CURRICULUM

DIPLOMA

Mechanical Engineering

(**Three year program-semester system**)

Council for Technical Education and Vocational Training

Curriculum Development Division

Sanothimi, Bhaktapur

2007(Revised in 2014)

Table of Content

1. Introduction:

Mechanical Engineering is one of the prominent and popular disciplines within engineering. Many people in the developed countries, developing countries and under developed countries have given emphasis for the broader application of mechanical engineering. This field has been helping the world for the mechanical development and it has been creating wage and self-employment opportunities both in public and private sectors. This curriculum is designed with the purpose of producing the middle level technical workforce equipped with knowledge and skills related to the field of mechanical 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 electronics engineering.

2. Curriculum title:

Diploma in Mechanicals Engineering (DME)

3. Objectives:

This curriculum has following objectives:

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

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

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

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

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

4. Program description:

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

5. Duration:

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

6. Target group:

The target group for this program 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 is maximum 48(Forty eight) in a batch.

8. Target location:

The target location is all over Nepal.

9. Entry criteria:

- SLC or equivalent with English, Science, and Mathematics or related TSLC
- Should pass the entrance examination.
- Physically fit for the program.

10. Selection:

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

11. Medium of instruction:

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

12. Pattern of attendance:

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

13. Teacher and student ratio:

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

14. Teachers and demonstrators:

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

15. Mode of education:

There will be inductive and deductive mode of education.

16. Instructional media and materials:

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

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

17. Teaching learning methodologies:

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

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

18. 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 final examination will be allocated for theoretical components of a subject.
- The final semester examinations of all theory components will be conducted through written tests.
- Generally the method of continuous assessment will be adopted for practical components.
- In some cases semester final examinations are also conducted for practical components as per the needs.
- The student who fails in the internal assessment will not be allowed to sit in the semester final examination and will also not allowed continuing the following semester study.

19. Provision of back paper:

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

20. 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.

21. Pass marks:

The students must secure minimum 40% marks both in theory and practical (Lab). Moreover, the students must secure minimum40% marks in the internal assessment and 40% in the final semester examination of each subject to pass all subjects offered in each semester.

22. Grading system:

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

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

23. 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 Mechanical Engineering**.

24. Career path:

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

25. Curriculum and credits:

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

26. Subjects codes

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

EG	XXXX	XX

→ Course Serial Number

→ Semester

→ Year

→ Engineering

Offering Departments:

AE: Automobile Engineering

AR: Architecture Engineering

CE: Civil Engineering

CT: Computer Engineering

EE: Electrical Engineering

EX: Electronics Engineering

ME: Mechanical Engineering

MG: Management

SH: Science and Humanities
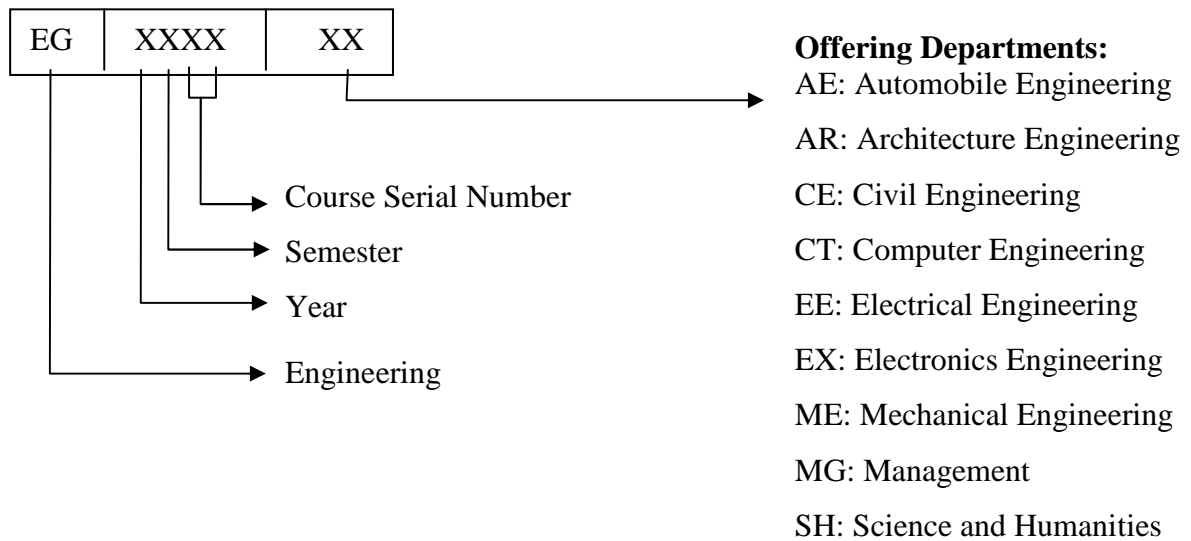
27. Provision of elective subjects:

There will be a provision of an elective subject in the final semester of this curriculum. Some subjects of mechanical engineering discipline are offered here with the provision of the elective viz; Product design, Power generation engineering, Industrial engineering and Tools, jigs, fixtures &die design.

29. Curriculum structure (Diploma in Mechanical Engineering)

DIPLOMA IN MECHANICAL ENGINEERING

YEAR: I   SEMESTER - I

S.N.	Code No.	Subject	Mode				Total Hours	Theory			Practical			Total Marks	Remarks
			L	T	P	Lab		Assmt. Marks	Final Marks	Time Hours	Assmt. Marks*	Final Marks	Time Hours		
1	EG 1101SH	Communication Nepali	2				2	10	40	1.5				50	*Continuous assessment
2	EG 1102SH	Communication English	2				2	10	40	1.5				50	
3	EG 1103SH	Engineering Mathematics I	4	1			5	20	80	3				100	
4	EG 1104SH	Engineering Physics I	3	1		2	6	20	60	3	10	10	1.5	100	
5	EG 1105SH	Engineering Chemistry I	3	1		2	6	20	60	3	10	10	1.5	100	
6	EG 1106ME	Engineering Drawing I			4		4				60	40	4	100	
7	EG 1107ME	Workshop Technology I	4		11		15	20	80	3	180	120	6	400	
		TOTAL	18	3	15	4	40	100	360		280	160		900	

YEAR: I   SEMESTER II

S.N.	Code No.	Subject	Mode				Total Hours	Theory			Practical			Total Marks	Remarks
			L	T	P	Lab		Assmt. Marks	Final Marks	Time Hours	Assmt. Marks*	Final Marks	Time Hours		
1	EG 1201SH	Engineering Mathematics II	3	1			4	20	80	3				100	*Continuous assessment
2	EG 1202SH	Engineering Physics II	3	1		2	6	20	60	3	10	10	1.5	100	
3	EG 1203 SH	Engineering Chemistry II	3	1		2	6	20	60	3	10	10	1.5	100	
4	EG 1204ME	Engineering Drawing II			4		4				60	40	4	100	
5	EG 1206 ME	Material Science	3			1	4	20	60	3	10	10	1.5	100	
6	EG 1208 ME	Workshop Technology II	4		8		12	20	80	3	120	80	6	300	
7	EG 1208 EE	Basic Electrical Engineering	3			1	4	20	60		10	10	1.5	100	
		TOTAL	19	3	12	6	40	120	400		220	160		900	

DIPLOMAIN MECHANICAL ENGINEERING

S.N.	Code No.	Subject	Mode				Total Hours	DISTRIBUTION OF MARKS						Total Marks	Remarks
								Theory			Practical				
			L	T	P	Lab		Assmt. Marks	Final Marks	Time Hours	Assmt. Marks*	Final Marks	Time Hours		
1	EG 2101EX	Basic Electronics Engineering	3			1	4	20	60	3	10	10	1.5	100	*Continuous assessment
2	EG 2103ME	Thermal Engineering I	4	1		1	6	20	60	3	10	10	1.5	100	
3	EG 2104 ME	Manufacturing Technology I	4		10		14	20	80	3	120	80	6	300	
4	EG 2105 ME	Machine Drawing	0		4		4				60	40	4	100	
5	EG 2106ME	Metrology	2			1	3	20	60	3	10	10	1.5	100	
6	EG 2107CT	Computer Applications	2			2	4	10	40	1.5	30	20	2	100	
7	EG 2109ME	Engineering Mechanics	3	1		1	5	20	60	3	10	10	1.5	100	
		TOTAL	**18**	**2**	**14**	**6**	**40**	**120**	**380**		**250**	**180**		**900**	

S.N.	Code No.	Subject	Mode				Total Hours	DISTRIBUTION OF MARKS						Total Marks	Remarks
								Theory			Practical				
			L	T	P	Lab		Assmt. Marks	Final Marks	Time Hours	Assmt. Marks*	Final Marks	Time Hours		
1	EG 2201ME	Computer Graphics (Auto CAD)	1			3	4				60	40	4	100	*Continuous assessment
2	EG 2202ME	Thermal Engineering II	4	1		1	6	20	60	3	10	10	1.5	100	
3	EG 2203ME	Manufacturing Technology II	4		9		13	20	80	3	120	80	6	300	
4	EG 2204ME	Machine Element & Mechanism	3			1	4	20	60	3	10	10	1.5	100	
5	EG 2205ME	Strength of Materials	3	1		1	5	20	60	3	10	10	1.5	100	
6	EG 2206ME	Fluid Mechanics and Machines	3	1		1	5	20	60	3	10	10	1.5	100	
7	EG 2207ME	Industrial Management	3				3	20	80	3				100	
		TOTAL	**21**	**3**	**9**	**7**	**40**	**120**	**400**		**220**	**160**		**900**	

DIPLOMA IN MECHANICAL ENGINEERING

YEAR: III · SEMESTER I

S.N.	Code No.	Subject	L	T	P	Lab	Total Hours	Assmt. Marks (Theory)	Final Marks (Theory)	Time Hours (Theory)	Assmt. Marks* (Practical)	Final Marks (Practical)	Time Hours (Practical)	Total Marks	Remarks
1	EG 3101ME	Basic Automobile Engineering	3		4		7	20	80	3	60	40	4	200	
2	EG 3102ME	Advanced Manufacturing Technology	4		8		12	20	80	3	120	80	6	300	
3	EG 3103ME	Industrial Attachment	0		3		3	0	0		60	40	4	100	
4	EG 3104ME	Maintenance Engineering	2		2		4	10	40	1.5	30	20	3	100	
5	EG 3106ME	Fundamentals of Hydraulics and Pneumatics	3		0	1	4	20	60	3	10	10	1.5	100	*Continuous assessment
6	EG 3107ME	Machine Design, Estimating and Costing	4	1	0		5	20	80	3				100	
7	EG 3108ME	Project I			5		5				60	40	4	100	
		TOTAL	15	1	22	1	40	90	340		340	230		1000	

YEAR: III · SEMESTER II

S.N.	Code No.	Subject	L	T	P	Lab	Total Hours	Assmt. Marks (Theory)	Final Marks (Theory)	Time Hours (Theory)	Assmt. Marks* (Practical)	Final Marks (Practical)	Time Hours (Practical)	Total Marks	Remarks
1	EG 3201ME	Basic Refrigeration and Air-conditioning	4			2	6	20	80	3	30	20	3	150	
2	EG 3202ME	Renewable Energy Technology	4			2	6	20	80	3	30	20	3	150	*Continuous assessment
3	EG 3203ME	Industrial Hygiene and Safety	3				3	20	80	3				100	
4	EG 3201 MG	Entrepreneurship Development	3		2		5	20	60	3	10	10	1.5	100	
5	EG 3207ME	Project II			12		12				180	120	6	300	
6	EG 3208 ME	Elective (One of the followings)	4		4		8	20	80	3	20	80	3	200	
		A: Product Design													
		B: Power Generation Engineering													
		C: Industrial Engineering													
		D. Tools, Jigs, Fixtures and Die Design													
		TOTAL	18		18	4	40	100	380		270	250		1000	

First Year
(First and Second Semester)

First Semester

Subjects:

1. EG 1101SH   Communication Nepali
2. EG 1102 SH   Communication English
3. EG 1103 SH   Engineering Mathematics I
4. EG1104 SH   Engineering Physics I
5. EG1105 SH   Engineering Chemistry I
6. EG1106 ME   Engineering Drawing I
7. EG1107 ME   Workshop Technology I

कम्युनिकेसन नेपाली

ई.जी. ११०१ एस.एच.

वर्ष : प्रथम

सेमेस्टर :प्रथम

जम्माः २ घण्टा ⁄ हप्ता

प्रवचनः २ घण्टा ⁄ हप्ता

पूर्णांक : ५०

कोर्षको परिचय

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

कोर्षको उद्देश्य :

यस पाठ्यांशको अध्ययनबाट विद्यार्थीहरूले निम्नलिखित भाषिक क्षमता विकास गर्न सक्नेछन्ः-

१ आफ्नो व्यावसायिक कार्य क्षेत्रमा प्रभावकारी सञ्चार गर्न

२ आफ्नो व्यवसायसँग सम्बन्धित विविध लेखन सीप प्रदर्शन गर्न

३ कार्य सम्पादनमा आवश्यक परिस्थितिजन्य संवाद गर्न ।

पाठ्यांशको विषयवस्तु

एकाइ १:संचारात्मक नेपाली भाषा   (७)

१.१ भाषिक भेदको परिचय

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

१.२ दैनिक कार्यमा प्रयोग हुने भाषाको ज्ञान र प्रयोग

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

एकाइ २: लेखन सीप   (१८)

२.१ बोध, शब्दनिर्माण र शब्दभण्डारको ज्ञान र अभ्यास

क) शब्द भण्डार निर्माण र अभ्यास

- उपसर्ग
- प्रत्यय, (कृत् तथा तद्धित)

- समास
- प्राविधिक तथा पारिभाषिक शब्दहरूको ज्ञान र प्रयोग

ख) प्राविधिक/पारिभाषिक शब्दहरूको शब्दस्रोत,

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

२.२ बुँदाटिपोट, सङ्क्षेपीकरण

- बुँदा लेखन
- सारांश लेखन

२.३ *अनुच्छेद लेखन / प्रतिवेदन लेखन*

२.४ निबन्ध लेखन

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

२.६ संवाद लेखन

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

३.१ कृति परिचयको ढांचा :

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

३.२ कृतिहरू:

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

सिकाई सामग्रीहरू

- त्रि. वि. पाठ्यक्रम विकास केन्द्र, अनिवार्य नेपाली शिक्षण निर्देशन, काठमाण्डौं
- लालानाथ सुवेदी, इन्जिनीयरिङ नेपाली विद्यार्थी पुस्तक भण्डार, भोटाहिटी, काठमाण्डौं ।

- लालानाथ सुवेदी, नेपाली व्याकरण, बोध ⁄ रचना (सम्बन्धित अंश मात्र) विद्यार्थी पुस्तक भण्डार, भोटाहिटी, काठमाण्डौं ।

- गोरखापत्र, कान्तिपुर आदि 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

Year: **I**

Semester: I

Total: 2 hour/week

Lecture: 2 hours/week

Tutorial: hours/week

Practical: hours/week

Lab: hours/week

Course Description:

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

Course Objectives:

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

Course Contents:

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

      1.1.   Define with examples:
- Phonemes
- Morphemes

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

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

      1.4.   Spellings   [1]
- British and American English spelling

Unit 2.   **Introduction to grammatical units with examples:**

      2.1   Grammatical units   [2]
- The word

- The phrase
- The clause
- The sentence

2.2   Types of sentence   [2]
- Forms
- Function

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

Unit 3.   Reading: **[2]**
- Reading comprehension
- Defining trade related terminologies

Unit 4.   Writing skills in English: **[12]**
4.1.   Writing paragraphs
4.2.   Writing dialogues
4.3.   Writing precies/summariie
4.4.   Writing letters
- Job application with resumes
- Leave application
- Business letters
- Orders
- Complains

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

Learning materials:

1. Poudel, R.C., A Manual to Communicative English, K.P.Pustak Bhandar, Kathmandu, 1956/57.
2. Shah,B.L.,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. Blundell, Jon, Higgens, Jonathan & Middlemiss, Nigel, Function of English, Oxford University Press
8. Naterop, Jean, Reuell, Rod, Telephoning in English, Cambridge University Press,
9. ……., Better English Pronunciation, Cambridge University Press, New edition
10. …….. Link English, Central Department of English, Tribhuvan University
11. References to be selected by the related lecturer(s) from among the texts available in the market that meet the content needs of this subject.
12. The related institute may develop its own textbook and approve from the related authority so as to have a prescribed textbook of this subject.

Engineering Mathematics I
EG 1103 SH

Year: I

Semester: I

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

Course Description:

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

Course Objectives:

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

Course Contents:

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

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

      1.2.   Trigonometric equations:
- Periodicity of trigonometric functions
- General solutions of the following equations:
  - $\sin x = k$, $\cos x = k$ and $\tan x = k$ and using trigonometric equations.

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

      1.4.   Properties of triangles:
- The sin law
- The cosine law
- The projection law

- The half angle formulae
- The area of a triangle
- The encircles and ex-circles of a triangle

Coordinate Geometry: [12]

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

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

    2.3.   Circle:
- Standard equation
- General form
- Tangents and normal

    2.4.   Parabola:
- Standard equation
- Tangents and normal

Unit 2.   Algebra: [12]

    3.1.   Progressions:
- A.P., G.P. and H.P.

    3.2.   Permutations and combinations

    3.3.   The binomial theorem for any index

    3.4.   Series:
- Exponential & logarithmic

    3.4.   Equations:
- Quadratic & polynomial

Unit 3.   Set relation and function: [8]

    4.1   Idea of set, set notations, set operations,

    4.2.   Venn diagram,

    4.3.   The set of real members and its subsets.

    4.4.   The absolute value of a real number.

    4.5.   Functions- algebraic and transcendental.

4.6.   Graphs of simple function.

Unit 4.   Calculus: [16]
5.1.   Limit of community.
5.2.   Derivatives from definition of simple functions like:
- xn, (ax+b)n, sin (ax +b), e^{ax}, a^x, and log x.
5.3.   Derivatives of sum, difference, product and quotient of functions, chain rule, parametric and   implicit functions
5.4.   Integration, Rules for finding integrals.
5.5.   Standard integrals and their uses.
5.6.   Definite integrals- definition and evaluation.
5.7.   Definite integral as limit of sum.

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

Engineering Physics I
EG 1104 SH

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

Course Description:

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

Course Objectives:

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

Course Contents:

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

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

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

1.4. Gravitation:
- Newton's law of universal gravitation.
- Gravitational attraction of earth:
- Acceleration due to gravity.
- Variation of acceleration due to gravity with height, depth, and latitude.
- Motion of satellites:
  - Orbital velocity,
  - Geostationary satellites.
- Weightlessness, motion of lift

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

1.6. Simple harmonic motion (SHM):
- Simple harmonic motion and its characteristics.
- Energy of simple harmonic motion.
- Simple pendulum.

1.7. Equilibrium and rotation of rigid bodies:
- Forces in equilibrium, torque, couple, C.G. and center of mass.
- Moment of inertia.
- Angular momentum and
- Its conservation.
- Work done by torque.

b. **Heat and thermodynamics:** [12]

2.1 Heat Phenomena and Quantity of Heat:
- Concept of temperature and thermal equilibrium.
- Temperature of scales.
- Quantity of heat gain or heat loss.
- Specific heat capacity.
- Determination of heat capacity by the method of mixtures.
- Newton's law of cooling.

2.2 Change of Phase:
- States of matter.
- Fusion and vaporization.
- Evaporation and boiling.
- Specific latent heats of fusion and vaporization.
- Melting and boiling points.
- Introduction of Saturated and unsaturated vapors.
- Variation of melting and boiling points with pressure.
- Triple point and critical point.

- Dew point and humidity.

   2.3   Thermal Expansion:
- Coefficients of linear, superficial and cubical expansions of solid and relation between them.
- Cubical expansion of liquids.
- Real and apparent expansions.
- Variation of density due to expansion.

   2.4   Heat Transfer:
- Thermal conduction and thermal conductivity
- Convection
- Radiation.
- Perfectly black body.
- Stefan-Boltzman's law of black body radiation.

   2.5   Gas Laws:
- Boyle's law,
- Charles law and ideal gas equation.
- Universal gas constant,
- Avogadro number and Boltzman constant.
- Volume and pressure coefficients of ideal gas.

   2.6   Kinetic Theory of Gases:
- Pressure in an ideal gas from molecular point of view.
- RMS speed, mean energy of a molecule of an ideal gas.

   2.7   Thermodynamics:
- First law of thermodynamics.
- Different thermodynamic process:
  - Adiabatic (equation and work done)
  - isothermal (equation and work done)
  - Isobaric and Isochoric
- Specific and molar heat capacities for different thermodynamic processes, $C_p - C_v = R$.
- Second law of thermodynamics.
- Efficiency of heat engine

c.   **Optics:**   **[8]**

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

   3.2   Refraction by plane Surfaces:
- Review of refraction by plane surfaces.

- Lateral shift
- Total internal reflection, critical angle
- Real and apparent depth.

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

3.4 Refraction through Prisms and Lenses:
- Deviation due to prism and minimum deviation.
- Refraction through lenses.
- Lens maker equation.
- Lens formula for converging lens, diverging lens
- Formation of images by lenses.
- Combination of lenses.
- Magnification,
- Power of a lens.

d. **Magnetism:** [10]

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

4.2. Earth's Magnetism:
- Horizontal and vertical components of earth's magnetic field.
- Declination and angle of dip.

4.3. Magnetic properties of materials;
- Molecular and modern theory of magnetism.
- Para magnetism and diamagnetism:
  - Permeability and
  - Susceptibility.
- Intensity of magnetization.
- Domain theory of ferromagnetism.
- Hysterisis

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

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

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

Engineering Chemistry I
EG 1105 SH

Year: I
Semester: I

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

Course Description:

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

Course Objectives:

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

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

Course Content:

Unit: 1:   Language of chemistry: [4]
      1.1   Symbol:
- Definition
- Significance (qualitative and quantitative)

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

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

Unit: 2:   **General chemistry:**   **[8]**

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

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

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

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

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

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

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

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

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

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

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

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

3.7   Atomic structure:
- Subatomic particles (electron, proton and neutron)
- Classical α - rays scattering experiment
- Rutherford's atomic model and its drawbacks

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

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

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

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

12. To standardize given unknown alkali (approximately N/10) solution with the help of by preparing standard acid solution. (Expression of strength in different ways) [2]
13. To carry out conductivity experiments on solids and liquids (CuSO4, Zn, Mg, Al, Fe, CCl_4, C_6H_6, C_2H_5OH) [2]

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

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

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

Engineering Drawing I

EG 1106ME

Total: 4 hours/week

Year: I

Lecture: hours/week

Semester: I

Tutorial: hours/week

Practical: 4 hours/week

Lab: hours/week

Course Description:

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

Course Objectives:

After completing this course the students will be able to

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

Course content:

Unit 1: Introduction   **[4]**
        1.1   Engineering drawing as graphic language
        1.2   Drawing instruments
        1.3   Scale: reduced scale, enlarged scale, full size scale
        1.4   Conventional line types
        1.5   Sheet size and sheet layout
        1.6   Drawing exercises on above sub units

Unit 2: Technical lettering &dimensioning   **[4]**
        2.1   General procedure for freehand technical lettering: letter stroke, letter proportion, use of pencil and pens, uniformity of letters
        2.2   Single stroke vertical capital letters, Single stroke inclined capital letters, Single stroke vertical lowercase letters, Single stroke inclined lowercase letters, vertical and inclined numerals, vertical and inclined fractions
        2.3   Dimensioning terms and notations
        2.4   Techniques of dimensioning: Size and location of dimensioning
        2.5   Types of dimensioning: Aligned and Unidirectional
        2.6   Rules for dimensioning
        2.7   Drawing exercises on above sub units

Unit 3: Geometrical construction   **[12]**
        3.1   Draw parallel and perpendicular lines
        3.2   Bisection and trisection on straight lines and angles
        3.3   Divide a straight line into any number of equal parts and proportionately.

3.4 Construction of polygons (triangles, squares, regular pentagon, regular hexagon, regular heptagon, regular octagon) inscribing and circumscribing about a given circle.

3.5 Determine center and draw tangent on circular arcs and circles (including open, cross belt tangents and ogee curve between two parallel lines)

3.6 Construction of standard curves (Conic section - parabola, ellipse, and hyperbola; Special Curves- cycloid, helix, spiral, involute)

3.7 Drawing exercises on above sub units

Unit 4: Projection of points, lines and planes [8]
4.1 Principle of projection
4.2 Principle planes of projections, four quadrants
4.3 Projection of point, line and plane on HP and VP
4.4 True Length of an oblique line
4.5 True shape of an oblique plane
4.6 Drawing exercises on above sub units.

Unit 5: Projection of geometrical solids [4]
5.1 Types of solids: polyhedral and solids of revolution
5.2 Projection of prismatic objects (triangular square base, circular base, hexagonal base)
5.2 Projection of pyramidal objects (triangular square base, circular base, hexagonal base)
5.3 Projection of points on the surfaces solids
5.4 Drawing exercises on above sub units.

Unit 6: Orthographic projection [24]
6.1 Principle of orthographic projection
6.2 Systems of orthographic projection: first angle and third angle
6.3 Draw an orthographic drawing (rectangular objects with horizontal, vertical and inclined surfaces, objects with cylindrical surfaces)
6.4 Analysis of three views including missing views
6.5 Drawing exercises on above sub units with dimensioning

Unit 7 Freehand Sketching [4]
7.1 Techniques of sketching: pencil hardness, paper with grid or lines
7.2 Techniques for horizontal and vertical lines; arcs and circles
7.3 Free hand exercise of different shapes with lines, arcs, and circles

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

Workshop Technology I

EG 1107 ME

Year: I
Semester: I

Total: 1 5 hours/week
Lecture: 4 hours/week
Tutorial: hours/week
Practical: 11 hours/week
Lab: hours/week

Course Description:

This subject deals with the identification of basic hand tools, measuring instruments, power tools, along with their uses, care and safety in the mechanical engineering sector.

Course Objectives:

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

Course content:

Unit 1:   Safety in the workshop   [2]
         1.1.   Rules in the mechanical workshop
         1.2.   Cause of accident and prevention
         1.3.   Types of safety (personal safety, tools, equipment and machine safety)

Unit 2:   Laying out and fitter's Tools   [4]
         2.1 Identification, use, care, and maintenance of Layout tools (scriber, punch, divider, surface plate, v-block and Vernier height gauge)

         2.2 Identification, uses, and care, of various types of hammer (ball pin, cross, straight, claw and soft)
         2.3 Wrenches types (single, double, pipe and adjustable) and use
         2.4 Types, uses and care of Vices (bench, machine, pipe and chain vices)

Unit 3: **Metal removing tools and methods** **[18]**

    3.1 Chisels

        3.1.1   Types and angle of the chisels and removing metal from the surface.

        3.1.2   Holding the hammer and chisel and chipping processes.

        3.1.3   Uses the chipping guard, care and maintenance the work place and tools.

    3.2   Handsaw and sawing

        3.2.1   Hand saw parts

        3.2.2   Method of the holding the work piece and rules of sawing.

    3.3   Files and filing

        3.3.1   Identify the parts, shapes, sizes, cuts of the files

        3.3.2   Method of the holding, balancing and the direction of the filing

        3.3.3   Clean and store the files

    3.4   Reamer and reaming

        3.4.1   Types of the reamers (hand, taper and adjustable)

        3.4.2   Select the holding device, reamer, drill speed

        3.4.3   The method of the reaming on the metal

        3.4.4   Care of reamers.

    3.5   Thread and threading

        3.5.1   Nomenclature, types and use of thread

        3.5.2   Thread making methods (Taps and dies, lathe machine, rolling, pressing)

        3.5.3   Care of threading tools

    3.6   Scraper and scraping

        3.6.1   Types, use and care of scraper (flat, three side and curve)

        3.6.2   Methods of the scraping and the qualities of the surface

Unit 4: **Measuring instrument** **[3]**

    4.1   Linear and angular measuring tools with their uses (scale, tape, vernier caliper, least count, micrometer, try square, bevel protractor)

    4.2   Types of gauges (wire, and filler, radius and thread)

    4.3   Rules of the measuring and using the measuring instrument.

    4.4   Care and store of measuring instrument.

Unit 5: **Rivet and riveting** **[1]**

    a.   Types, use and size of rivets

    b.   Types of riveted joints

    c.   Riveting process and tools

Unit 6: **Solder and soldering** **[1]**

    6.1 Soldering accessories (iron, solder, cleaning tools and the fluxes)

    6.2 Process of cleaning and joining

    6.3 Care and of the storing of accessories.

Unit 7:   **Shear and shearing**   **[2]**
        7.1 Types and use of shearing tools (hand and press)
        7.2 Different process involved in shearing (of sheet, bars, flat, angle)

        7.3 Safety rules and care of the tools

Unit 8:   **Bend and bending**   **[2]**
        8.1 Bending devices (vice pliers, range, hand bar and fork)
        8.2 Method of bending the metal bar, flat and the plate
        8.3 Safety rules and care of the tools

Unit 9:   **Drill and Drilling**   **[3]**
        9.1   Drill machines: Use and Types (hand, bench, gang, column and radial)
        9.2   Drill bits: Types, Bit size, purpose and angle
        9.3   Drill and work holding devices
        9.4   Speed and bit selection for different work material
        9.5   Operation on drill machine using coolant
        9.6   Safety rules and care of the tools

Unit 10:   **Sheet metal works**   **[12]**
        10.1 Types and thickness of different metal sheet (mild steel, galvanized steel, Copper, brass, aluminum)
        10.2 Marking tools: types and uses (scriber, rules, try square, punch, divider, trammel and depth gauge)
        10.3 Hand tools (snipes, stacks, punch plat, hatchet, blow horn, hand punch, pop riveter's fork devices, hammers, fly cutter, groove, seaming tools)
        10.4 Power tools: Working and use (Bending, rollers, folders, and edge forming, sawing, crimping, spot welding and polishing)
        10.5 Development of sheet
            10.5.1 Types of development (rectangular, conical, triangular)
            10.5.2 Marking and cutting to produce patterns templates (sheet boxes, book stand, scoop, tool box, funnel pipe and machine guards)
        10.6 Sheet metal joining
            10.6.1 Types and use of joints (lap, butt, seam)
            10.6.2 Steps on sheet metal joining
        10.7Safety precautions in sheet metal workshop

Unit 11: Plumbing works

    11.1 Introduction

    11.2 Plumbing tools: types, materials, use and care.

    11.3 Pipes:

        11.3.1 Types: polythene, GI, CI

        11.3.2 Operations (bending, thread cutting, joining)

11.3.3 Applications

11.4 Pipe fittings: types and uses

11.5 Introduction to water supply system: city and domestic

11.6 Importance and general layout of Domestic sewerage and drainage system

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

Practical

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

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

Project list

S. No	Project	Skill	Metal	Mm size/	Time hrs
1	Hammer	Measuring, marking, sawing, filing, drilling, thread cut	Tool steel 1 pc	25x25x155	8
2	Paper height	Measuring, marking, sawing, filing	M. S. rod 1 pc	Ø 30x30	14
3	G. Clamp	Measuring, marking, dot, punching, drilling, chiseling, sawing, filing		10x100x70	14
4	Bottle opener	Measuring, marking, sawing, radius filing, drilling	M.S. flat 1 pc	2x3x110	8
5	Dove tail	Measuring, marking, drilling, sawing, fitting, male and female, Scrapping	M.S. flat 2 pc	6x30x51	8
6	Hammer handle	Measuring, marking, filing, thread cutting	M.S. rod	Ø 2x210	5
7	Corn seller	Measuring, marking, Sawing, bending, riveting, soldering	Pipe Ø 65x70 G.I. wire Ø 3x100	65x70 Ø 3x100	8
8	Hacksaw frame	Measuring, marking, cutting, bending	M.S. flat	3x600	8
9	Hanger	Measuring, marking, bending, joining	G. I. wire	Ø 3x800 or 1000	5
10	Candle light	Measuring, marking, cutting, filing, bending, drilling, thread cutting	M.S. flat	10x100x150 3x25x300	17
11	Try square	Measuring, marking, cutting, filing, riveting, drilling	M.S. flat M.S. sheet	10x20x80 2x15x120	8
12	Hand vice	Measuring, marking, cutting, filing, drilling, counter sink, reaming, thread cutting	M.S., M.S. rod	16x16x200 Ø 12x70 Ø 8x80	14
13	G.I. box	Measuring, marking, cutting, hem, seaming, folding, riveting, soldering	G.I. sheet 22 gauge	200x200	5
14	Funnel	Measuring, marking, rolling, seaming, soldering	G.I. sheet 22 gauge	100x300	5
15	Store box	Measuring, marking, heming, seaming, cutting, folding, riveting	G.I. sheet 22 gauge	400x500	10
16	Hand tool box	Measuring, marking, heming, seaming, cutting, folding, riveting	Block sheet	1.5 600x1000	18
17	Practical test	Evaluate the all the bench work Sharping the hand tool and power tool	As per need	As per need	10
				Total (hrs.)	**165**

Second Semester

Subjects:

1. EG 1201SH   Engineering Mathematics II
2. EG 1202 SH   Engineering Physics II
3. EG 1203 SH   Engineering Chemistry II
4. EG 1204 ME   Engineering Drawing II
5. EG 1206ME   Material Science
6. EG 1208ME   Workshop Technology II
7. EG 1208 EE   Basic Electrical Engineering I

Engineering Mathematics II
EG 1201 SH

Year: I
Semester: II

Total: 4 hour /week
Lecture: 3 hours/week
Tutorial: 1 hours/week
Practical: hours/week
Lab: hours/week

Course Description:

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

Course Objectives:

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

Course Contents:

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

Unit 2. **Algebra:** [15]

    2.1.   Complex number in the from A+ ib.
- Algebra of complex numbers.
- Polar representation of complex numbers.

    2.2.   De Moivre's theorem and its applications

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

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

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

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

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

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

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

    4.1.   Coordinates in space,

    4.2.   Coordinates in planes.

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

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

- Correlation and Regression

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

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

Engineering Physics II
EG 1202 SH

Total: 6 hour /week

Year: I

Semester: II

Lecture: 3 hours/week
Tutorial: 1 hours/week
Practical: hours/week
Lab: 2 hours/week

Course Description:

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

Course Objectives:

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

Content Contents:

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

- Different types of arrangement of capacitors.
- Energy storage.
- Action of dielectrics

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

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

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

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

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

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

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

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

3.3　Viscosity:
- Stream line and turbulent flows.

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

Unit 4. Modern physics: [10]

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

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

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

Engineering Physics Practical II: *[30]*

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

Learning materials:

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

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

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

Engineering Chemistry II
EG 1203 SH

Total: 6 hour /week

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

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

Practical: hours/week

Lab: 2 hours/week

Course Description:

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

Course Objectives:

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

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

Course Content:

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

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

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

    1.3   Nitric acid:
- Manufacture by Ostwald's process
- Properties and uses.
- Nitrogen cycle
- Fixation of Nitrogen
- Chemical fertilizers
- Oxides of nitrogen as pollutant (general concept)

- Acid rain (due to oxides of nitrogen and oxide of Sulphur "Sulpherdioxide")

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

1.5 Hydrochloric acid:
- Lab preparation
- Properties and uses

1.6 Hydrogen Sulphide:
- Lab preparation
- Properties and uses

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

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

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

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

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

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

2.4 Aluminum:
- Properties and uses

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

2.6 Zinc:
- Properties & uses

2.7 Iron:
- Properties & uses

2.8 Lead:
- Properties & uses

2.9 Alloys:

- Definition
- Purpose of making alloys
- Types of alloys

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

    3.1.   Organic compounds
- Organic compounds:
  - Historical background, classification, and nomenclature
  - Functional groups and homologous series
- Saturated hydrocarbon: Properties of Methane
- Unsaturated hydrocarbon: Properties of Ethylene and Acetylene
- Aromatic compounds:
  - Definition
  - Comparison of aliphatic and aromatic compounds
  - Properties of Benzene

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

Engineering Chemistry Practical II:

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

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

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

Engineering Drawing II

EG1204 ME

Total: 4 hours /week

Year:　I

Semester:　II

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

Course Description:

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

Course Objectives:

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

Course content:

Unit 1:　Sectional views [8]
    1.1　Use of sectional views
    1.2　Cutting plane line and hatching lines
    1.3　Types of section (full, half, partial, removed, rotated and offset)
    1.4　Drawing exercises on above sub units

Unit 2:　Isometric drawing [12]
    2.1　Introduction to axonometric projection
    2.2　Isometric projection and isometric drawing
    2.3　Procedure of making an isometric drawing (box and co-ordinate construction method)
    2.4　Non isometric lines and surfaces
    2.5　Angles in isometric
    2.6　Circles and circular arcs in isometric
    2.7　Orientation of object in isometric drawing
    2.8　Isometric drawing (rectangular objects with horizontal, vertical and inclined planes; objects with cylindrical surfaces and holes)
    2.9　Drawing exercises on above sub units

Unit 3:   Oblique drawing   **[4]**
    3.1   Oblique projection and oblique drawing
    3.2   Procedure of making an oblique drawing
    3.3   Rules for placing object in oblique
    3.4   Angles, circles and circular arcs in oblique
    3.5   Cavalier and cabinet projection
    3.6   Oblique drawing of objects with plane and curved surfaces
    3.7   Drawing exercises on above sub units

Unit 4:   Surface development   **[16]**
    4.1   General concepts and practical considerations
    4.2   Development of right and oblique solids (prismatic and pyramidal: circular, triangular, square, hexagonal base)
    4.3   Development of truncated right and oblique solids (prismatic and pyramidal: circular, triangular, square, hexagonal base)
    4.4   Drawing exercises on above sub units

Unit 5:   Intersection of solids   **[12]**
    5.1   Lines of intersection of geometric surfaces
    5.2   Intersection of solids (two prisms, prism and pyramid)
    5.3   Drawing exercises on above sub units

Unit 6:   Pattern making   **[8]**
    6.1   Pattern of geometrical solids
    6.2   Pattern of intersecting solids
    6.4   Pattern making exercises on above sub units

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

Material Science

EG 1206 ME

Total: 4 hours /week

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

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

Practical: hours/week

Lab: 1 hours/week

Course Description:

This course deals various problems regarding materials and machining should be solved by technicians with their introductory knowledge about materials. It also describes the knowledge for material selection, substitution, property evaluation and various materials types.

Course Objectives:

After completing this course the students will be able to:
1. Understand about different properties of materials and their dependence on.
2. Understand about the principle of iron and steel production.
3. Explain the principle of heat treatment.
4. Develop knowledge for material selection.

Course content:

Unit 1: Introduction to materials   **[8]**
      1.1 Classification of materials
      1.2 Metals and non-metals
      1.3 Relationship between structure and properties
      1.4 Physical properties (luster, color, density)
      1.5 Mechanical properties (plasticity, elasticity, ductility, malleability, toughness)
      1.6 Electrical properties (conductivity and effect of temperature)
      1.7 Magnetic properties (ferro-magnet, para-magnet, dia-magnet and hysteresis loss)
      1.8 Thermal properties (specific heat, latent heat and thermal expansion)

Unit 2: Arrangement of atoms   **[5]**
      1.1 Atomic structure
      2.1 Periodic table
      3.1 Atomic bonds
      4.1 Crystalline and amorphous solids
      5.1 Unit cell
      6.1 Crystal structure (BCC, FCC and HCP)
      7.1 Allotropic and polymorphic transformation
      8.1 Crystal imperfection and their effects on properties

Unit 3: Testing of metals [7]

    3.1 Types of testing

    3.2 Non-destructive testing (X-ray, ultrasonic, magnetic tests) and their uses

    3.3 Destructive testing

        3.3.1   Tensile test

        3.3.2   Fatigue test

        3.3.3   Hardness test (Brinell and Rockwell)

        3.3.4   Impact test (Charpy and Izod)

Unit 4: Iron-ironcarbide diagram [5]

    4.1 Solid solution

    4.2 Cooling curves

    4.3 Equilibrium diagram

    4.4 Different mixtures and phases in iron-iron carbide diagram

    4.5 Classification of steels and iron in $Fe-Fe_3C$ diagram

Unit 5: Heat treatment process [6]

    1.1 Purpose of heat treatment

    1.2 Annealing

    1.3 Normalizing

    1.4 Quenching

    1.5 Tempering

    1.6 Surface hardening

Unit 6: Steels and cast iron [7]

    6.1 Difference between steels and cast iron

    6.2 Types of steels (HSLA steel, stainless steel, tool steel)

    6.3 Types of cast iron (grey, white, malleable, ductile)

    6.4 Various steel making processes (Bessemer, Open hearth, Electric, Duplex)

Units 7: Non Metals [7]

    7.1 Introduction to non-metals

    7.2 Lubricants: properties, classification and uses

    7.3 Fuels: properties, classification and uses

    7.4 Polymers: properties, classification and uses

    7.5 Rubber: properties and uses

    7.6 Ceramics: properties, classification and uses

    7.7 Composite materials: properties, classification and uses

    7.8 Glass: properties, classification and uses

Lab/Practical exercise

1. Corrosion of metals- Identification/ Protection

2. Micro Structure observation of Metals

3. Identification of metals and non-metals

4. Testing of mechanical properties of metals

5. Heat treatment (Annealing, hardening and tempering)

Reference/Text Books:
1. H.S. Bawa, Material and Metallurgy, TMG edition, New Delhi, India
2. A.K Gupta, R.C Gupta, Material Science, S.Chand and Co.Ltd,New Delhi, India
3. Donall R. Askelad, "The Science and Engineering of Materials", Chapman and Hall, Madras. India
4. A Kumar, H K Dhingra, Materials and Metallurgy. Dhanpat Rai and Co. India
5. Sunil Risal, Khem Gyanwali, Material Science, Sigma Carts printing, Nepal

Workshop Technology II

EG 1208 ME

Year: I
Semester: II

Total: 12 hours /week
Lecture: 4 hours/week
Tutorial: hours/week
Practical: 8 hours/week
Lab: hours/week

Course Description:

This course is the extension one for the students who have undergone manufacturing process. The course deals with further new and advanced methods such as foundry and welding of work performances. Technicians need to acquire advanced techniques and performance standard so as to be competent in the mechanical engineering field.

Course Objectives:

After completing this course the students will be able to
1. Understand and follow the safety rules in foundry and welding shops;
2. Produce casting parts as per supplied drawing;
3. Produce parts as per specification using forging hand tools in forging Shop;
4. Perform the heat treatment of forges parts;
5. Describe the different types of welding methods and processes.
6. Weld the given job (mild steel plates, rods) as per supplied drawing.
7. Connect and disconnect/dismantle oxyacetylene welding equipments set;
8. Weld the given job in flat position using oxyacetylene flame with or without filler rod;
9. Braze the given job by selecting hard solders, fluxes

Course contents:

A. Foundry:
Unit 1. Introduction to foundry: **[1]**
      1.1.   Describe introduction to foundry practice
      1.2.   Development, advantages and uses of casting
      1.3.   Describe safety in foundry practice

Unit 2. Casting: **[10]**
      2.1.   Types of casting process (permanent mould, centrifugal, die, shell moulding, investment)
      2.2.   Types and properties of casting materials
      2.3.   Construction and uses of Melting furnace (Cupola, induction and crucible)
      2.4.   Sand casting

        2.4.1   Pattern making

            2.4.1.1   Material for pattern

            2.4.1.2   Consideration of draft and shrinkage control of metal

        2.4.2   Sand moulding

            2.4.2.1   Application and care of different hand tools

            2.4.2.2   Core making

  2.5   Finishing process

B.   Forging:

Unit 1 Introduction to forging   [1]

    1.1.   Introduce to hand forging, its applications, advantages and limitations,

    1.2.   Forging materials

    1.3.   Safety in forging practice

Unit 2 Forging operations   [3]

    2.1 Hand forging

        2.1.1 Tools: nomenclature, application and care

        2.1.2 Operations: Bending, Cutting down, Setting down, Swaging, Squeezing,
            drawing twisting, Upsetting, Punching and drifting, Forge welding

    2.2 Power forging

        2.2.1   Power hammer: types, working, application and care (drop, press, machine)

    2.3   Defects on forging process, cause and their possible remedies

Unit 3 Heat treatment of forged materials   [2]

    3.1   Introduction and purposes of heat treatment

    3.2   Types and uses (Annealing, Hardening, Tempering)

C. Welding:

Unit 1. Introduction to welding   [1]

    1.1.   Introduction to welding

    1.2.   Classification of welding

    1.3.   Selection of different types of welding processes

Unit 2. Introduction to arc welding   [1]

    2.1   Introduction to arc welding

    2.2   Arc column theory

    2.3   Power sources for arc welding

    2.4   Types of welding : SMAW, GMAW, GTAW

    2.5   Safety precautions in arc welding

Unit 3. Arc Welding equipment and accessories [4]

    3.1   Arc welding machines: types, uses and care

    3.2   Problems in welding machines: troubles, causes and remedies

    3.3   Arc welding machine and operators' accessories.

Unit 4. Arc welding electrode: classification, application and care [2]

Unit 5. Arc Welding fundamentals and techniques: [6]

    5.1   Condition of welding table and welding machine

    5.2   Influencing factors in arc welding

        5.2.1   Correct position of welder

        5.2.2   Face protection of welder

        5.2.3   Arc length

        5.2.4   Angles of electrode

        5.2.5   Travel speed of electrode

        5.2.6   Amperage

    5.3   Method, application and advantages of striking an arc (tap, Scratch)

    5.4   Weld movement: types, application and advantages

    5.5   Welding joints: types and application

    5.6   Defects on welding process, cause and their possible remedies

Unit 6. Introduction to oxyacetylene (Gas) welding: [2]

    6.1   Oxy-acetylene welding principle

    6.2   Advantages and application of oxy-acetylene welding

    6.3   Safety precaution in oxy-acetylene welding

        6.3.1   Personnel safety

        6.3.2   Fire prevention

        6.3.3   Care of cylinders, hoses, acetylene generators

        6.3.4   Lighting of welding torch

        6.3.5   Safety accessories

Unit 7. Properties, uses, storages and handling of oxygen and acetylene gases [1]

Unit 8. Oxyacetylene welding equipment and accessories [6]

    8.1   Oxygen cylinder

    8.2   Acetylene cylinder/generator

    8.3   Oxygen and acetylene regulator

    8.4   Wrenches

    8.5   Hoses, hose clips and hose coupler

    8.6   Welding torch-low pressure, equal pressure

    8.7   Welding nozzle-solid piece, multiple piece

    8.8   Filler rod holder

8.9   Gas lighter

8.10   Operator's safety accessories

Unit 9. Filler rod and flux: classification, selection, use and   storages   **[2]**

Unit 10 Oxy-acetylene flame: types, properties and use

Unit 11. Oxy-acetylene welding operations and welding techniques   **[6]**

11.1   Equipment set up

11.2   Testing for leaks

11.3   Lighting the torch and flame adjustment

11.4   Shutting off equipment

11.5   Running a bead with filler rod

11.6   Backfire and flashback

11.7   Restarting the weld

11.8   Welding techniques-leftward and rightward welding

11.9   Weld movements

11.10 Weld appearance

Unit 12. Welding joints, welding position and types of welds   **[2]**

12.1   Welding joints, their types and application

12.2   Welding positions, their types and application

12.3   Types of weld and their applications

Units 13. Distortion in welding: types and their control   **[2]**

Units 14. Testing of welding joints: types and process

Units 15. Oxygen gas cutting   **[4]**

15.1   Gas cutting principle

15.2   Major influencing factors of gas cutting

15.2.1   Composition of steel

15.2.2   Temperature of work-piece

15.2.3   Thickness of work- piece

15.2.4   Surface defects

15.2.5   Purity of oxygen

15.2.6   Temperature of oxygen

15.3   Cutting methods

15.3.1   Oxygen cutting (manual and machine)

15.3.2   Oxygen deseaming

15.3.3   Oxygen gauging and larcing

15.4   Selecting of tip and working pressure in manual gas cutting

15.5   Cleaning of the cutting tips

15.6   Examples of correct and incorrect techniques in manual gas cutting

Unit 16. Brazing [3]

16.1   Brazing principle, application and advantages

16.2   Difference between welding and brazing

16.3   Brazing equipment and materials

16.4   Brazing procedures

16.4.1   Requirement for a successful brazing

16.4.2   Brazing operation

Lab/practical

Practical I: Foundry

Molding exercise (practical)

1.   Single Wood pattern making [5hrs.]
2.   Split wood pattern making   [6hrs.]
3.   Core box making [6hrs.]
4.   Sand molding for split pattern with core (6hrs.)
5.   Making wax suitable pattern such as anyone of flying bird, twisted spiral coiled or any simple irregular article. [2hrs.]
6.   Making moulds with plaster of Paris of above no. 6 [2hrs.]
7.   Casting on sand moulds [2hrs.]
8.   Casting on permanent moulds [2 hrs.]
9.   Casting on investment mould [2 hrs.]

Practical II: Forging:

Forging exercise (practical)

1. Safety and familiarization with equipment and tools [1 hr]
2. Square piece   [3 hrs.]
3. Rectangular Small Flat Chisel [3 hrs.]
4. Heat treatment of Chisel [5 hrs.]

Practical III: Welding

Arc welding exercise (practical):

1.   Safety precaution and familiarization with welding machine and accessories [2hrs.]
2.   Striking an arc welding on plate [3 hrs.]
3.   Padding on flat surface [5 hrs.]
4.   Closed and Square butt joint [5 hrs.]
5.   Corner joint [4hrs.]
6.   Tee joint [5 hrs.]
7.   Lap joint [4 hrs.]

8.   V-butt joint [5 hrs.]
9.   Arc cutting on mild steel plate [4 hrs.]

Gas Welding Exercise (practical):
1.   Lining without filler rod [4 hrs.]
2.   Lining with filler rod [4 hrs.]
3.   Butt joint [4 hrs.]
4.   Corner joint [4 hrs.]
5.   Lap joint [4 hrs.]
6.   Tee joint [4 hrs.]
7.   Straight gas cutting [3 hrs.]
8.   Circular gas cutting [2 hrs.]

Brazing Exercise (practical):
1.   Closed square butt joint brazing [3 hrs.]
2.   Lap joint brazing [3hrs.]
3.   Tee joint brazing [3hrs.]

Suggestion for instructions:

1. Note: every practical exercise [assignment] must be accompanied with performance report in A4 size paper. Assignments, Drawing, and Performance Report must be submitted for the work evaluation.

NOTE: Here certain portion of Forging subjects added, thinking it necessary relevant subjects for workshop, however, it is not included on prescribe syllabus on Workshop Technology II (Foundry and welding)

Reference:
1. Elements of workshop technology Vol. I: Manufacturing Processes - S. K. Hajra Choudhary, a. K. Hajra Choudhary – media promoter & publishers Pvt. Ltd., 20-g Sleater Road, Seervai building. 'B'. Bombay-400 007- 2005 A.D. 14th edition
2. A textbook of workshop technology [manufacturing processes] – R. S. Khurmi & J. K. Gupta – publication division of Nirja construction & development co. Pvt. Ltd.- 15th edition
3. Manufacturing science technology [manufacturing processes & machine tools] – K. Vara Prasada Rao – New age international publishers, 4835/24, Ansari road, Daryaganj, New Delhi-110 002

Basic Electrical Engineering

EG 1208 EE

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

Course Description:

This course provides a basic framework for understanding the fundamental concept of Electric circuits. The course deals with circuit fundamentals, machines and basic electrical control system.

Course Objectives:

After completing this course the students will be able to:
1. understand the fundamental concept of electric circuits
2. understand the fundamental principles of electricity, magnetism
3. Analyze AC circuits.
4. understand the DC and AC machines.
5. understand the basic electrical control system.

Course contents:

Unit 1: Introduction [3]

      1.1 Concept of generation, transmission and distribution system of electricity in Nepal
      1.2 Concept of electric charge, current and potential difference
      1.3 Comparison between AC and DC
      1.4 Concept of resistance, inductance and capacitance

Unit 2: Electric Circuit [4]
      2.1 Electric circuit & Ohm's law
      2.2 Factors affecting resistance and temperature variation of resistance
      2.2 Series and parallel combination of resistance
      2.3 Kirchhoff's Laws
      2.4 Electrical Power & Energy
      2.5 Related numericals

Unit 3: Magnetism & Magnetic Circuit [3]
3.1 Definition of magnetic field, magnetic flux and magnetic flux density
      3.2 Ferro- magnetic, Dia-magnetic and para-magnetic materials
      3.3 Faraday law of electromagnetic induction and lenz's law.
      3.4 Comparison between electric circuit and magnetic circuit

Unit 4: AC circuit analysis [9]

4.1 Generation of 1φ voltage and current, mathematical equation and waveforms.

4.2 Terminologies: Cycle, frequency, time period, amplitude, average and r.m.s values, phase and phase difference

4.3 AC in pure resistance, inductance and capacitance

4.4 AC in RL, RC and RLC series circuit with resonance & related numericals

4.5 Types of power, power triangle and effects of power factor & related numericals

4.6 Generation of 3 φ voltage and current, mathematical equation and waveforms

4.7 Voltage and currents in star and delta connection, Advantages of 3 φ system & related numerical

Unit 5: DC machines [6]

5.1 Construction and operating principle of DC machines

5.2 Types of DC generators and DC motors

5.3 Speed control of DC motor

5.4 Losses and efficiency of DC machines.

Unit 6: AC machines [8]

6.1 Construction, operating principles and emf equation of transformer, Conceptof Ideal transformer & related Numerical

6.2 Losses and efficiency of transformer.

6.3 Knowledge of auto transformer and 3φ transformer

6.4 Construction & operating principle of 3 φ induction motor.

6.5 Losses and efficiency of induction motor

6.6 Construction of synchronous machine.

Unit 7: Electrical Measurement [4]

7.1 Electrical measuring units and instruments

7.2 Classification of measuring instrument

7.3 Working principle of MI (Moving Iron) and MC(moving coil) ammeter and . Voltmeter

7.4 Basic concept of energy meter and meggar.

Unit 8: Electric Wiring & Safety [3]

8.1 Types of wiring and application with accessories.

8.2 Electric shock, preventive method and first aid to be taken in electrical Accident

8.3 Earthing and need of earthing

Unit 9: Concept of Control system **[5]**

      9.1 Control system with examples

      9.2 Types of control system with block diagram.

      9.3 Control system components such as sensors, transducer, stepper motor, and servo motor

      9.4 Basic knowledge of PID & PLC controller

List of Experiments:

1. Use of ammeter and voltmeter to measure current and voltage
   2. Verification of ohm's law.
   3. Verification of KCL and KVL.
   4. Performing resonance analysis of RLC series circuit.
   5. Phase and live voltage measurements in 3 Ø system with power measurement.
   6. Demonstration of various parts of AC and DC machine.
   7. Demonstration of PID Controller

References:

2. Fundamentals of Electrical Engineering & Electronics by S.K.Sahdev
3. A text book of electrical technology by B L Thareja& A.K. thareja
4. Fundamentals of Electrical Engineering and Electronics by J.B. Gupta
5. Electrical Estimating & Costing by Surjit Singh
6. A course manual on safety engineering by A.K.Mishra

Second Year
(Third and Fourth Semester)

Third Semester

Subjects:

1. EG 2101 EX Basic Electronic Engineering
2. EG 2103 ME Thermal Engineering I
3. EG 2104 ME Manufacturing Technology
4. EG 2105 ME Machine Drawing
5. EG 2106 ME Metrology
6. EG 2107 CT Computer Applications
7. EG 2109 ME Engineering Mechanics

Basic Electronics Engineering

EG 2101 EX

Year: II
Semester: I

Total: 4 hours /week
Lecture: 3hours/week
Tutorial: hours/week
Practical: hours/week
Lab: 1 hours/week

Course Description:

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

Course Objectives:

After completing this course the student will be able to:
1. Identify and explain the working principles of various semiconductor devices, relate their characteristics and applications.
2. Explain the characteristics of CB, CE and CC configuration circuits.
3. Identify and explain the working of digital electronics.

Course contents:

Unit 1: Introduction to electronics engineering   [2]

      1.1 Status of electronics in Nepal

      1.2 Importance of electronics in the field of mechanical engineering

      1.3 Application of electronics in the field of mechanical engineering

Unit 2: Introduction to some useful components in mechanical engineering   [3]

      2.1 Basic construction, principle of operation and applications of resister, Capacitor, Inductor, Switch, Relay, Fuses, Transformer

Unit 3: Introduction to semiconductor diode   [5]

      3.1 Basic concept of semiconductors

      3.2 Impurities to semiconductor

      3.3 Types of semiconductor (N type and P type)

      3.4 Introduction to PN junction diode

         3.4.1   Basic structure

         3.4.2   VI characteristics

      3.5 Half and full wave rectifier (principle)

      3.6 Rectifier filter circuits (basics of RC and LC filter)

Unit 4: Zener diode [3]

      4.1 Basic construction

      4.2 Principle of operation

      4.3 VI characteristics

      4.4 Zener diode as voltage regulator

Unit 5: Introduction to bipolar junction transistor (BJT) [5]

      6.1 Basic structure of BJT (PNP and NPN)

      6.2 Principle of PNP and NPN

      6.3 BJT as an amplifier

      6.4 Basic configuration of transistor circuits (CE, CB, CC)

            6.4.1   VI characteristics of CE, CB, CC

            6.4.2   Comparison

Unit 6: Introduction to special semiconductor devices [3]

Basic construction, features, and uses of:

      6.5 Silicon controlled rectifier

      6.6 UJT (unijunction transistor)

      6.7 JFET (junction field effect transistor)

      6.8 MOSFET (metal oxide semiconductor)

      6.9 Photo diode and opto coupler

Unit 7: Introduction to integrated circuit [2]

      7.1 Introduction

      7.2 Schematic symbol

      7.2 Introduction to SSI, LSI, VLSI

      7.3 Basics of linear and digital ICS

Unit 8: Introduction to number system [5]

      a.   Decimal number system

      b.   Binary number system

      c.   Octal number system

      d.   Hexa- decimal number system

      e.   Conversion of number system

Unit 9: Introduction to binary operations [4]

      9.1   Addition, subtraction, multiplication and division

      9.2   Introduction to codes (BCD, ASCII, Gray code, Excess-3 code)

Unit 10: Fundamentals of digital electronics [5]

10.1 Introduction to logic gates

10.2 Symbols, truth table, Boolean expression of NOT, AND, OR, NAND, NOR, XOR and XNOR

10.3 Boolean algebra and associate rules

10.4 De-Morgan's theorem (statement only)

10.5 Universal gate

Unit 11: Introduction to combinational logic devices [3]

11.1 Encoder/decoder

11.2 Multiplexer and de-multiplexer

11.3 Parity generator and checker

11.4 Adder and subtractor

Unit 12: Introduction to sequential logic devices [5]

12.1 Introduction to latches and flip flops
12.2 Basic construction, symbol and truth table of SR, JK, D, T flip flop
12.3 Introduction to counters: Synchronous and asynchronous counters(ring counter)
12.4 Shift registers-shift left and shift right

List of experiments:
1. Demonstration of resistor, capacitor, inductor, relay, fuses and transformer
2. Study of VI characteristics of PN junction diode
3. Design and study rectifier circuits
4. Study of VI characteristics of CE, CB and CC configuration of transistor
5. Study of logic gates using trainer kits
6. Study of encoder and decoder
7. Study of multiplexer and de- multiplexer
8. Study of adder and subtractor
9. Study of counter and register

References Books
1. Electronics devices and circuits by J.B Gupta
2. Principle of electronics by V.K Mehta
3. Digital electronics by Morismano
4. Fundamentals of digital electronics by malvino
5. Electronics device and circuit by ES bogard

Thermal Engineering I

EG 2103 ME

Total: 5 hours /week

Year:　II
Semester:　I

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

Course Description:

This course deals with the fundamental laws of thermodynamics and basic thermodynamics processes.

Course Objectives:

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

1. Laws of thermodynamics
2. Properties of ideal gas
3. Basic thermodynamics processes

Course content:

Unit 1: Basic concept of thermodynamics: [8]
     1.1 Definition and importance of thermodynamics
     1.2 Thermodynamic system (open, closed and isolated system)
     1.3 Forms of energy
     1.4 Point and path functions, state of system,
     1.5 Thermodynamic process, cycle
     1.6 Properties of system (intensive and extensive properties)
     1.7 Thermal equilibrium, sensible heat and latent heat
     1.8 Related Problems.

Unit 2: Heat transfer: [10]
     2.1 Modes of heat transfer (conduction, convection and radiation)
     2.2 Fourier's law of heat conduction (Temperature gradient, Thermal conductivity)
     2.3 Newton's law of heat transfer by convection, free and forced convection
     2.4 Heat transfer by radiation, Stefan- Boltzman law of thermal radiation
     2.5 Related Problems.

Unit 3: Ideal gases: [8]
     3.1 Definition of ideal gas
     3.2 Boyle's law

3.3 Charles's law

3.4 General gas law

3.5 Characteristics of gas equation , Universal gas constant, Specific heat, Relation between specific heats and gas constant

3.6 Related problem.

Unit 4: Zeroth law of thermodynamic: [4]

1.1 Definition and applications

2.1 Different types of thermometer and their applications.

Unit 5: First law of thermodynamics: [12]

5.1 Statement of first law, mathematical representation

5.2 Application of first law to open and closed system

5.3 General energy equation, internal energy, enthalpy, relationship between heat transfer and change in internal energy

5.4 Related problem.

Unit 6: Second law of thermodynamics: [12]

6.1 Limitation of first law

6.2 Statement of second law : Kelvin Planck and clausius statement

6.3 Concept of heat pump, refrigerator and heat engine

6.4 Thermal efficiency, reversible and irreversible processes, entropy, T-S diagram

6.5 Related problems.

Unit 7: Basic thermodynamic processes: [6]

7.1 Constant volume process

7.2 Constant pressure process

7.3 Constant temperature process

7.4 Adiabatic process

7.5 Polytrophic processes

7.6 Related problem.

Practical
List of Experiments

1) Determine thermal conductivity of given specimen.
2) Compare different types of thermometers.
3) Demonstrate steam tables & charts
4) Verify ideal gas laws

Suggestion for instruction:

1. Use illustrative teaching materials like model, charts, and overhead transparencies to visualize the complex parts.

References:

1. Kulshrestha, S. K. Reprint 2002 Thermal Engineering, Vikash Publishing House Pvt. Ltd. New Delhi – 110014, India
2. RathaKrishanan E, 2002 Fundamental of Engineering Thermodynamics, Prentice Hall India Pvt. Ltd, New Delhi – 110001, India

Manufacturing Technology I

EG 2104 ME

Year: **II**

Semester: **I**

Total: 14 hours /week

Lecture: 4 hours/week

Tutorial: hours/week

Practical: 10 hours/week

Lab: hours/week

Course Description:

The subject aims at imparting knowledge and skill components in the field of basic manufacturing science. The course is offered as an extension of the Workshop Technology II. It deals with different machine tools required for manufacturing processes.

Course Objectives:

After the completion of the course, the student shall be able to
1. Practice workshop safety rules effectively
2. Operate various equipments and machine tools and manipulate them
3. Produce simple metal components and articles using different machine tools and accessories
4. Supervise mechanical works in the subject related field
5. Perform maintenance works of the machines and undertakes repair works wherever necessary.

Course contents:

Unit 1:   General safety Considerations on machining workshop   [1]

Unit 2:   Metal Cutting   [8]

     2.1   Introduction
     2.2   Orthogonal and Oblique cutting
     2.3   Classification of cutting tools
     2.4   Tool geometry in Co – ordinate System
     2.5   Types of chips
     2.6   Sources of heat in metal cutting
     2.7   Tool failure
     2.8   Tool life
     2.9   Tool wear
     2.10 Cutting Tool Materials
     2.11 Machinability

Unit 3:   Lathe machine   [8]

     3.1   Introduction and Classification of lathe machine

3.2 Working Principle and construction of Engine lathes

3.3 Lathe Accessories: Centers, Face plates, Chuck, dogs, Mandrels, Tool Posts, Steady rests and follower rests

3.4 Lathe Operations: Turning, Facing, Taper turning, Threading, Drilling, Boring, Reaming and Knurling

3.5 Cutting variables: Cutting Speed, Feed and Depth of Cut

3.6 Machining Time

3.7 General repair and maintenance of lathe machine

Unit 4:   Shaping Machines   [5]

4.1 Introduction and Working Principle

4.2 Classification of Shaping Machines

4.3 Shaper Mechanism – Quick Return Mechanism

4.4 Shaper Tools

4.5 Work holding devices and tool holding devices

4.6 Shaper Operations – Horizontal, Vertical and Angular cutting

4.7 Cutting Speed, Feed and Depth of Cut

4.8 Machining Time

4.9 General repair and maintenance of shaper machine

Unit 5:   Drilling Machines   [4]

5.1 Introduction and Working Principle

5.2 Classification of Drill Presses

5.3 Work Holding attachments and accessories

5.4 Drilling Tools

5.5 Drilling Operations: Drilling, Counter- boring, Counter-sinking and Reaming

5.6 General repair and maintenance of shaper machine

Unit 6:   Milling Machines   [8]

6.1 Introduction and Working Principle

6.2 Classification of Milling Machines

6.3 Principal Parts of Column and Knee type Milling Machine

6.4 feed mechanism of milling machine

6.5 Milling Cutters: types, nomenclature and uses

6.6 Milling Operations: Plain, Face, Angular, Form, Gang and Keyway Milling

6.7 Milling Methods: Peripheral, Up, Down, Face and End Milling

6.8 Work Holding Devices and Cutter Holding Devices

6.9 Indexing Heads

6.10 Indexing Methods: Direct, Plain, Compound and Differential Indexing

6.11 Cutting Speed, Feed and Depth of Cut

6.12 Machining Time

6.13 General repair and maintenance of shaper machine

Unit 7: **Grinding Machines** **[6]**

7.1 Introduction and Working Principle
7.2 Abrasives and Bonds
7.3 Grain, Grade and Structure
7.4 Specification of Grinding Wheels
7.5 Mounting, Loading and Glazing of Grinding Wheels
7.6 Trueing and Dressing of Grinding Wheels
7.7 Classification of Grinding Machines
7.8 Grinding Operations: Cylindrical, Internal, Surface, Face, Form, Center less Grinding and Sharpening of Cutting Tools
7.9 Cutting Speed, Feed and Depth of Cut
7.10 Machining Time

Unit 8: **Planning Machines** **[5]**

8.1 Introduction and Working Principle
8.2 Classification of Planer Machines
8.3 Planer Mechanism
8.4 Planer Operations – Planning horizontal surface; Planning vertical surface; Planning angular surface and Planning Formed surface
8.5 Cutting Speed, Feed and Depth of Cut
8.6 Machining Time
8.7 General repair and maintenance of shaper machine

Unit 9: **Boring Machines** **[3]**

9.1 Introduction and Working principle
9.2 Classification of Boring Machines
9.3 Boring Operations: Facing; Counter-boring; Counter-sinking and Trepanning
9.4 Jig Boring Machines
9.5 Cutting Speed, Feed and Depth of Cut
9.6 General repair and maintenance of shaper machine

Unit 10: **Capstan and Turret Lathes** **[6]**

10.1 Introduction and Working Principle
10.2 Difference between a Capstan and Turret Lathe and a Engine Lathe
10.3 Classification of Capstan and Turret Lathes
10.4 Difference between a Capstan Lathe and a Turret Lathe
10.5 Work Holding Devices and Tool Holding Devices

10.6 Capstan and Turret Lathe Operations: External Thread cutting; Internal Thread Cutting

10.7 Cutting Speed, feed and Depth of Cut

10.8 General repair and maintenance of shaper machine

Unit 11: Broaching Machines [3]

11.1 Introduction and Working Principle

11.2 Classification of Broaching Machine

11.3 Broaching Methods: Internal Broaching; External Broaching; Pull Broaching; Push Broaching and Continuous Broaching

11.4 Cutting speed, Feed and Depth of Cut

11.5 Machining Time

12.6 General repair and maintenance of shaper machine

Unit 12: Cutting Fluids [2]

12.1 Introduction

12.2 Functions of Cutting Fluids

12.3 Qualities of Good Cutting Fluids

12.4 Classification of Cutting Fluids

12.5 Application of Cutting Fluids

12.6 Safety in the Use of Cutting Fluids

Unit 13: Maintenance [1]

13.1 Introduction

13.2 Types of Maintenance

13.3 Maintenance Schedule

References:

1. Workshop Technology, Part 1, Dr. W. A. J. Chapman, Standard Publishers and Distributors, Delhi, INDIA, First Edition, 1998

2. Workshop Technology, Part 2, Dr. W. A. J. Chapman, Standard Publishers and Distributors, Delhi, INDIA, First Edition, 1998

3. Elements of Workshop Technology, Vol. I: Manufacturing Processes, S. K. Hajra Choudhury and A. K. Hajra Choudhury, Media Promoters and Publishers Pvt. Ltd., Bombay, INDIA, Tenth Edition, 1993

4. Elements of Workshop Technology, Vol. II: Machine Tools, S. K. Hajra Choudhury, S. K. Bose and A. K. Hajra Choudhury, Media Promoters and Publishers Pvt. Ltd. , Bombay, INDIA, Eight Edition, 1988

5. A Course in Workshop Technology, Vol. I – Prof. B. S. Raghuwanshi, Dhanpat Rai and Co. (P) Ltd, Delhi, INDIA, Ninth Edition, 2002

6. A Course in Workshop Technology, Vol. II – Prof. B. S. Raghuwanshi – Dhanpat Rai and Co. (P) Ltd, Delhi, INDIA, Ninth Edition, 2002

7. Workshop Technology, Vol. I – H. S. Bawa – Tata McGrawHill publishing company Limited, New Delhi, INDIA,

8. Workshop Technology, Vol. II – H. S. Bawa – Tata McGrawHill publishing company Limited, New Delhi, INDIA,

9. A text book of Workshop Technology - R. S. Khurmi and J. K. Gupta - S. Chand and Company Ltd, New Delhi. INDIA

10. All about Machine Tools – Heinrich Gerling – New Age International (P) Limited, Publishers, New Delhi, INDIA, Sixteenth Edition 2000

Practical Exercise

List of Practical

S. N	Description	Time (hours)
1	Demonstration of formation of chips on a lathe, continuous, discontinuous and fractured by changing variables like rake angle, speed feed and depth of cut.	10
2	Grinding of single point (H.S.S.) tools.	6
3	Demonstration of preparing soluble oil cutting fluid and its use for improving the surface	6
	Practice of various operations on Lathe (Facing, turning, step turning, knurling)	10
4	Practice of taper turning and screw cutting on a centre lathe	10
5	Practice of drilling, boring and reaming on a lathe.	10
6	Practice of mounting cutters on the milling m/c and setting of m/s.	6
7	Practice of up milling and down milling operation.	10
8	Practice on shaper machine.	15
9	Practice on Milling machine.	20
10	Surface grinding on a flat surface.	10
11	Practice on drilling machine	8
12	Practice on Capstan & Turret Lathes	20
13	Schedule maintenance work required for various machine tools.	9
	Total (hrs.)	**150**

Machine Drawing

EF 2105 ME

Year: II
Semester: I

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

Course Description:

This course deals with drawings about machines, elements of machine, standard graphical signs, symbols and notations, different type of fits with limits and tolerances, layout- installation, assembled & detail drawings of a plant or machine.

Course Objectives:

After completing this course the students will be able to:

1. Read and sketch different universally accepted graphical signs, symbols and notations.

2. Understand the importance of limits, fits and tolerances in machines.

3. Draw few common machine elements with prevailing common practices.

4. Prepare working (detail & assembled) drawings.

5. Understand layout and installation drawings.

Course contents:

Unit: 1   Symbols   [4]

1.1   Introduction to machining, surface roughness, plumbing and structural symbols and their meaning
1.2   Drawing exercises on above sub unit

Unit: 2   Limits, tolerances and fits   [8]

2.1   Nominal and basic size, limits of size.
2.2   Fundamental deviations, tolerances, upper & lower deviation.
2.3   Types of fit (clearance, interference& transition)
2.4   Hole basis & shaft basis system.
2.5   Go, no-go gauge, interchangeability & selective assembly.
2.6   Drawing exercises on above sub units

Unit: 3.   Gear, pulley and belt   [8]

3.1   Spur gear and definitions of spur gear terminology

3.2 Construction of base circle, spur gear teeth (involute) profile

3.3 Pulleys &belts (fast and loose pulleys, V-belt pulleys, rope pulleys)

3.4 Drawing exercises on above sub units

Unit: 4   Working drawing (detail or production drawing)   [16]

4.1 Introduction – drawing layout, title box, bill of materials (part list)

4.2 Sketch of details of different components of a machine with free hand dimensioning

4.3 Review of different type of sectioning- full, half, partial (or broken), revolved, removed and offset

4.4 Review of common dimensioning types

4.5 Drawing exercises on above sub units

Unit: 5   Working drawing (assembly drawing)   [20]

5.1 Introduction to drawing layout, detail item list (bill of materials), drawing numbers (sheet numbers), sheet folding and filing styles

5.2 Accepted norm and common practices for assembly drawing

5.3 Sectioning & dimensioning concept for assembly drawing

5.4 Sequences of preparing the assembly drawing

5.5 Drawing exercises on above sub units

Unit: 6   Installation and layout drawing   [4]

6.1 Introduction to plant or machine layout and installation drawing

6.2 Drawing exercises (Observation and group discussion of minimum two sets of installation and layout drawings)

References:

1. N.D Bhatt and V.M. Panchal, Machine Drawing, Charotar Publishing House, 2001).

2. Luzadder, W.J., Fundamental of Engineering Drawing, Prentice-Hall of India Pvt-Ltd., New Delhi, Latest edition.

Metrology

EG 2106 ME

Total: 3 hours /week

Year: II
Semester: I

Lecture: 2 hours/week
Tutorial: hours/week
Practical: hours/week
Lab: 1 hours/week

Course Description:

Metrology is the science of measurements. Engineering metrology mainly deals with the measurements of lengths and angles and other quantities which are expressed in linear or angular terms. It is mainly concerned with establishing units of measurements, developing methods of measurements, analyzing errors, accuracy of measurements, principle of measurements.

Course Objectives:

After completing this course the students will be able to
1. Describe the principles of different types of measuring instruments
2. Understand the uses of various kinds of measuring instruments
3. Understand the techniques of handling and maintaining measuring instruments
4. Use properly linear, angular and surface measuring instruments
5. Carry out alignment tests with machine tools

Course contents:

Unit 1   Introduction   **[4]**

    1.1 Definition, types and scope of Metrology
    1.2 Measurement and it's types
    1.3 Metrological terminology (precision, accuracy, sensitivity, resolution)
    1.4 Errors (types and sources of errors)
    1.5 Classification of standards
    1.6 Standards and it's classification

Unit 2   Linear measuring instruments   **[8]**

    2.1   Construction, working principle, type, range of measurement, scale division value, precision, accuracy, sensitivity, application and care of:
        2.1.1   Non-precision type (steel rule, calipers, divider, telescopic gauge, depth gauge, screw pitch gauge)
        2.1.2   Precision type (micrometer, Vernier caliper, radius and feeler gauge, slip gauges or gauge blocks, comparator, dial indicator)

Unit 3   Angular measuring instruments   [8]

    3.7 Construction, working principle, type, range of measurement, scale division value, precision, accuracy, sensitivity, application and care of:

        3.7.1 Non precision type (engineering square, combination set, protractor, adjustable bevel)

        3.7.2 Precision type (universal bevel protractor, spirit level, sine bar, indexing head, angle dekkar, clinometer, autocollimator, angle gauges)

Unit 4.   Surface measuring instruments   [2]

    4.1 Construction, working principle, type, range of measurement, scale division value, precision, accuracy, sensitivity, application and care of:

        4.4.1 Straight edge

        4.4.2 Try square

        4.4.3 Surface plate, surface gauge

Unit 5.   Measurement of surface finish   [4]

    5.1 Introduction

    5.2 Surface texture and its types (roughness, waviness, form error)

    5.3 Numerical evaluation of surface texture

    5.4 Indication of surface roughness symbols used

Unit 6   Machine tool testing   [4]

    6.1 Introduction

    6.2 Measuring instruments used for machine tool testing

    6.3 Common geometrical tests to be carried out with

- Lathe
- Drilling machine
- Milling Machine

    6.4 Practical test

List of laboratory works

1. To be familiar with construction, working principle, handling and care of various Linear, angular and surface measuring instruments
2. To perform linear measurements
3. To perform angular measurements
4. To perform surface measurements
5. To use slip gauges for measuring unknown gap
6. To use dial indicator
7. To measure angle of small and large components using sine bar and slip gauge
8. To perform alignment test with Lathe

9. To perform alignment test with Milling machine
10. To perform alignment test with Drilling Machine
11. To perform measurement of different parameters like external diameter, internal diameter, effective pitch diameter, pitch of screw threads with the help of various instruments
12. To perform measurement of parameters of spur gear
13. To measure surface roughness of various surfaces of objects

References:
1. Jain, R., K., Engineering Metrology
2. M. S. Mahajan A text book of Metrology
3. Gupta A Text Book of Metrology
4. Engineering Metrology & Instrumentation by R.K Rajput, S K Kataria & sons Publisher, Delhi
5. J.F. Gaylor, C.R. Shifbolt, Metrology for Engineers
6. Anand K. Bewoor, Vinay A. Kulalarni, Metrology and mesurement

Computer Applications

EG 2107 CT

Total: 4 hours /week

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

Course Description:

The course deals with the major components, accessories of computer and their application.

Course Objectives:

After completing this course the students will be able to:
1. understand the basic features of major components in computer.
2. understand the applications, characteristics and operation of the components.
3. install and maintain different components

Course contents:

Unit 1: Introduction to Computer   **[4]**
     1.1 Introduction to computers and computing
     1.2 Characteristics of computer, history, generation and types

Unit 2: Computer system   **[12]**
     2.1 Computer Hardware: CPU, VDU, input and output devices
     2.2 Computer Software: role and types
     2.3 Computer memory and storage system
     2.4 Operating System
          2.4.1 Importance, types and application: DOS, Window, Linux
          2.4.2 Booting process, internal and external commands
     2.5 Application Software: Importance, types and application (Word, Excel, Power point, Excess)
     2.6 Utility Software: Importance, types and application (Multimedia, Virus and Antivirus)

Unit 3: Computer networking & data communications   **[4]**
     3.1 Types of network
     3.2 Networking topology
     3.3 Networking Protocols
     3.4 Transmission media
     3.5 Internet/E-mail

Unit 4: Introduction to C Programming   **[10]**
     4.1 Operations, Data types

4.2 Conditional statements
4.3 Loops
4.4 Functions
4.5 Arrays
4.6 File handling

List of Practical
a. Identification and assembling of computer Components
b. Practice on DOS Commands
c. Installation and practice of Windows program (Word
d. Installation and Configuration of Devices Drivers
e. Use of E-mail/ internet
f.   Computer programming in C practice

Engineering Mechanics
EG 2109 ME

	Total: 5 hours /week
Year: **II**	**Lecture: 3 hours/week**
Semester: **I**	**Tutorial:** **1 hours/week**
	Practical: **hours/week**
	Lab: 1hours/week

Course Description:

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

Course Objectives:

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

Course contents:

Unit 1.	**Introduction**	**[3]**
	1.1 Definition, classification and scope of engineering mechanics	
	1.2 Basic concepts	
	1.3 Physical quantities	
	1.4 Reference frame of axes	
	1.5 System of units	
Unit 2.	**Static of particles and rigid bodies**	**[9]**
	2.1 Introduction	
	2.2 Concepts of force and force system	
	2.3 Resultant of a force system	

2.4 Determination of resultant of different force systems

2.5 Resolution of forces

2.6 Rectangular components of force

2.7 Moment of a force about a point

2.8 Moment of a force about an axis

2.9 Principle of Moments

2.10 Torque and couple

2.11 Related problems

Unit 3. Equilibrium [3]

3.1 Introduction to the concept of equilibrium

3.2 Conciliations of equilibrium in two- and three dimensions

3.3 Body constraints and free body diagrams

Unit 4. Distributed forces [8]

4.1 Concept of concentrated and distributed forces

4.2 Centre of gravity and centroids

4.3 Location of centroids and centre of gravity of lines, areas and solid bodies with regular and composite shapes and forms

4.4 Second moment of area and moment of inertia

4.5 Related problems

Unit 5. Friction [5]

5.1 Introduction

5.2 Definition

5.3 Nature of friction and types

5.4 Theory of dry friction

5.5 Laws of friction

5.6 Angle of friction and coefficient of friction

5.7 Friction on an inclined plane

5.8 Related problems

Unit 6. Dynamics [7]

6.1 Introduction to dynamics

6.2 Kinematics of particles

6.3 Motion and its types

6.4 Rectilinear motion of particles: displacement, velocity, speed, acceleration and distance traveled by particles

6.5 Curvilinear motion of particles: radius vector, displacement, velocity, and acceleration

6.6 Motion under gravity

6.7 Relative motion and dependent motion

6.8 Kinematics of rigid bodies

6.9 Introduction to kinetics

6.10 Newton's laws of motion

6.11 Equations of motion and related problems

6.12 Linear momentum of particles

6.13 Principle of impulse and momentum

6.14 Related Problems

Unit 7. Work, power and energy [10]

7.1 Relation between rpm, torque and power

7.2 Application of work and energy principles to rigid bodies

7.3 Potential and kinetic energy

7.4 Law of conservation of mechanical energy

7.5 Related problems

Lab/ Practical

List of laboratory experiments

1 Verification of parallelogram law and triangle law of forces

2 Verification of polygon law of forces

3 Verification of principle of moments

4 Determination of coefficient of friction (μ) between wood, steel, copper and glass (horizontal and vertical)

5 Determination of moment of inertia by flywheel

6 Determination of the support reaction of simply supported beams with concentrated loads at one or more points

7 Identification of composition and resolution of forces by vector method

References:

1 Beer F.P & Johnston ER: Mechanics for Engineers, 7th Edition, Mc Graw Hill.

2 Malhotra, M.M, Subramanian, R., Gahlot RathorP.S, B.S: Text book in applied mechanics, Wiley Eastern Limited.

3 Kumar, D.S: Engineering Mechanics, Kataria S.K & Sons.

4 Hibbler R.C: Engineering mechanics, Statics and Dynamics

S.S. Bhavikatti, K.G. Rayashekarappa, Engineering Mechanics, revised edition

Fourth Semester

Subjects:

1. EG2201ME   Computer Graphics (Auto CAD)
2. EG 2202ME   Thermal Engineering II
3. EG 2203ME   Manufacturing Technology II
4. EG 2204 ME Machine Element and Mechanism
5. EG 2205ME   Strength of Materials
6. EG 2206ME   Fluid Mechanics and Machines
7. EG 2207ME   Industrial Management

Computer Graphics (Auto CAD)

EG 2201 ME

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

Course Description:

This course deals with generation of two-dimensional and three-dimensional drawing using AutoCAD. It also deals with the inserting dimensions and text in drawing.

Course Objectives:

After completing this course the students will be able to
1. Draw two dimensional objects
2. Draw isometric and three dimensional objects
3. Insert dimension and text on drawing.

Course contents:

Unit 1: Introduction   **[4]**

  1.1   Introduction: loading, screen organization, versions
  1.2   Communicate with AutoCAD using the keyboard and different menus (cursor, screen, pull-down, toolbar menu)
  1.3   AutoCAD command and system variables, Command options and default
  1.4   Setting UNITS and DRAWING LIMITS
  1.5   Coordinate System: Rectangular and polar

Unit 2: Basic Drawing Commands   **[12]**

  2.1   LINE command: types and loading
  2.2   POINT command
  2.3   XLINE command and its options
  2.4   ARC command and its options
  2.5   CIRCLE command and its options
  2.6   POLYGON command and its options
  2.7   PLINE command and its options
  2.8   MLINE command and its options
  2.9   SPLINE command and its options
  2.10 ELLIPSE and RECTANGLE command with options

Unit 3:   Modifying commands   **[12]**

      3.1   Object selection methods
      3.2   ERASE, OOPS, UNDO, REDO commands
      3.3   OFFSET command
      3.4   COPY, MOVE, ROTATE, MIRROR, ARRAY commands
      3.5   SCALE, STRETCH commands
      3.6   CHAMFER, FILLET commands
      3.7   TRIM, EXTEND commands
      3.8   EXPLODE, BREAK, LENGTHEN and DIVIDE commands
      3.9   PEDIT command
      3.10 CHPROP command, ltype, ltscale, lweight and color
      3.11 DDSELECT, DDMODIFY commands
      3.12 Use of Grips

Unit 4:   Drawing Aids in AutoCAD   **[6]**

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

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

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

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

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

Unit 7:   Fine tuning drawings   **[2]**

      7.1   HATCH and BHATCH commands

Unit 8:   Grouping in AutoCAD   **[2]**

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

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

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

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

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

Unit 11: Isometric drawing in 2D   **[8]**

     11.1 Starting, Types and changing of iso-planes (left, right, top)

     11.2 Creating isometric drawing

Unit 12: 3-D solid modeling   **[8]**

     12.1 Creating solids: box, cylinder, cone, wedge and sphere
     12.2 Boolean operations: Union, Subtraction, Intersection
     12.3 EXTRUDE command

Unit 13: Plotting drawings   **[4]**

     13.1 Layout management
     13.2 Device information, pen parameters, paper size and orientation
     13.3 Scale, rotation and origin
     13.4 MVIEW, MVSETUP commands

Reference:

    1. G. Omura; Mastering AutoCAD, Latest Edition

Thermal Engineering II

EG 2202 ME

Total: 6 hours /week

Year: II
Semester: II

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

Course Description:

This course deals with the application of laws of thermodynamics, types and functions of internal combustion engines and air compressors. It deals with the performance of internal combustion engines. It also deals with the characteristics of fuel & its calorific values.

Course Objectives:

After completing this course the students will be able to

1. Describe the thermodynamics cycles.
2. Explain the working principle of various systems & components of internal combustion engines
3. Describe the performance of internal combustion engines.

Course contents:

 Unit 1:   Fuels and combustion of fuels: **[6]**
      1.1   Classification of fuels
      1.2   Merits and Demerits of fuels
      1.3   Combustion equation
      1.4   Heating value of fuels: higher and lower heating values
      1.5   Air fuel mixture ratio: lean, stoichiometric and rich mixtures

 Unit 2: Thermodynamic cycles: **[16]**
      2.1   Air standard cycles
      2.2   Definition and purpose of air standard efficiency
      2.3   Carnot cycle, Otto cycle, Diesel cycle, Dual cycle, Gas cycle, Rankine cycle, their representation on P-V and T-S diagrams,
      2.4   Related Problems.

Unit 3:   Internal combustion engine: **[22]**
      6.1   Introduction to internal combustion engine
      6.2   Classification of I. C. Engine

6.3   Engine components and their function

6.4   Two stroke and four stroke cycle petrol and diesel engines and their comparison.

6.5   Petrol fuel System

      6.5.1   Purpose and layout of petrol fuel system

      6.5.2   Fuel pump: mechanical and electric fuel pump

      6.5.3   Fuel filter

      6.5.4   Carburetor and carburetion

      6.5.5   Simple carburetor and its defect

      6.5.6   Types of carburetor

      6.5.7   Systems of carburetor

      6.5.8   Idle system

      6.5.9   Main metering or fuel supply system

      6.5.10 Accelerating pump system

      6.5.11 Power fuel supply system

      6.5.12 Choke system

      6.5.13 Introduction to electronic fuel injection system

6.6   Diesel fuel injection system

      6.6.1   Purpose and layout of diesel fuel injection system

      6.6.2   Fuel feed pump

      6.6.3   Fuel filters

      6.6.4   Fuel injection pump: Inline type and Distributor type

      6.6.5   Fuel injectors and its types

      6.6.6   Introduction to common rail direct injection system

6.7   Ignition systems

      6.7.1   Battery point ignition systems

      6.7.2   Magneto ignition system

      6.7.3   Electronic ignition system

6.8   Cooling system

      6.8.1   Air cooling and water cooling, overheating and excessive cooling

      6.8.2   Types of cooling system: Air cooling and water cooling system

      6.8.3   Importance of engine coolant

6.9   Lubrication system

      6.9.1   Types of lubrication system

      6.9.2   Functions of lubricating oil

      6.9.3   Viscosity numbers and grade of lubricating oil

      6.9.4   Types of lubrication system: splash system and pump pressurized system

Unit 4:   Performance of I.C. engine: **[10]**

      4.1 Indicated power

      4.2 Brake power

      4.3 Friction power

4.4 Specific fuel consumption

4.5 Efficiencies of I.C. engines

4.6 Indicated thermal, brake thermal, Mechanical and relative efficiencies

4.7 Engine emission and legal requirements

4.8 Related problems.

Unit 5: **Air compressor:** [6]

5.1 Air compressors

5.2 Uses of compressed air

5.3 Classification of air compressor: Reciprocating compressor, Single stage reciprocating compressor, Rotary compressor

5.4 Difference between reciprocating and rotary compressor.

Practical

1. Determine the calorific value of fuel (petrol, diesel).
2. Demonstrate Performance of internal combustion engine.
3. Demonstrate various systems of internal combustion engines:-
    a) Fuel Supply System
    b) Cooling System
    c) Ignition System
    d) Lubrication System
    e) Governing
4. Perform engine emission test
5. Study performance of air-compressor.

Suggestion for instruction:

1. Use illustrative teaching materials like model, charts, and overhead transparencies to visualize the complex parts.
2. Show videos in the class in related topics.
3. Students are asked to assemble, dismantle and test the parts in the practical classes.
4. Use of appropriate tools is emphasized to test the condition of parts.

Reference:

3. Pulkrabek, W. W. 2002 Engg. Fundamentals of Internal Combustion Engines, Prentice Hall of India Pvt. Ltd. New Delhi – 110001, India
4. Kulshrestha, S. K. Reprint 2002 Thermal Engineering, Vikash Publishing House Pvt. Ltd. New Delhi – 110014, India
5. Domkundwar& Arora, A course in Refrigeration and air conditioning, Dhanpat Rai and sons, 1682, NaiSarak, Delhi – 110006, India
6. RathaKrishanan E, 2002 Fundamental of Engineering Thermodynamics, Prentice Hall India Pvt. Ltd, New Delhi – 110001, India

Manufacturing Technology II

EG 2203 ME

Total: 13 hours /week

Year: **II**

Semester: **II**

Lecture: 4 hours/week
Tutorial: hours/week
Practical: 9 hours/week
Lab: hours/week

Course Description:

This course deals with different advanced machine tools required for manufacturing industry. The subject aims at imparting knowledge and skill components to the student making them competent and potential in the field of applied manufacturing science. The course is offered as an extension of the Manufacturing Technology I.

Course Objectives:

1. Practice special casting processes for casting different metals
2. Apply advanced welding techniques for joining different metals
3. Use surface finishing processes for obtaining required surface finish in different components
4. Produce simple gears using gear generating processes
5. Produce simple threads using threads generating processes
6. Use powder metallurgy for producing simple articles
7. Operate machines that uses advanced machining processes

Course contents:

Unit 1: Jigs and Fixtures [4]

    1.1 Introduction
    1.2 Difference between Jig and Fixture
    1.3 Uses of Jigs and Fixtures
    1.4 Principles of Design of Jigs and Fixtures
    1.5 Materials for Jigs and Fixtures
    1.6 Drilling Jigs
    1.7 Turning Jigs
    1.8 Milling Fixtures
    1.9 Grinding Fixtures
    1.10 Welding Fixtures
    1.11 Boring Fixtures

Unit 2: Special Casting Processes [12]

   2.1 Introduction

   2.2 Permanent Mould Casting: Introduction; Working Principle, Advantages, Limitations and Applications

   2.3 Slush Casting: Introduction; Working Principle, Advantages, Limitations and Applications

   2.4 Die Casting: Introduction; Working Principle, Advantages, Limitations and Applications

   2.5 Centrifugal Casting: Introduction; Working Principle, Advantages, Limitations and Applications

   2.6 Investment Casting: Introduction; Working Principle, Advantages, Limitations and Applications

   2.7 Mercast Process: Introduction; Working Principle, Advantages, Limitations and Applications

   2.8 Continuous Casting: Introduction; Working Principle, Advantages, Limitations and Applications

   2.9 Precision Casting: Introduction; Working Principle, Advantages, Limitations and Applications

   2.10 Casting Defects and their possible remedies

Unit 3: Metal Forming [10]

   a. Bulk Deformation Processes
      i. Introduction
      ii. Forging - Open Die, Impression Die, Closed Die

      iii. Forging Dies, Hammers and Presses
      iv. Rolling – Flat rolling and Shape Rolling
      v. Extrusion – Types of Extrusion; Dies and Presses
      vi. Drawing – Wire, Bar and Tube Drawing
   b. Sheet Metal Working
      i. Introduction
      ii. Bending
      iii. Deep Drawing
      iv. Spinning

Unit 4: Advanced Welding Techniques [10]

   4.1 Atomic Hydrogen Welding: Introduction; Working Principle and Applications

   4.2 Plasma Arc Welding: Introduction; Working Principle and Applications

   4.3 Electro – Slag Welding: Introduction; Working Principle and Applications

   4.4 Ultrasonic Welding: Introduction; Working Principle and Applications

   4.5 Explosive Welding: Introduction; Working Principle and Applications

   4.6 Electron Beam Welding: Introduction; Working Principle and Applications

    4.6   Laser Beam Welding: Introduction; Working Principle and Applications

    4.7   Welding Defects and their possible remedies

Unit 5: Surface Finishing Processes   **[6]**

    5.1   Introduction

    5.2   Terminology

    5.3   Lapping: Introduction, Working Principle and Applications

    5.4   Honing: Introduction, Working Principle and Applications

    5.5   Super finishing: Introduction, Working Principle and Applications

    5.6   Buffing: Introduction, Working Principle and Applications

    5.7   Polishing: Introduction, Working Principle and Applications

    5.8   Tumbling: Introduction, Working Principle and Applications

    5.9   Burnishing: Introduction, Working Principle and Applications

Unit 6: Gear Generating Processes   **[6]**

    6.1   Introduction

    6.2   Classification of Gears

    6.3   Terminology

    6.4   Methods of Forming Gears

    6.5   Machining of Gears

    6.6   Gear Shaping

    6.7   Gear Cutting by Rack Cutters

    6.8   Gear Hobbing

    6.9   Gear Milling by a Formed Disc Cutter

Unit 7: Thread Generating Processes   **[6]**

    7.1   Introduction

    7.2   Types of Threads

    7.3   Terminology

    7.4   Thread Cutting

    7.5   Thread Milling

    7.6   Thread Grinding

    7.7   Thread Rolling

Unit 8: Powder Metallurgy   **[6]**

    8.1   Introduction, definition and concept

    8.3   Characteristics of Metal Powders

    8.4   Methods of Producing Metal Powders

    8.5   Principles of Powder Metallurgy

    8.6   Process of Powder Metallurgy

    8.7   Advantages and Disadvantages of Powder Metallurgy

    8.8   Applications of Powder Metallurgy

References:

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2. Fundamentals of Modern Manufacturing, materials, processes and systems – Mikell P. Groover – John Wiley and Sons, Inc , Singapore, 2004
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6. Manufacturing Science – Amitabha Ghosh and Ashok Kumar Mallik – Affiliated East – West Press Private Limited, New Delhi, INDIA, Reprint 2005
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9. Elements of Manufacturing Processes – B. S. Nagendra Parashar and R. K. Mittal – Prentice Hall of India Pvt Ltd, New Delhi, INDIA, 2003
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11. Manufacturing Technology, Foundry, Forming and Welding – P. N. Rao – Tata McGraw – Hill Publishing Company Limited, New Delhi, INDIA, Second Edition, 1998
12. A Course in Workshop Technology, Vol. II – Prof. B. S. Raghuwanshi – Dhanpat Rai and Co. (P) Ltd, Delhi, INDIA, Ninth Edition, 2002
13. Elements of Workshop Technology Vol. II (Machine Tools) – S. K. Hajra Choudhury, S. K. Bose and A. K. Hajra Choudhury, Media Promoters and Publishers Pvt Ltd, Bombay, INDIA, Eight Edition 1988
14. Fundamentals of Design and Manufacturing – G. K. Lal, Vijay Gupta and N.Venkata Reddy, Narosa Publishing House, New Delhi, INDIA, First Edition, 2006

Practical

List of experiments
1. Study of various Jigs and Fixtures.   [6]
2. Study of various Special Casting Processes [22]
3. Demonstrate mechanical working of metals [8]
4. Study of various Metal Forming Processes [15]
5. Study of various Advanced Welding Techniques. [22]
6. Study of various Surface Finishing Processes.   [14]
7. Produce simple gears using gear generating processes. [22]
8. To generate threads on a job by various thread generating process. [18]
9. Study of power metallurgy. [8]

Machine Elements and Mechanism

EG 2204 ME

Total: 4 hours /week

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

Course Description:

This course deals with the fundamental law & their application in the field of machines and mechanisms. This deals with position, velocity, acceleration and forces in a mechanism. The main emphasis is given on graphical approach than analytical approaches. It also deals with fundamentals of vibrations in a machine.

Course Objectives:

After completing this course the students will be able to
1. Understand design and uses of various machine components.
2. Understand design and uses of various mechanisms.

Course contents:

Unit 1: Machine elements   **[24]**

     1.1   Introduction
     1.2   Shaft, axles (concept, types and comparison between shaft and axle)
     1.3   Bearing (types, application, selection)
     1.4   Belt, pulleys (types, application, selection)
     1.5   Gear (types, application, dimensioning and calculation)
     1.6   Chains (types, application)
     1.7   Ropes (types, application)
     1.8   Power transmission (belt drive, gear drive, chain drive and related problems)
     1.9   Couplings, clutches (types, function and application)
     1.10 Springs (types and application)
     1.11 Seals (types and application)

Unit 2: Joints/connection   **[12]**

     2.1 Detachable joints
         2.1.1   Thread (types, description and application)
         2.1.2   Screws (types, description and application)
         2.1.3   Nut and bolts (types, description)

2.1.4   Pin & keys (types, description and application)

2.1.5   Tapers (types, description and application)

2.2 Permanents joints

2.2.1   Rivet joints

2.2.2   Shrink connection (shrinking process and application)

2.2.3   Soldering

2.2.4   Welded joints

Unit 3: Mechanisms [6]

3.1 Lever mechanism (crank)

3.2 Cam mechanism

3.3 Wedge and screw mechanism

3.4 Gear mechanism

3.5 Friction mechanism

3.6 Belt mechanism

3.7 Hydraulic and pneumatic mechanism

3.8 Electro mechanical mechanisms

Unit 4: Introduction to balancing [3]

4.1 Introduction

4.2 Static: principle and application

4.3 Dynamic: principle and application

List of Experiments:

1. Study of geometry of machine elements and specification
    1.1. Detachable joint
    1.2. Permanent joint
    1.3. Machine element (shaft, axle, bearing, belt, pulley, chain, gears, belt drive, gear drive, chain drive, coupling & clutches, spring, seals)
2. Study of mechanisms and their characteristics
    2.1 Lever mechanisms
    2.2 Cam mechanisms
    2.3 Wedge & screw mechanism
    2.4 Gear mechanism
    2.5 Friction mechanism
    2.6 Belt mechanism
    2.7 Hydraulic and pneumatic mechanism
    2.8 Electro-mechanical mechanism

References:

1. Rao, J. S. & Dukkipati, R. V. 2002 (or latest edition) Mechanism & Machine Theory, New Age Ineternational, India
2. Shigley, J.E. & Uicker, J.J. 1995 (0r latest) Theory of Mechines and mechanisms, McGrew Hill, Singapore.

Strength of Materials

EG 2205 ME

Year: **II**	**Total: 5hours /week**
Semester: **II**	**Lecture: 3 hours/week**
	Tutorial: **1 hours/week**
	Practical: **hours/week**
	Lab: 1 hours/week

Course description:

In Engineering every structure is designed and its drawing is prepared, then the work is executed. After design the structural members are checked for various stresses whether the member is safe or not for the given load conditions. Then the size and the position of the member are fixed. The responsibility of Diploma holder is to carry out the job successfully under the guidance of an engineer and by the support of tradesmen.

Course Objectives:

After completing this course the students will be able to
1. Understand different types of force action
2. Understand important mechanical properties of materials.
3. Conduct the laboratory test or determining
4. Interpret test results of different properties of materials

Course contents:

Unit 1:   **Introduction to strength of materials and its scope**   **[1]**

Unit 2:   **Load**   **[9]**
         2.1 Concept of load and reaction
         2.2 Different forms of loading: concentrated, U.D.L. and varying/ distributed load:
                2.2.1   Moment of inertia
                2.2.2   Center of gravity
                2.2.3   Section modulus
                2.2.4   Reaction and its determination
                2.2.5   Concept of internal forces
                2.2.6   Deformation of a body under the action of an external forces

Unit 3:   **Stress and strain**   **[6]**
         3.1 Elastic limit, Hooke's law, stress strain curve
         3.2 Related problems

Unit 4:   **Tension and compression**   **[5]**
         4.1 Tensile strength

4.2 Compressive strength
        4.3 Related problems

Unit 5:   **Shear and torsion**   **[8]**
        5.1 Shear stress and strain
        5.2 Shearing strength of materials
        5.3 Torsional stress and strain
        5.4 Related problems:
                5.4.1   Moment of resistance
                5.4.2   Polar modulus

Unit 6:   **Bending**   **[8]**
        6.1 Shear force and bending with diagrams
        6.2 Bending stress and strain
        6.3 Related problems: beam deflection

Unit 7:   **Design of axially loaded columns**   **[4]**
        7.1 Introduction
        7.2 Columns with different support conditions
        7.3 Stresses in compressed columns
        7.4 Timber columns
        7.5 Related problems

Unit 8:   **Combined loading**   **[5]**
        8.1 Unsymmetrical bending
        8.2 Eccentric tension and compression
        8.3 Combined bending and torsion
        8.4 Combined shear and torsion
        8.5 Related problems

Reference

2. Strength of Materials by R.S. Khurmi
3. Strength of Materials by S. Ramamurthan
4. Theory and problems of Strength of Materials by William A. Nash
5. Strength of Materials by Siger
6. Mechanics of Structures by S.B. Junnarkan
7. Strength of Materials by A. Kozachenko and others

Lab Experiments

1. Bending test
2. Shear test
3. Deflection test
4. Torsion test
5. Experimental determination of support reactions.

Fluid Mechanics and Fluid Machines

EG 2206 ME

Total: 5 hours /week

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

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

Practical: **hours/week**

Lab: 1 hours/week

Course Description:

This course deals with the general theories and equations of fluid mechanics. It also describes various applications of theories including water turbines and pumps.

Course Objectives:

After completing this course the student will be able to explain:
1. General properties of fluids
2. Various characteristics of fluid at static and kinematics conditions
3. Basic theories and equations of fluid mechanics with their applications
4. Various phenomena of viscous flow
5. Dynamic action of fluid
6. Theories and working principles of fluid machines

Course contents:

Unit: 1   Properties of fluid   [3]

        1.1   General introduction of fluid

        1.2   Density, specific volume, specific weight and specific gravity

        1.3   Fluid viscosity

        1.4   Surface tension and capillarity

        1.5   Compressibility and Bulk modulus

        1.6   Related Problems

Unit 2:   Fluid static   [5]

        2.1   Fluid pressure, fundamental equation of fluid static and pressure head

        2.2   Absolute pressure, gauge pressure and atmospheric pressure

        2.3   Pressure measuring devices and manometer

        2.4   Force on plane and curved submerged bodies

        2.5   Buoyancy, flotation and stability

        2.6   Related Problems

Unit 3:   Kinematics of fluid   [2]

        3.1   Description of fluid motion, path line and stream line

3.2   Types of fluid displacement

3.3   General types of fluid flow

Unit 4:   **Basic equations of fluid flow**   **[7]**

4.1   Continuity equation

4.2   Bernoulli's equation

4.3   Momentum equation

4.4   Applications of basic equations of fluid flow

4.5   Related Problems

Unit 5:   **Viscous flow**   **[7]**

5.1   Laminar and turbulent flow

5.2   Reynold's number

5.3   Flow of viscous fluid in circular pipe: Hagen-Poiseuille equation

5.4   Boundary layer concept

5.5   Lift and drag on immersed body

5.6   Resistance to flow and head losses in close conduits

Unit 6:   **Notches and weir**

6.1   Types and difference of notches and weirs

6.2   Flow over rectangular and triangular notches, co-efficient of discharge

Unit 7:   **Dynamic action of fluid**   **[5]**

7.1   Dynamic force and power

7.2   Force exerted by fluid jet on stationary and moving flat/ curved plates

7.3   Related problems

Unit 8:   **Water turbines**   **[9]**

8.1   Basics of hydropower plants

8.2   introduction and development of water turbines

8.3   Classification of water turbines

8.4   Working principles of Pelton, Francis, Propeller and Cross flow turbines

8.5   Head, efficiencies, specific speed and general characteristics curve of water turbines

8.6   Introduction of water turbine governor and their functions

Unit 9:   **Pumps**   **[7]**

9.1   Classification of pumps (positive displacement and roto-dynamic pumps)

9.2   Working of centrifugal, axial and piston pumps

9.3   Pump characteristics and selection of pump

9.4   Hydraulic ram pump

Lab/Practical

1. Study of properties of fluid   [1]
2. Validity of Bernoulli's theorem   [3]
3. Losses in pipe flow through bends and fittings   [2]
4. Performance characteristics of Pelton turbine   [3]
5. Performance characteristics of Francis turbine   [3]
6. Compare the characteristics of various pumps   [3]

Suggestions for instruction:

1. Give appropriate examples of surrounding.
2. Use SI units as well as possible.
3. Solving related problems in the class and give as home assignment.
4. Use as much as figures and diagrams with direction of flow.
5. Site visit of power plant, irrigation plant and drinking water supply system are advantage for this course

References:

1. B.S. Massy, 1980, Fluid Mechanics, English Language Book Society and Van Nostrand Reinhold Company, London
2. F.M. White, 1986, Fluid Mechanics, Mc Graw-Hill Book Company, Singapore
3. J.F. Douglas, J. M. Gasiorek and J. A. Swaffield., 2002, Fluid Mechanics, Person Education Pvt. Ltd., Singapore
4. Dr. Jagdish Lal 2002, Fluid Mechanics and Hydraulics, Metropolitan Book Co. Private Ltd., New Delhi India
5. Dr. Jagdish Lal 1997, Hydraulic Machines, Metropolitan Book Co. Private Ltd., New Delhi India
6. R. K. Rajput, 1999, S Chand and Company Ltd. Fluid Mechanics and Hydraulics Machines, New Delhi
7. V. L. Streeter and E. B. Wylie., 1983, Mc Graw-Hill Book Company, Singapore

Industrial Management

EG 2207 ME

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

Course Description:

This course deals with the fundamental concepts of organization, management, leadership and supervisory, production management, marketing of products or services, materials management and inventory control, engineering economics and capital management required for supervisors and first line managers engaged in industrial activities.

Course Objectives:

After completing the course the student will be able to
1.   Describe the concept of organization and management
2.   Understand the basic theories of management
3.   Explain the various leadership behaviors of a manager
4.   Explain the concept of production management and production control
5.   Understand the process of marketing
6.   Demonstrate the understanding of materials management
7.   Apply the principles of engineering economics and capital management

Course contents:

Unit 1   Introduction   [15]

    1.1   Organization
        1.1.1   Organization as an open system
        1.1.2   Evolution of organizations
        1.1.3   Principle of organization
        1.1.4   Formal and informal organization
    1.2   Forms of ownership
        1.2.1   Single ownership: introduction, advantages and disadvantages
        1.2.2   Partnership organization: introduction, types, advantages, disadvantages
        1.2.3   Joint stock company: introduction, types, advantages, disadvantages
        1.2.4   Cooperative organizations: basic concept, advantages, disadvantages
        1.2.5   Public corporation: introduction, advantages and disadvantages
    1.3   Organization structure
        1.3.1   Line organization
        1.3.2   Line and staff organization

1.3.3　Functional organization

　　　1.3.4　Departmentalization

　　1.4　Management

　　　1.4.1　Functions of management

　　　1.4.2　Level of management

　　　1.4.3　Managerial skills

　　1.5　Theory of management

　　　1.5.1　Evolution of management theory

　　　1.5.2　Scientific management theory

　　　1.5.3　Administrative management theory

　　　1.5.4　Behavioral management theory

　　　1.5.5　Modern management theory

Unit2　Leadership and supervision　　　　　　　　　　　　　　**[3]**

　　2.1　Definition of leadership

　　2.2　Qualities of leadership

　　2.3　Difference between management and leadership

　　2.4　Theories of leadership

　　2.5　Leadership styles

　　2.6　Definition of supervision

　　2.7　Duties of a foreman

　　2.8　Essential qualities of a foreman

Unit3　Production management　　　　　　　　　　　　　　　**[11]**

　　3.1　Introduction

　　3.2　System concept of production

　　3.3　Various techniques used in production system

　　　3.3.1　Forecasting

　　　3.3.2　Plant location and layout

　　　3.3.3　Product design and analysis

　　　3.3.4　Production planning and control

　　　3.3.5　Maintenance management

　　　3.3.6　Inventory control

　　　3.3.7　Quality control

　　3.4　Finance and capital management

　　　3.4.1　Sources of finance for investment

　　　3.4.2　Assets and liabilities

　　　3.4.3　Fixed capital and working capital

　　　3.4.4　Accounting (definition and importance of accounting, concept of debit and credit, journal and ledger, profit and loss account, balance sheet)

　　3.5　Concept of time and motion study

Unit 4   Marketing   **[5]**

    4.1   Definitions of market and marketing

    4.2   Modern concepts of marketing: customer orientation and customer satisfaction

    4.3   Functions of marketing: buying, selling, transport, storage, standardization & grading, financing, risk bearing, market information

    4.4   Concept of marketing mix: product, price, place, promotion

    4.5   Understanding consumer behavior

    4.6   Understanding the concept of distribution channels

    4.7   Sales promotion

    4.8   Advertising

    4.9   Trade exhibitions

Unit5   Materials management and inventory control   **[6]**

    5.1   Definition of materials management

    5.2   Functions of material management: material planning, store/stock control, purchasing, receiving and issue of materials, simplification/standardizing/coding of materials, transportation and handling, value engineering and value analysis, disposal of scrap, surplus and obsolete materials.

    5.3   Store management: meaning, objectives, function of store

    5.4   Inventory control (inventory level, economic lot size and related numerical)

Unit 6   Engineering economics   **[5]**

    6.1   Introduction

    6.2   Importance of manufacturing industry in the economy of the country

    6.3   Estimating and costing

    6.4   Classification of costs

    6.5   Types of project evaluation techniques

References:

1. Ahuja, K.K. (1994). Industrial Management. CBS Publishers and Distributors, India.
2. Agrawal, G.R. (2003). Principles of management in Nepal. M.K. Publishers and distributors, Kathmandu, Nepal.
3. Mahajan, M. (2002). Industrial engineering and production management (2nd ed.). Dhanpat Rai and Co. (P) Ltd., Delhi.
4. Panneerselvam, R. (2005). Production and Operations management (2nd ed.).Prentice-Hall of India, Private Limited, Delhi.
5. Sharma, S.K & Sharma, Savita (2002). A course in Industrial engineering and operations management. S.K. Kataria and Sons, Delhi, India.
6. Verma, A.P. (2002). Industrial Engineering. S. K. Kataria & Sons, Delhi.

Third Year
(Fifth and Sixth Semester)

Fifth Semester

Subjects:

1. EG 3101 ME Basic Automobile Engineering
2. EG 3102 ME Advance Manufacturing Process
3. EG 3103 ME Industrial Attachment
4. EG 3104 ME Maintenance Engineering
5. EG 3106 ME Fundamentals of Hydraulics and Pneumatics
6. EG 3107 ME Machine Design, Estimating & Costing
7. EG 3108 ME Project I

Basic Automobile Engineering
EG 3101ME

Year: **III**
Semester: **I**

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

Course Description:

This course deals with the main components, their types and functions of an automobile. It also describes the uses and types of automobile and incorporates the electrical system used in automobile.

Course Objectives:

After completing this course the students will be able to
1. describe the uses of various kinds of motor vehicles,
2. explain the operation of various aggregates, components of motor vehicle,
3. check to the condition and motor vehicles components, and
4. carry out servicing of those components.

Course contents:

Unit 1. Introduction to an automobile [4]

    1.1 Meaning of automobile
    1.2 Classification of automobile
    1.3 Layout of Chassis
    1.4 Basic parts & various operating systems used in automobile
    1.5 Basic dynamics of automobile

Unit 2. Transmission (Power train) [10]

    2.1   Clutch: functions, types, construction and operation
    2.2   Gear box: functions, types, construction and operation
    2.3   Propeller shaft and universal joints: functions, types, construction and operation
    2.4   Differential: functions, construction and operation
    2.5   Rear axle: functions and types

Unit 3. Front axle and steering system [9]

    3.1 Front axle: function, types and construction
    3.2 Steering system: purpose, types, construction and operation
    3.3 Steering gearbox: functions, types, construction and operation

3.4 Wheel alignment: front suspension height, camber, steering axis inclination, caster, toe, turning radius

Unit 4. Brakes [5]
4.1 Braking system : types, function and construction
4.2 Disc and drum brakes: operation and servicing
4.3 Brake mechanism: operation and servicing

Unit 5.Tires and wheels [4]

5.1 Tires: purpose, types, construction, size, tire pressures
5.2 Wheels: types and construction

Unit 6. Suspension system [5]

6.1 Main components: identification and care
6.2 Springs: functions, types and construction
6.3 Dampers: purpose, construction and operation

Unit 7. Electrical and electronic systems [8]

7.1 Sub-systems: starting system, charging system, accessory system
7.2 Main components of electrical sub-systems: identification, functions, operations and care.
7.3 Battery: construction, specification, operation and care of lead-acid battery
7.4 Starting motor with solenoid switch: construction, operation and care
7.5 Alternator and regulator: construction, operation and care
7.6 Circuit diagram of electrical system: identification of color code, connections and care
7.7 Electronic components: identification, functions, operation and care

Practical

Unit 1.   Introduction to automobile [2]

1.1   Describe the functions of main components of automobile
1.2   Distinguish the various types of automobile

Unit 2.   Transmission (Power train)

2.1 Clutch [6]

2.1.1 Demonstrate construction and operation of coil spring clutch and a diaphragm clutch
2.1.2 Trouble shooting in clutch system
2.1.3 Perform repair and maintenance of different types of clutch

2.2 Gearbox [8]
2.1.3 Demonstrate different types of manual gear box and transfer case

2.1.4 Trouble shooting in gearbox and transfer case

2.1.5 Repair and maintenance of different types of gearbox and transfer case

2.3 Propeller shaft differential and rear axle **[2]**

2.3.1 Function propeller shaft, slip joint, universal joints and differential in rear axle drive

2.3.2 Repair and maintenance of propeller shaft, slip joint universal joints, differential and rear axle

Unit 3. Front axle and steering system **[8]**

3.1 Inspect the condition of front axle

3.2 Function of steering system

3.3 Dismantling the parts of steering system

3.4 Identification of parts of steering system and their function

3.5 Checking and replacement of defective parts

3.6 Assembling and testing of parts

Unit 4. Brakes **[8]**

4.1 Identify and describe the construction of components of brake

4.2 Trouble shooting in brake system

4.3 Repair and maintenance of different types of brake system

Unit 5. Wheels and tires **[4]**

5.1 Function of wheels and tires

5.2 Types of tires and their specification

5.3 Checking defective tire and their repair and replacement

5.4 Fitting of tires to the vehicle

Unit 6. Suspension system **[8]**

6.1 Types of suspension system

6.2 Identification of parts and their function

6.3 Dismantling the parts

6.4 Checking and replacement of defective parts

6.5 Assembling and testing of parts

Unit 7. Electrical and electronic system **[10]**

7.1 Identify the major components of electrical and electronic system

7.2 Explain the purpose, construction, operation of battery, starter motor,   alternator, regulator and accessories

7.3 Check the condition of battery, starter motor, alternator, regulator, switches, diodes and wirings

Suggestion for instruction:

2. Use illustrative teaching materials like model, charts, and overhead transparencies to visualize the complex parts.
3. Show videos in the class in related topics.
4. Students are asked to assemble, dismantle and test the parts in the practical classes.
5. Use of appropriate tools is emphasized to test the condition of parts.

References:

1. Pulkrabek, W.W., 2002, Engineering Fundamentals of the Internal Combustion Engine, Prentice-Hall of India Private Limited, New Delhi – 110001, India.
2. Crouse, W. H. and Anglin, D. L., 1997, Automotive Mechanics, 9th Edition, TATA-McGrawHill publishing company ltd, New Delhi, India.
3. Rajput, R. K., 2006, A textbook of Automobile Engineering, Laxmi Publications (P) Ltd, New Delhi, India.
4. Kirpal Singh, A text book of automobile engineering
5. P.S. Gill, Automobile Engineering, S.K. Katariya

Advanced Manufacturing Technology

EG 3102 ME

Year: III
Semester: I

Total: 12 hours /week
Lecture: 4 hours/week
Tutorial: hours/week
Practical: 8 hours/week
Lab: hours/week

Course Description:

The subject aims at imparting knowledge and skill components to the students who have aimed to develop their career as job professionals. The course is offered as an extension of the Manufacturing Technology II. The intention of this course is to polish the knowledge and skill of the students by introducing modern trends in manufacturing processes. It deals with modern aspects of manufacturing technology.

Course Objectives:

After the completion of the course, the student shall be able to
1.   Demonstrate knowledge and skill on non-conventional machining methods
2.   Produce simple metal components and articles using NC and CNC machines
3.   Supervise advanced mechanical works in the subject related field
4.   Demonstrate knowledge and skill on advanced manufacturing technologies.

Course contents:

Unit 1.   Non-conventional Machining Processes   [12]
  1.1. Limitations of conventional Machining
  1.2. Introduction to non-conventional machining
  1.3. Non-conventional machining processes: Working principle, operating parameters
      and application
      1.3.1.   Electro Chemical Machining
      1.3.2.   Chemical Machining
      1.3.3.   Electric Discharge Machining
      1.3.4.   Abrasive jet Machining
      1.3.5.   Ultrasonic Machining
      1.3.6.   Electron Beam machining
      1.3.7.   LASER Beam Machining
      1.3.8.   Plasma Arc Machining

Unit 2. Introduction to CAD, CAM and CIM   **[10]**

    2.1 Definition of CAD, CAM and CIM

    2.2 Computers: The Foundation of CAD/CAM

    2.3 General Design procedure and application of computer in design

    2.4 Computer integrated manufacturing systems (CIMS)

    2.5 Basic components of CIMS

    2.6 Benefits of CAD/CAM and CIMS

    2.7 Programmable Controllers

    2.8 Adaptive controller

    2.9 Automation
        2.9.1   Objectives of Automation
        2.9.2   Types of Automation
        2.9.3   Applications of Automation

Unit 3. Numerical Control and Computer Numerical Control of Machine tools **[12]**

    3.1   Introduction
    3.2   Basic Components of NC systems
    3.3   Classification of NC systems
    3.4   Working Principles of NC Machines
    3.5   Advantages and Limitations of NC Machine Tools
    3.6   Applications of NC Machine Tools
    3.7   Introduction to Computer Numerical Control Machine tools
    3.8   Brief History of CNC Machine tools
    3.9   Major Elements of CNC Systems
    3.10 Functions of CNC Machine Tools
    3.11 Comparison of NC systems and CNC systems
    3.12 Types of CNC systems
    3.13 Advantages of CNC Machines
    3.14 Applications of CNC Machines

Unit 4. Computer Aided Process Planning (CAPP)   **[10]**

    4.1. Process Planning
        4.1.1   Introduction
        4.1.2   Aims of Process Planning
        4.1.3   Process Planning Sheet
        4.1.4   Operation Sequence Planning
        4.1.5   Operation Sheet
    4.2 Computer Aided Process Planning (CAPP)
        4.2.1. Introduction
        4.2.2. Traditional Process Planning
        4.2.3. Automated Process Planning
        4.2.4. Types of CAPP

4.2.5.　Advantages of CAPP

Unit 5　Robotic Technology　[10]

5.1 Introduction

5.2 Robot Anatomy

5.3 Classification of Robots

5.4 Robot Drive

5.5 Robot Control System

5.6 Accuracy and Repeatability

5.7 End Effectors

5.8 Applications of Robots

5.9 Future Robots

Unit 6 Automated Guided Vehicle System (AGVS)　[6]

6.1 Introduction

6.2 Components of an AGVS

6.3 Types of AGVS

6.4 Advantages of AGVS

6.5 Applications of AGVS

References:

1. Fundamentals of Modern Manufacturing, materials, processes and systems, Mikell P. Groover, John Wiley and Sons, Inc , Singapore, 2004
2. Manufacturing Engineering and Technology, Serope Kalpakjian and Steven R. Schmid, Addison Wesley Longman (Singapore) Pte. Ltd., Fourth Edition, 2000
3. Production Engineering and Science, Dr. P. C. Pandey and Dr. C. K. Singh, Standard Publishers Distributors, Delhi, INDIA, Seventh Edition, 2003
4. Manufacturing Processes II – H. S. Bawa, Tata McGraw Hill Publishing Company Limited, New Delhi, INDIA, 2004
5. Computer Aided Manufacturing, C. Elanchezhian, T. Sunder Selwyn and G. Shanmuga Sundar, Laxmi Publications (P) Ltd, New Delhi, INDIA, First Edition, 2005
6. Manufacturing Technology, M. Adithan and A. B. Gupta, New Age International (P) Limited, Publishers, New Delhi, INDIA, 1996
7. Numerical Control by Marthin (E.L.B.S.)
8. Understanding of CAD/CAM- Design with computer by D.J. Bowman, and R.N. MC-Douglas (BPB Publication

Practical
List of experiments

1. To be get acquainted with construction, principle and operation of NC and CNC machine tools   [6]
2. To make program for CNC machines   [15]
3. To perform machining operation in NC and CNC machine tool   [20]
4. To make a design of manufacturing process for a production of a given component   [10]
5. To be get acquainted with anatomy, principle, control system, operation and application of Robot [6]
6. To plan a manufacturing process for machining a part of type shaft   [6]
7. To plan a manufacturing process for machining a part of type casing   [6]
8. To plan a manufacturing process for machining a part of type gears   [6]
9. To be get acquainted with hardware, software, operating system and command of
   (Computer Aided Design) and CAM (Computer Aided Manufacturing)   [20]
10. To have basic skills in loading programs, making directories, opening and saving files in CAD   [20]
11. To have basic skills in loading programs, making directories, opening and saving files in CAM   [20]

Industrial Attachment

EG 3103 ME

Year: III
Semester: I

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

Course description:

The students will be deputed to various mechanical workshop/service stations on a full time basis as a trainee or intern. At the end of the course, students will submit a report conforming to a standardized format along with the daily diary. Industrial attachment shall consist of exposure of world of work to learn skills and techniques in design, operation, diagnosis, maintenance and repair of mechanical sector based on the nature of the organization.

Course objectives:

After completing the course the students will be able to:
- Match the technical skills learn in the institute with the needs of the employer.
- Increase self-confidence to face the real world of work.
- Develop the strong linkage between industry and institution.
- Ensure the standard of the training as per the market demand.
- Sensitize with modern and new technologies applied in the industry.

Course contents:

The report will be prepared on the basis of the following guidelines.

1. Profile of the industry including workshop layout.
2. Basic feature of the workshop
3. General problems of the workshop/industry
4. Special technological aspect learnt during the internship/attachment.
5. Report on selected technological aspects.
6. Suggestions for improvement of selected aspect of the problems (store management, layout improvement, work study etc).
7. Daily diary maintenance

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Maintenance Engineering
EG 3104 ME

Year: III
Semester: I

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

Course Description:

This course deals with the necessity of maintenance of equipment and machines in the industries and various types of maintenance works that are performed. It also compares the merits and demerits of different maintenance strategies that need to be adopted in the industry.

Course Objectives:

After completing this course the students will be able to
a) explain the necessity of maintenance in industry
b) describe the causes of components failure
c) select the appropriate maintenance strategies
d) perform the necessary maintenance as per equipment manual

Course contents:

Unit 1: Introduction to maintenance: **[1]**

    1.1 Definition and needs
    1.2 Maintenance objectives

Unit 2: Wear   **[4]**

    2.1 Causes of component failure
    2.2 Types of failure
    2.3 Wear reduction methods
    2.4 Assets care: effective monitoring and maintenance

Unit 3: Types maintenance   **[10]**

    3.1 Break down: definition, merit/demerits, and applications
    3.2 Preventive: definition, merit/demerits, applications
    3.3 Predictive: definition, merit/demerits, applications
    3.4 Proactive: definition, merit/demerits, applications

Unit 4: Maintenance activities **[15]**

    4.1   Inspections: methods, inspection schedule, inspection report [parts, working condition, strength]

    4.2   Adjustments: methods, tools, [gap, clearance, etc.]

    4.3   Testing: methods, equipment, procedures [pressure, temperature, etc.]

    4.4   Calibrations: methods, equipment/instruments, procedures [pressure gauge, temperature etc.]

    4.5   Rebuilds: methods, equipment, procedures [gears, shaft]

    4.6   Replacements: as per requirement or on regular replacement cycle, procedures [v-belts, filters, gears, bearings]

Laboratory

Exercise I: Calibration of Thermometer

Exercise II: Calibration of Pressure gauge

Exercise III: Assemble and disassembly of various machine components likes v-belts, filters, gears, bearings

Exercise IV: Familiarization on the use of the adjustment tools

Suggestions for instruction:

1. The method of teaching is lecture on theory augmented by relevant examples and practical demonstration as much as possible.
2. Use relevant diagrams and charts as much as possible.

References:

1. S.N. Bhattacharya, 1995, *Installation Servicing and Maintenance*, S. Chand & Company Ltd., New Delhi – 110055, India. ISBN: 81-219-0831-0.
2. Sushil Kumar Srivastava, 1998, *Industrial Maintenance Management*, S. Chand & Company Ltd., New Delhi – 110055, India. ISBN: 81-219-1663-1.
3. P. Gopalakrishnan & A. K. Banerji, 1991, *Maintenance and Spare Parts Maintenance*, Prentice-Hall of India Pvt. Limited, New Delhi – 110001. ISBN: 0-87692-669-3.
4. www.wmeng.co.uk/wmeng/wmrem/rem.htm

Fundamentals of Hydraulics and Pneumatics

EG 3106 ME

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

Course Description:

This course deals with the basic fundamentals of hydraulics and pneumatics and provides general concept associated with hydraulics and pneumatics equipment.

Course Objectives:

After completing this course the student will be able to:
1. describe the uses of various kinds of hydraulic and pneumatic equipment
2. explain the operation of various kinds of hydraulic and pneumatic equipment
3. demonstrate basic knowledge of service, check, maintenance, diagnosis and testing of hydraulic and pneumatic equipment

Course contents:

Unit 1. Fundamental of hydraulics and pneumatics   [4]
    1.1 Introduction
    1.2 Development stage of hydraulic and pneumatic equipment
    1.3 Introduction of hydrostatics and hydrodynamics
    1.4 Basic principles of hydraulics and pneumatics
    1.5 Advantages and disadvantages
    1.6 Applications of hydraulic and pneumatic system

Unit 2. Industrial hydraulics   [15]
    2.1 Hydraulic system
        2.1.1 Types of hydraulic system and their properties: Open center system, closed center system
        2.1.2 Major and auxiliary components and their purposes

    2.2 Hydraulic Fluid
        2.2.1 Function of hydraulic oil
        2.2.2 Types of hydraulic fluids: Petroleum base fluids, Synthetic base fluids, Water
        2.2.3 Properties of hydraulic oil
        2.2.4 Basic requirements of hydraulic oil

    2.3 Hydraulic Components

2.3.1 Pumps: Introduction to hydraulic pumps and their types

2.3.2 Gear pump, principle, uses, trouble shooting

2.3.3 Vane pump, principle, uses, trouble shooting

2.3.4 Piston pump, principle, uses, trouble shooting

2.4 Hydraulic Cylinders

2.4.1 Introduction to hydraulic cylinders and its types

2.4.2 Piston types: single and double acting

2.4.3 Vane type cylinder

2.4.4 Miscellaneous cylinder

2.5 Hydraulic Valves and its types

2.5.1 Purpose and function of Pressure control valves, flow control valve and direction control valve

2.6 Hydraulic Motor

2.6.1 Introduction to hydraulic motor and types

2.6.2 Gear motor

2.6.3 Vane motor

2.6.4 Piston motor

2.7 Accumulator

2.7.1 Purpose and functions of accumulator

2.7.2 Spring loaded accumulator

2.7.3 Weight loaded accumulator

2.7.4 Pneumatic accumulator

2.8 Hydraulic Filters

2.8.1 Purpose and functions

2.8.2 Contaminants

2.8.3 Types of filters

2.9 Reservoir

2.9.1 Function

2.9.2 Basic features of reservoir

2.10 Oil Cooler

2.10.1 Functions

2.10.2 Types of oil cooler

Unit 3. Industrial Pneumatics [14]

3.1 Pneumatic system

3.1.1 Introduction and types of pneumatic system

3.1.2 Components of pneumatic system

3.2 Compressed air

3.2.1 Properties of compressed air

3.2.2 Preparation of compressed air

     3.3   Compressors

          3.3.1   Piston type compressors

          3.3.2   Vane type compressors

          3.3.3   Helical compressors

          3.3.4   Centrifugal compressors

     3.4   Air Cylinder and Air Motors

          3.4.1   Introduction

          3.4.2   Types

     3.5   Valves

          3.5.1   Pressure control valve

          3.5.2   Flow control valve

          3.5.3   Direction control valve

     3.6   Working principle of After Coolers
     3.7   Working principle of Dryers
     3.8   Working principle of Receiver
     3.9   Filters

          3.9.1   Purpose

          3.9.2   Contaminants in a pneumatic system

          3.9.3   Types

          3.9.4   Selection of filters

Unit 4. Hydraulic and pneumatic circuits   **[4]**

     4.1. Hydraulic and pneumatic symbols

     4.2. Drawing of hydraulic and pneumatic circuits

Unit 5. Introduction to general maintenance of hydraulic system and pneumatic system   [8]

     5.1. Preventive Maintenance

          4.2.1   Lines cleaning

          4.2.2   Preventive overhauling

          4.2.3   Preventing leaks, air-in-oil problems

     5.2. Diagnosis and Testing of Hydraulic system and Pneumatic system

          4.2.4   Introduction

          4.2.5   Basic steps

Practical/Lab   **[15]**

    1.   Experimental works on hydrostatics
    2.   Basic Hydraulic System
    3.   Pump operation system
    4.   Compressor operation system
    5.   Identification of hydraulic and pneumatic symbols

6. Control of pneumatic actuators, Direct command/Indirect command
7. Speed control of cylinder
8. Electro-pneumatic control of linear actuators
9. Automatic reciprocation and sequential operations
10. Control of Cylinders with Relays and Limit Switches
11. Circuit design problem

References:
1. Andrew Parr, Hydraulics and Pneumatics: A Technicians and Engineers Guide, Butterworth-Heinemann; 2nd edition (March 8, 1999) ISBN-10: 0750644192
2. Anthony Esposito, Fluid Power with Applications, 6TH edition, Prentice Hall
3. Hydraulics-John Deere service publications, Molino, Illions
4. G. P.Gorkhali, First Course in Hydraulics
5. S. Ilango, V. Soundarayan, Introduction to Hydraulics and Pneumatics, latest edition

Machine Design, Estimating and Costing

EG 3107 ME

Year: III

Semester: I

Total: 5 hours /week

Lecture: 4 hours/week

Tutorial: 1 hours/week

Practical: hours/week

Lab: hours/week

Course Description:

Knowledge of method of finding shapes and sizes of machine element is very essential from their strength and stiffness / rigidity viewpoints. Also the knowledge of calculation of manufacturing cost of machine element is essential. After completion of the course students will be able to design and find out the cost of the simple machine element. Theory explanation is supported by applied numerical problems.

Course Objectives:

After completing this course the students will be able to

1. analyze the factors affecting choice of material, assuming knowledge of materials as covered in material science and strength of materials.
2. design the simple machine elements for axial and torsional loading.
3. calculate the total cost of manufacturing of simple machine element.

Course contents:

Unit 1. Fundamental principles   [10]

    1.1   The difference between mechanism, machine element, and machine.

    1.2   Design procedure , Gathering information and formulating design problems.

    1.3   Basic requirements of machine elements, strength, stiffness, rigidity, wear resistance

    1.4   Magnitude, direction, and type of load – axial, bending, torsion, and combination.

    1.5   Strain and elasticity, stress, factor of safety.

    1.6   Elastic and plastic behavior of ductile and brittle materials, modulus of elasticity and modulus of rigidity.

    1.7   Fatigue, endurance limit, stress concentration, effects on factor of safety.

    1.8   Materials availability, weight and dimensions, process-ability and standardization.

    1.9   Manufacturing considerations in design

    1.10 Related Problems

Unit 2. Design of following components under axial loading   [12]

    2.1   Bolts under tension, both tension and compression, effect of initial tightening

    2.2   Riveted joints lap and butt for tie bar

2.3   Welded connections (lap and butt weld)

2.4   Turn buckle

2.5   Pins

2.6   Helical springs.

2.7   Related Problems

Unit 3.   Design of the following under torsional loading.   [12]

3.1 Shaft

3.2 Bearings

3.3 Rectangular taper sunk key

3.4 Rigid flange coupling

3.5 Straight armed cast iron pulley

3.6 Related Problems

Unit 4.   Estimating and costing   [6]

4.1   Introduction – Purpose of estimating and costing.

4.2   Difference of estimating and costing.

4.3   Types of costs.

4.4   Ladder of costs.

4.5   Allocating of overheads.

Unit 5.   Estimation of material cost.   [6]

5.1   Estimation of cost by volume.

5.2   Estimation of cast by weight.

5.3   Cost estimation of simple machine elements (pulley, spindle, wall bracket, Turn buckle)

5.4   Related Problems

Unit 6.   Estimation in machine shop.   [7]

6.1   Set up time

6.2   Estimation of operation time: machine time for various operations – turning, facing, threading, drilling, milling and shaping.

6.3   Non machining time.

6.4   Down time

6.5   Related Problems

Unit 7.   Estimation in welding, foundry and sheet metal shops   [7]

7.1   Welding shop: gas welding and arc welding.

7.2   Foundry shop: pattern cost and casting cost.

7.3   Sheet metal shop: size of blank, blanking and punching time.

7.4   Related Problems

References:

1. Rajendra Karwa: A Text Book of Machine Design; Laxmi publications, Latest edition
2. SG Kulkarni: Machine Design; TMH Outline series.
3. Banga and Sharma: Estimating and Costing; Khanna Publishers Delhi.
4. TTTI Madras: Mechanical Estimating and Costing.
5. R.S. Khurmi: A Text Book of Machine Design,
6. V.B. Bhandari, Design of Machine Elements, 3rd edition, 2014
7. Dr. P.C. Sharma and Dr. D.K. Agrawal, Machine Design, 11th edition, 2011

Project I

EG 3108 ME

Total: 5 hours /week

Year: III
Semester: I

Lecture: hours/week
Tutorial: hours/week
Practical: 5 hours/week
Lab: hours/week

Course Description:

This section of the syllabus will be the combination of the knowledge and the skill learnt during the previous courses. The student will be given an outline of device/item/tool/mechanism for the purpose. He/She shall then design and analyze the selected project work. The project report shall be submitted for appraisal. The project report will consists of the following:

- Design considerations (Static and Dynamic consideration)
- Force-load calculation (if any).
- Considerations on material selection.
- Assembly drawing/working drawing including Bill of Quantity (BOQ).
- Detail analysis of the components or elements.

The student will be allocated a team of guides comprising of the theory teacher and the practical teacher for his project and design work. The student shall also consult the library and internet for his work.

Before submission of the final work, he/she shall have to present his/her work among the evaluation team.

Sixth Semester

Subjects:

1. EG 3201 ME Basic Refrigeration and Air Conditioning
2. EG 3202 ME Renewable Energy Technology
3. EG 3203 ME Industrial Hygiene & Safety
4. EG 3201 MG Entrepreneurship Development
5. EG 3207 ME Project II
6. EG 3208 ME Elective (One of the followings)
   A: Product Design
   B: Power Generation Engineering
   C: Industrial Engineering
   D: Tools, Jigs, Fixtures and Die Design

Basic Refrigeration and Air Conditioning

EG 3201 ME

Total: 6 hours /week
Year: **III**   **Lecture: 4 hours/week**
Semester: **II**   **Tutorial: hours/week**
Practical: hours/week
Lab: 2 hours/week

Course Description:

This course deals with the study of refrigeration and air-conditioning systems, main components, and functions of conventional refrigeration and air-conditioning systems. It also describes the uses of and types of refrigeration and air-conditioning applications and incorporates the study of refrigerants and psychrometry.

Course Objectives:

After this course the students will be able to:
1. Describe the uses of various kinds of RAC systems
2. Explain the operation of components of conventional RAC systems
3. Installation, testing and diagnosis of RAC components/ system

Course contents:

Unit 1   Introduction to Refrigeration   **[6]**
    1.1   Meaning and need of Refrigeration
    1.2   Units of Refrigeration
    1.3   Reversed Carnot Cycle
    1.4   Heat Pump
    1.5   Comparison between heat engine, heat pump & refrigerator
    1.6   Coefficient of performance
    1.7   Related Numerical Problems

Unit 2 Vapor Compression Refrigeration Cycle   **[10]**
    2.1   Description of cycle
    2.2   Diagrams & Representation on P-V, T-S & P-H diagrams
    2.3   Factors affecting the performance of a simple vapour compression
    2.4   Deviation of actual vapour compression cycle from theoretical cycle
    2.5   Related Numerical Problems

Unit 3. Vapor Compression Refrigeration System & Controls   **[7]**
    3.1   Basic components: Function, types, specification and constructional details (compressor, condenser, expansion device & evaporator)

3.2   Control valve: Solenoid, thermostat, low pressure/high pressure cut out, oil safety switch

Unit 4. Vapor Absorption Refrigeration System [6]
  4.1   Comparison between vapor compression and vapor absorption system
  4.2   Theoretical Vapor absorption refrigeration system
  4.3   Actual Vapor absorption refrigeration system
  4.4   Applications of Vapor absorption refrigeration system

Unit 5. Refrigerants [5]
  5.1   Definition
  5.2   Primary & Secondary Refrigerants
  5.3   Designation of refrigerants
  5.4   Desirable properties of refrigerants
  5.5   Properties and applications of commonly used refrigerants: R12, R22 and R134a
  5.6   Newer Refrigerants

Unit 6. Refrigeration Plants [5]
  6.1   Layout & working of Ice Plant
  6.2   Layout & working of Cold storage
  6.3   Layout & working of Water Cooler
  6.4   Layout & working of Domestic Refrigerator

Unit 7. Psychrometry [10]
  7.1   Psychometric terms-Dry and wet bulb temperatures, Saturation, Dew point, adiabatic saturation, temperature, Relative humidity, absolute humidity, humidity ratio.
  7.2   Psychometric chart and its uses
  7.3   Psychometric processes-Sensible heating and sensible cooling, humidification and dehumidification, cooling and dehumidification, heating and humidification, and their representation on psychometric chart.
  7.4   Related common numerical problems

Unit 8 Basics of air conditioning [4]
  8.1   Meaning of air conditioning
  8.2   Metabolism in human body
  8.3   Human comfort
  8.4   Applications of air-conditioning

Unit 9. Air-conditioning System [5]
  9.1   Introduction
  9.2   Description of room air conditioner
  9.3   Central air conditioning system
  9.4   Air conditioning components: Filter, Fan, Radiator, Convector, Damper

Unit 10. Desert Air Cooler [2]

   10.1 Principle of evaporative cooling

   10.2 Working of Desert Air Cooler

Practical

1. Practice on: Tube cutting, flaring, bending and joining
2. Repair & maintenance of domestic refrigerator
3. Repair & maintenance of water cooler
4. Repair & maintenance of window type room air conditioner
5. Testing of a refrigeration unit to find out:
   i) Refrigeration capacity
   ii) Power input
   iii) COP
6. Charging refrigerant in an open as well as hermetically sealed units.
7. Physical detection of leakage of refrigerant by various methods.
8. To detect troubles/faults in a refrigeration system and to remove them.
9. Study and sketch of various types of expansion device
10. Study and sketch of thermostat, strainer, drier, H.P. L.P. and oil safety control and service valve.

Renewable Energy Technology

EG3202 ME

Total: 6 hours /week

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

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

Practical: hours/week

Lab: 2hours/week

Course Description:

This course deals with the basic fundamentals of renewable energy technology. Students will understand basic principles and application of various forms of renewable energy technology.

Course Objectives:

After completing this course the student will be able to:
1. Understand energy basics, unit conversion, potential of energy resources
2. Operate, repair and maintenance equipment and systems of renewable energy technology
3. Estimate potential of resources

Course contents:

Unit 1. Introduction [6]

     1.1   Law of energy conservation
     1.2   Energy consumption pattern (national, global)
     1.3   World energy reserves
     1.4   Importance of renewable energy resources
     1.5   Environmental concerns

Unit 2. Solar radiation [8]

     2.1   Introduction
     2.2   Extraterrestrial solar radiation
     2.3   Components of radiation
     2.4   Geometry of earth and sun
     2.5   Geometry of collector and the solar beam
     2.6   Effects of the earth's atmosphere
     2.7   Measurement of solar radiation and measuring devices

Unit 3. Applications of solar energy [12]

    3.1   Introduction

    3.2   Solar thermal

        3.2.1   Low temperature applications of solar energy (domestic hot water system, solar dryer, solar distillation, solar ponds, swimming polar heating)

        3.2.2   Concentrating collectors

        3.2.3   Flat plate collectors

    3.3   Solar electricity

        3.3.1   Semiconductors

        3.3.2   Analysis of photovoltaic cells

        3.3.3   Types of photovoltaic cells

        3.3.4   Solar home system

        3.3.5   Institutional solar photovoltaic system

        3.3.6   Solar water pumping

        3.3.7   Storage battery

Unit 4. Micro-hydro [12]

    4.1   Introduction

    4.2   Principles and classification

    4.3   Components of hydropower

    4.4   Pre-feasibility and detail study

    4.5   Turbines (impulse, reaction)

Unit 5. Wind energy [10]

    5.1   Introduction

    5.2   Turbine types

    5.3   Power extraction by a turbine

    5.4   Electricity generation

    5.5   Mechanical power

Unit 6. Bio energy [8]

    6.1   Introduction

    6.2   Types

    6.3   Methods of bio-conversion (physical, thermo-chemical, biological)

    6.4   Bio-gas plant: principle, construction &working

Unit 7. Geothermal energy [2]

Unit 8. Tidal power and Ocean thermal energy conversion [2]

Practical
1. Measurement of solar radiation
2. Demonstration of domestic solar water heater
3. Head/pressure measurement of micro hydro power project by different methods
4. Discharge measurements of small streams by different methods
5. Wind velocity measurement
6. Wind turbine installation practice
7. Biogas installation visit

References:

1. John W. Twidell and Anthony D. Weir, Renewable Energy Resources, English Language Book Society, ISBN 0419144706, Edition 1986
2. Philip G. Hill, Power Generation, Resources, Hazarch Technology and Costs, MIT Press, 1977
3. A. Thumann, Fundamentals of Energy Engineering, Fairmount Press, Prentice Hall Inc., 1984
4. A.W. Culp, Principles of Energy Conversion
5. G.D.Rai, Non-Conventional Energy Sources, Khanna Publisher, New Delhi, India

Industrial Hygiene and Safety

EG 3203 ME

Year: III
Semester: II

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

Course Description:

Awareness about hygiene and safety is the most important thing which every operator, worker, technician and engineer must always bear in mind while working in the industry. Human life is very precious and the organization of the industry must pay full attention to health and safety of workers. This course deals with various industrial hazards and their prevention.

Course Objectives:

After completing this course the students will be able to

1. induce safety awareness
2. locate unsafe locations and activities on shop floor and take corrective actions
3. understand statutory requirements regarding industrial hygiene and safety
4. manage industrial safety

Course contents:

Unit 1: Introduction to industrial hygiene and safety   [6]

   1.1   Scope of industrial hygiene and safety
   1.2   Cost and liability of industrial hygiene and safety
   1.3   Accident, causes of accident and accident prevention methods
   1.4   Principles and practices of safety management

Unit 2: Industrial Environment   [4]

   2.1   Sanitation in industry
   2.2   Ventilation system
   2.3   Lighting system
   2.4   Heating system

Unit 3: Electrical safety   [6]

   3.1   Effects of electric current on health
   3.2   Electrical accidents
   3.3   Electrical safety standards and regulations
   3.4   Prevention of electrical accidents
   3.5   Safety requirements for electric installation
   3.6   Protective equipment for electrical safety

Unit 4: Fire Prevention and control [4]

    4.1 Fire hazards
    4.2 Accident prevention principle
    4.3 Fire control methods

Unit 5: Noise Pollution and its control [4]

    5.1 Effect of noise on health
    5.2 Standard requirements for industrial noise levels
    5.3 Noise control principle and methods
    5.4 Personal protective equipment

Unit 6: Air Pollution [2]

    6.1 Classification of pollutants in industry
    6.2 Sources of pollutants
    6.3 Permissible limits
    6.4 Control of the environment

Unit 7: Electromagnetic Radiation [4]

    7.1 Health hazards due to electromagnetic radiation
    7.2 Permissible limits of electromagnetic radiation
    7.3 Electromagnetic radiation protection principle
    7.4 Personal protective equipment

Unit 8: Industrial Vibration [2]

    8.1 Causes of vibration
    8.2 Personal protective devices

Unit 9: Material Handling [4]

    9.1 Factors affecting selection of means for handling of materials
    9.2 Mechanical material handling
    9.3 Handling of dangerous chemicals

Unit 10: Machine Guarding [4]

    10.1 Legal requirements

    10.2 Assessment of guards

    10.3 Types of guards

    10.4 Design aspect of guards

Unit 11: Physical and chemical hazards and Safety measures in various operations [5]

    11.1 Arc welding and gas welding

    11.2 Forging

    11.3 Casting

    11.4 Machining

    11.5 Automotive works

Suggestions for instructions:

1. Demonstration of protective devices
2. Visit to industries
3. Demonstration of using various instruments and equipment

References:

1. William Handley, Industrial Safety handbook, Mc-Graw Hill
2. H. V. Krishnan, An introduction to Safety Engineering and Management
3. M. K. Polter, Occupational Health & Safety in Manufacturing Industries, Mir Publishers, Moscow
4. H. W. Henrich, Industrial Accident Prevention, Mc-Graw Hill

Entrepreneurship Development

EG 3201 MG

Year: III
Semester: II

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

Course description:

This course is designed to provide 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:

Unit 1: Introduction to business & entrepreneurship (9)

    1.1   Overview of entrepreneur and entrepreneurship

    1.2   Wage employment , self- employment and business

    1.3   Synopsis of types and forms of enterprises

    1.4   Attitudes, characteristics & skills required to be an entrepreneur

    1.5   Myths about entrepreneurs

    1.6   Overview of MSMEs (Micro, Small and Medium Enterprises) in Nepal

Unit 2: Exploring and developing entrepreneurial competencies (10)

    2.1   Assessing individual entrepreneurial inclination

    2.2   Assessment of decision making attitudes

    2.3   Risk taking behavior and risk minimization

    2.4   Creativity and innovation in business

    2.5   Enterprise management competencies

Unit 3: Business identification and selection **(4)**

    3.1   Sources and method of finding business idea(s)

    3.2   Selection of viable business ideas

    3.3   Legal provisions for MSMEs in Nepal

Unit 4: Business plan formulation **(17)**

    4.1   Needs and importance of business plan

    4.2   Marketing plan

- Description of product or service
- Targeted market and customers
- Location of business establishment
- Estimation of market demand
- Competitors analysis
- Estimation of market share
- Measures for business promotion

    4.3   Business operation plan

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

    4.4   Organizational and human resource plan

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

    4.5   Financial plan

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

    4.6   Business plan appraisal

- Return on investment
- Breakeven analysis
- Risk factors

Unit 5: Small business management (5)

    5.1   Concept of small business management

    5.2   Market and marketing mix

    5.3   Basic account keeping

Practical [30 Hours]

Unit 1: Overview of business & entrepreneurship (2)

    1.1   Collect business information through interaction with successful entrepreneur

Unit 2: Exploring and developing entrepreneurial competencies (2)

    2.1   Generate innovative business ideas

Unit 3: Product or service identification and selection (2)

    3.1   Analyze business ideas using SWOT method

Unit 4: Business plan formulation (22)

    4.1   Prepare marketing plan

    4.2   Prepare operation plan

    4.3   Prepare organizational and human resource plan

    4.4   Prepare financial plan

    4.5   Appraise business plan

    4.6   Prepare action plan for business startup

Unit 5: Small business management (2)

    5.1   Prepare receipt and payment account

    5.2   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 3207 ME

Total: 12 hours /week
Lecture: hours/week
Tutorial: hours/week
Practical: 12 hours/week
Lab: hours/week

Year: III
Semester: II

Course Description:

This section of the syllabus will be the combination of the knowledge and the skill learnt during the whole course. The student will be given an outline of device/item/tool/mechanism in the field of specialization to be fabricated or repaired or maintained as applicable to different specialization. He/She shall then design and produce or undertake it by himself or do the maintenance or repair job. The finished product along with project report shall be submitted for appraisal. The project report will consists of the following:

- Design considerations-use of relevant standards to design computations.
- Force-load calculation and their complete analysis.
- Considerations on material selection/heat treatment/manufacturing options.
- Assembly drawing/working drawing along with limit, fit and tolerance application including Bill of Quantity (BOQ).
- Estimating and costing /manufacturing time estimate/safety considerations.
- Economic analysis of the product.
- Test/check performance of design prototype.

The student will be allocated a team of guides comprising of the theory teacher and the practical teacher for her/his project and design work. The student shall also consult the library and internet for her/his work.

Before submission of the final work, he/she shall have to present his/her work among the evaluation team.

Product Design

EG 3208 ME
(Elective)

Total: 8 hours /week

Year: III
Semester: II

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

Course Description:

This course deals with product design process in the necessities of industrial design aspects in product design for customers requirements. It also covers the knowledge of evaluating the existing design.

Course Objectives:

After completion of this course students will be able to:

1. Identify major faces of the design activities.
2. Analyze the functional requirements of the design to determine the priorities.
3. Understand the ergonomic factors involved in design.
4. Able to appraise the designs for economical use of material and processes.
5. Able to compile a specification for the design.

Course contents:

Unit 1. Design Process   [4]

    1.1   Introduction – definition of product design.
    1.2   Design by evolution.
    1.3   Design by innovation.
    1.4   The design problem – identification and formulation.
    1.5   Physical reliability and economic worthiness.
    1.6   Examination of design in relation to safety, service life, environmental factors, cost etc.
    1.7   Examination of the detailed design for manufacturability.

Unit 2. Functional Analysis in Product Design.   [4]

    2.1 Importance of product function, behavior and performance.
    2.2 Main function and sub-function and methods of prioritization.
    2.3 Converting function into design.

Unit 3. Production Process.   **[10]**

    3.1   Role of processing in design.

    3.2   Classification of manufacturing process.

    3.3   Basic factors to be considered to simplify in designing machining process and machine operations.

    3.4   Factors affecting the form of casting webs, section changes, radii, draft…. Etc.

    3.5 Factors to be considered for design of forged components.

    3.6 Main factors to be considered for design of a welded structure.

    3.7   Comparing fabricated, cast, or forged products for economic production.

Unit 4. Assemble Process   **[10]**

    4.1 Definition, identification of machine components for mechanical assembly.

    4.2 The assembly process: mechanical fastening, joining methods, adhesive bonding.

    4.3 Assembly systems – full manual assembly, mechanical aided manual assembly, and automated assembly.

    4.4 Design for assembly.

    4.5 Important guide lines for cost reduction and ease of assembly.

Unit 5. Ergonomic Factors   **[6]**

    5.1   Meaning of ergonomics in terms of man-machine relationship.

    5.2   The human in the work place.

    5.3   The human as source of power.

    5.4   The human as sensor and controller.

    5.5   Analysis of ergonomic factors involved in the use of simple instruments, example: microscope, micrometer, lamp, lathe machine … etc.

Unit 6. Design Specification.   **[10]**

    6.1   Necessity of development of engineering specification.

    6.2   Specific requirements in terms of customer need principle markets, performance, environment, similar products, equipment, and expected life.

    6.3   Specific study for common products used in machine design, example: electric plug, foot pump, leather shoe, bicycle, writing pen, note pad.

    6.4   Compile and compare specification of different types of product design

Unit 7. Examination of simple products, fully documented with hard ware, model Drawing, etc. in terms of :-   **[8]**

    7.1 Specification and definition of the problem

    7.2 The various factors such as function, manufacture, material, cost, etc. influence in design.

Unit 8. Practical case studies for tutorial assignment.   **[8]**

Practical

1. Case study and class presentation: identify the obsolete and or existing product and draw the product life cycle with necessary parameters of product failure and present it in your class.   (25)

2. Case study and class presentation: Modify the previous product and present in your class.   (15)

3. Consider a product, analyze its ergonomic, aesthetic and manufacturing factors involved and present in your class.   (20)

References:

1.   AK Chilate and RC Gupta,   Product Design and Manufacturing, Prentice Hall of India.
2.   David G. Ullman, Mechanical Design Process: The McGraw-Hill Co. Inc.
3.   PC Sharma, A Text Book of Production Engineering; S Chand & Company Ltd.

Power Generation Engineering

EG 3208 ME
(Elective)

Total: 8 hours /week

Year: **III**

Semester: **II**

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

Course Description:

This course deals with the knowledge and skills related to the power generation engineering.

Course Objectives:

After completing this course the students will be able to have knowledge on
1.   Steam generations, steam nozzles, condensers & turbines
2.   Hydro-electric power plant, Diesel engine power plant, Gas turbine power plant & Nuclear power plant.

Course contents:

1. Steam Generations   **[16]**
    1.1 Introduction to boilers
    1.2 Classification of boilers (fire and water tube, low and high pressure boilers)
    1.3 Boilers mounting and accessories
    1.4 Performance of boiler
    1.5 Working of lamont, Loefflor, Benson, Velox, Babcock and wilcox boiler and Lancashire boiler
    1.6 Modern boiler (Stirling boilers)

2. Steam nozzle, condensers, and turbines   **[8]**
    2.1 Steam nozzle: classification and its use
    2.2 Condenser: classification, construction and working
    2.3 Steam turbine: classification, working principle and difference between impulse and reaction turbine.

3. Hydro-electric power plant   **[10]**
    3.1 Layout of hydro-electric power plant
    3.2 Classification of hydro-electric power plant
    3.3 Comparison with steam and diesel power plant
    3.4 Governing of turbines

4. Diesel engine power plant   **[10]**
    4.1 Types of diesel engine power plants

4.2 Layout and components of diesel engine power plant

4.3 Advantages and applications

5. Gas turbine power plant [7]
5.1 Working principle

5.2 Layout and components of gas turbine power plant

5.3 Classification of gas turbine power plant

5.4 Applications and advantages

6. Nuclear power plant [9]
6.1 Working principle

6.2 Layout and components

6.3 Types of nuclear reactor

6.4 Application, advantages and its challenges

List of Practical
1. Case study and presentation of construction and working detail of :- [25]
   a. Hydro electric power plant
   b. Diesel power plant
2. Study of controls provided in power plants listed above in S.No.1 [10]
3. Visit of various power plants and submit report in terms of:- [25]
   a. Detailed layout.
   b. Capacity.
   c. Elements of each unit.
   d. Control systems provided
   e. Barometers which are being controlled.
   f. Maintenance schedule.
   g. Lubrication systems, uses.

Text Books
1. Arora S. C. and domkundwar " A course in power plant engineering", S.Dhanpat rai, 2001
2. Nag P. K., "Power plant engineering" Third edition, Tata McGraw-Hill, 2007
3. A course in power plant engineering engineering by T.Morse

Reference Books
1. A course in power plant engineering By Agrawal.
2. El-Wakil M. M., "Power plant technology", Tata Mc-Graw-Hill, 1984
3. Nagpal G. R., "Power plant Engineering", Khanna Publishers, 1998
4. Rai G. D., "Introduction to power plant technology" Khanna Publishers, 1995.

Industrial Engineering

EG 3208 ME
(Elective)

Total: 8 hours /week

Year: III

Semester: II

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

Course Description:

The elective course in industrial engineering is designed to develop professionalism of the students in this sector. Industrial engineering is concerned with the design, improvement and installation of integrated systems of people, materials, equipment and energy. It draws upon specialized knowledge and skills in the mathematical, physical, and social sciences, together with the principles and methods of engineering analysis and design to specify, predict and evaluate the results to be obtained from such systems. To design, operate, maintain and improve any production system it is not possible by a single engineering professional. It is the responsibility of collective efforts of technical team that consists of engineers, technologists and technicians. This course deals with the concepts and principles of industrial engineering, design of production system, process planning, production planning and control, inspection and quality control, engineering economics and costing, quality control, production and productivity which is essential for the technical manpower engaged in lower as well as middle level management in any manufacturing company.

Course Objectives:

After completing the course the student will be able to
1. Describe the system concept of manufacturing organization
2. Assist in designing production system
3. Plan/assist to plan manufacturing processes
4. Assist in production planning and control activities
5. Apply the principles of engineering economics
6. Assist in inspection of raw materials and quality control of products
7. Understand productivity and its improvement techniques

Course contents:

Unit 1.   Industrial Engineering   [8]

      1.1   Definition and evolution of industrial engineering
      1.2   Functions of industrial engineering
      1.3   Functions of industrial engineering: problem solving and decision making

1.4   Broad functional areas of industrial engineering

1.5   Practical works:

     1.5.1   Identify a particular manufacturing or service company. Students are required to draw a system diagram of this organization and identify various input resources, conversion processes and outputs as a products or services to satisfy the needs of the customers.

Unit 2.   Design of production system   [9]

2.1 Introduction to a manufacturing plant

2.2 Classification of manufacturing processes

2.3 Plant location

     2.3.1   Importance of plant location

     2.3.2   Factors affecting plant location

2.4 Factory building and plant layout

     2.4.1   Types of factory building

     2.4.2   Importance of plant layout

     2.4.3   Types of plant layout

     2.4.4   Flow patterns

2.5 Material handling

     2.5.1   Factors affecting material handling (engineering and economics)

     2.5.2   Classification of material handling equipment

2.6 Layout practices of various workshops (fitting shop, machine shop, welding shop, sheet metal shop, smithy and foundry shop, carpentry shop etc.)

2.7 Tutorials/Practical works

     2.7.1   Break-even analysis for most economical location decision

     2.7.2   Analysis of given qualitative and quantitative factors to find the best site for locating the plant

Unit 3.   Process Planning   [9]

3.1   Concept of product engineering

3.2   Process operations

3.3   Steps of process planning

3.4   Process plans

3.5   Planning and tooling for low cost processing

3.6   Practical works in preparing process planning sheets

     3.6.1   Process planning sheets for some mechanical components such as Piston manufacturing, Connecting rod manufacturing, manufacturing of Cam shaft of I.C. engine, etc.

     3.6.2   Select an appropriate industry near by the college and identify its products. Group assignment is recommended to develop process planning sheets for particular product. Students are required to present their process planning sheet/s in class room.

Unit 4. Production Planning and Control (PPC)   **[10]**

    4.1   Introduction

    4.2   Principle and objectives of PPC

    4.3   Functions of PPC

    4.4   Production planning, production control

    4.5   Types of production system (job, batch, continuous)

    4.6   Forecasting methods, techniques and types

    4.7   Inventory control (economic order quantity, ABC analysis)

    4.8   Network techniques

        4.8.1   Critical path method (CPM)

        4.8.2   Program evaluation and review technique (PERT)

    4.9   Tutorials/practical works

        4.9.1   Tutorials on sales forecasting, economic order quantity, CPM, PERT

        4.9.2   Development of route sheet, operational sheet, bill of quantity, machine load chart, work order sheet, material requisition form, move ticket, inspection ticket, Gantt chart for scheduling, manufacturing flow chart

Unit 5. Estimating and Costing   **[5]**

    5.1   Introduction to estimating and costing

    5.2   Estimating and costing in various shops (machine shop, sheet-metal shop, welding/fabrication shop, plumbing shop)

    5.3   Tutorials/Practical works

        5.3.1   Calculation of material cost, labor cost, overhead

        5.3.2   Tutorials on fixed cost, variable cost, break even analysis, return on investment, profit loss statement.

Unit 6. Inspection and Quality Control   **[5]**

    6.1.   Definition of inspection

    6.2.   Need for inspection and inspection standards

    6.3.   Functions of inspection

    6.4.   Acceptance sampling

    6.5.   Definition and concept of quality

    6.6.   Quality assurance

    6.7.   Statistical quality control

    6.8.   Statistical process control

    6.9.   Control charts

    6.10. Tutorials/practical works

        6.10.1. Simple statistical tools for problem solving: data sheet, chart and graph, Pareto diagram, cause and effect diagram, histogram, control chart and correlation diagram

        6.10.2. Variable control charts and their analysis

6.10.3. Attribute control charts and their analysis

Unit 7. Production and Productivity [4]

7.1 Definition and difference between of production and productivity
7.2 Importance of productivity
7.3 Measurement of productivity
7.4 Factors affecting productivity
7.5 Productivity improvement techniques

Unit 8. Project Works [10]

8.1 Related teacher is suggested to identify a particular industry where productivity is being decreased or not being improved. Design a project work for students demanding their views on productivity improvement ways for that particular case based on overall course they trained for.

Or

8.2 Create other relevant project works covering all relevant topics of this course by related teachers based on their experience and industrial linkage.

Practical: **(60 hrs.)**

1. Select an appropriate manufacturing industry near by the institute and identify its products. Group assignment is recommended to develop process planning sheets for particular product. Students are required to present their process planning sheet/s in class room.
2. Conduct a case study of any one product and prepare report including following points:
   - Bill of quantity
   - Materials cost
   - Labor cost
   - Overhead cost
   - Fixed cost
   - Variable cost
   - Profit and loss statement
   - Break even analysis
   - Return on investment
3. Collect a sample of any product, prepare and analyze followings:
   i. Simple statistical tools for problem solving: data sheet, chart and graph, Pareto diagram, cause and effect diagram, histogram, control chart and correlation diagram
   ii. Variable control charts and their analysis
   iii. Attribute control charts and their analysis

Suggestions for Instructions:

1. Lectures by teacher
2. Presentations by students
3. Guest speakers on any relevant industrial engineering topics
4. Industrial visits on existing engineering and management practices
5. Relevant case studies on industrial engineering
6. Tutorials
7. Assignments and project works to broaden the horizon of industrial engineering techniques in students

Note: the above given topics and sub topics are basic guidelines to drive the course for initial stage. The course improvement is a continuous process based on the feedback of the industries. Therefore related authorities are recommended to review the course continuously to address the future needs more effectively.

References:

1. Ahuja, K.K. (1994). Industrial Management. CBS Publishers and Distributors, India.
2. Mahajan, M. (2002). Industrial engineering and production management (2nd ed). Dhanpat Rai and Co. (P) Ltd., Delhi.
3. Panneerselvam, R. (2005). Production and Operations management (2nd ed.).Prentice-Hall of India, Private Limited, Delhi.
4. Sharma, P.C. (2003). A text book of production engineering. S. Chand and Company Ltd. Delhi, India.
5. Sharma, S.K & Sharma, Savita (2002). A course in Industrial engineering and operations management. S.K. Kataria and Sons, Delhi, India.
6. Verma, A.P. (2002). Industrial Engineering. S. K. Kataria & Sons, Delhi.

Tools, Jigs, Fixtures, and Die Design

EG 3208 ME
(Elective)

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

Course Description:

Tools, Jigs and fixtures are essential parts in design and production process. After completion of this course students understand and appreciate the importance of tools, jigs and fixtures for safety, economic and standardized production activities.

Course Objectives:

After completing this course the students will be able to
1. Use tools, jigs and fixtures for simplicity, ease and safety of operation.
2. Use the proper and standard tools, jigs and fixtures.
3. Examine the possible defects in a manufactured component and rectify them as required.

Course contents:

Unit 1. Press tool Processes   **[15]**

    1.1 Introduction
    1.2 Principles of press operations
    1.3 Press working equipment and press selection
    1.4 Operation procedure with example: blanking, cropping, piercing, drawing, embossing, coining and trimming
    1.5 Possible defects and their control measures
    1.6 Elementary approach to press tool design limited to the single blank: follow-on blank, V-bending, channel bending and single draw tool

Unit 2. Jigs and fixtures   **[15]**

    2.1 Introduction – necessity of jigs and fixtures
    2.2 Application of jigs and fixtures
    2.3 Principle of location and locating devices
    2.4 Application and types of common drilling jigs: table, channel, latch and box
    2.5 Use of slip bushes, indexing devices and angle plates
    2.6 Purpose of clamping elements and types of clamps

    2.7   Milling fixtures: setting blocks and tenors, multi-station and indexing fixtures, special vice jaws

    2.8   Assembly and welding fixtures

    2.9   Materials for jigs and fixtures

    2.10 Analysis of economic benefit by using jigs and fixtures

Unit 3. Forging Dies [10]

    3.1   Introduction to types of die forging: open and closed

    3.2   Importance of die design in forging

    3.3   Materials for die blocks

    3.4   Selection of die blocks

    3.5   Die inserts

    3.6   Die maintenance

Unit 4. Practical case studies for tutorial assignment [20]

Practical:

1. Visit at least one industry and study industrial practices related to the subject and submission of the visit report. (8)
2. Perform various operation of different process: blanking, piercing, drawing, embossing, coining, trimming. (10)
3. Design various elements of simple jigs and fixtures (8)
4. Prepare jigs & Fixture for turning operation (8)
5. Prepare two drilling jigs. (Details of at least one sheet showing manufacturing drawing with tolerances and material specification) (8)
6. Prepare Milling Fixtures such as setting blocks and tenons, multi station and indexing fixtures. (10)
7. Prepare arc welding fixtures. (8)

Reference Books:

1. SAJ Parsons, Production tooling equipment; BI Publication.
2. PC Sharma, A text book of Production Engineering; S. Chand and Company Ltd.
3. M. Adithan and AB Gupta, Manufacturing Technology; New Age International Publishers India.

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