposal will be evaluated by the supervisor. This proposal carries the 10% of project final marks and this mark will be given by the project supervisor.

2.0 A mid-term progress report not exceeding 12 double-spaced pages shall be submitted before the end of the 8th week of the term. An oral presentation will take place during the 9th week of term. This mid-term written and oral reports will account for 25% of the final marks.

3.0 Final report minimum of 25 double-spaced pages will be submitted at the end of the 15th week of the term. This report will be evaluated by the project supervisor. This report carries 40% of final marks.

4.0 An oral presentation of the final report is to be conducted during the 16th week of the term by a panel of external examiner. The oral defence carries 25% of the final marks.

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

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