

# **CURRICULUM**

## **DIPLOMA**

# **Automobile Engineering**

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



Council for Technical Education and Vocational Training  
**Curriculum Development & Equivalence Division**  
**Sanothimi, Bhaktapur**  
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## **Introduction**

The automobile Engineering is genuine field in the engineering and technology sector. Many people in the world have been given emphasis for the broader application of automobile. This sector has been helping the world for the overall development and it has been creating wage and self employment opportunities both in public and private sectors.

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

This course is based on the job required to perform by an automobile technician at different related industries and organizations in Nepal and abroad. The Diploma in Automobile Engineering program extends over three years. Each year is divided into two semesters. There are six semesters in total within the period of three years. This curriculum includes the core subjects like physics, chemistry, and mathematics applicable in the field of auto-mechanical engineering. It also includes language subjects like Nepali and English applicable for the communication in the field of automobile. The second year course focuses on the basic disciplinary subjects of Automobile Engineering. Similarly, third year comprises of the disciplinary subjects of Automobile Engineering. It also has provision of elective subjects in the specific areas of automobile engineering. The course structure and the subject wise contents that follow reflect the details of this curriculum. In short, this curriculum guides its implementers to produce competent and highly employable middle level technical workforce in the field of automobile engineering. The contents of individual subjects prescribed in the curriculum are incorporated in the light of "must to know and must to do" principle.

## **Rationale of Revision**

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

- It crossed the 5 years period of its implementation after the 1<sup>st</sup> revision and similarly the implementing agencies/college have requested to revise this curriculum based on their teaching experiences.
- The year-wise re-adjustments of the existing subjects are felt necessary.
- Some new subjects seem to be introduce as per the advancement in technology.
- It is needed to revisit its weightage in both theory and practical marks and contents to make it more practical oriented.
- The technologies invented in the field of automobile are necessary to incorporated.

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

## **Curriculum Title**

Diploma in Automobile Engineering (DAE).

## **Aim**

The program aims to produce mid-level technical human resource equipped with knowledge and skills in allied field of study.

## **Objectives**

This curriculum has following objectives:

- Prepare mid-level competent workforce in the related field.
- Prepare such technicians who are able to work in the automobile sector related local workshop and industrial settings of the country.
- Meet the demand of such technical workforce for the automobile industries of Nepal.
- Reduce the dependence on employing such technicians from foreign countries.
- Prepare technical workforce demonstrating positive attitude and respect for the profession and socio-cultural values.
- Create self-employment opportunities.

## **Group Size**

The group size is a maximum of 48 students.

## **Entry Criteria**

- SLC pass or SEE or equivalent with minimum C Grade (2.0 Grade Point) in Mathematics and Science and 1.6 Grade Point or equivalent in English and as per the provisions mentioned in the admission guidelines of Office of the Controller of Examinations, CTEVT.
- Pre-diploma in related subject or equivalent with minimum 68.33%.
- Pass entrance examination administered by CTEVT.

## **Duration**

The total duration of this curricular program is three academic years [six semesters]. The program is based on semester system. Moreover, one semester consists of 19.5 academic weeks including evaluation period. Actual teaching learning Hrs. will be not less than 15 weeks in each semester.

## **Medium of Instruction**

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

## **Pattern of Attendance**

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

## **Teacher (Instructor) and Student Ratio**

The ratio between teachers and students must be:

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

### **Qualification of Instructional Staff**

- The program coordinator should be a master's degree holder in the related subject area.
- The disciplinary subject related teachers should be a bachelor's degree holder in the related subject area.
- The demonstrators should be a bachelor's degree holder or diploma or equivalent with 3 years work experience in the related subject area.
- The foundational subject related teacher (refer to course codes SH and MG) should be master's degree holder in the related subject area.

### **Instructional Media and Materials**

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

- **Printed media materials:** Assignment sheets, case studies, handouts, performance checklists, textbooks etc.
- **Non-project media materials:** Displays, models, photographs, flipchart, poster, writing board etc.
- **Projected media materials:** Slides, Multimedia Projector.
- **Audio-visual materials:** Audiotapes, films, slide-tapes, videodisc, etc.
- **Computer based instructional materials:** Computer based training, interactive video etc.
- **Web-Based Instructional Materials** (Online learning)
- **Radio/Television/Telephone**
- **Education-focused social media platform**

### **Teaching Learning Methodologies**

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

- **Theory:** Lecture, Group discussion, assignment and group work etc.
- **Practical:** Demonstration, observation and self-practice.
- **Internship:** Industrial Practice.

### **Approach of Learning**

There will be inductive, deductive and learner-centered approaches of learning.

### **Examination and Marking Scheme**

#### **a. Internal assessment:**

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

**b. Final examination**

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

**c. Requirement for final practical examination:**

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

**d. Final practicum evaluation will be based on**

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

**e. Pass marks**

- The students must secure minimum 40% marks in theory and 50% marks in practical. Moreover, the students must secure minimum pass marks in the internal assessment and in the semester final examination of each subject to pass the subject.

**Provision of Back Paper**

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

**Disciplinary and Ethical Requirements**

- Intoxication, insubordination or rudeness to peers will result in immediate suspension followed by the review of the disciplinary review committee of the institute.
- Dishonesty in academic or practical activities will result in immediate suspension followed by administrative review, with possible expulsion.

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

### **Grading System**

The grading system will be as follows:

<u>Grading</u>	<u>Overall marks</u>
• Distinction:	80% and above
• First division:	65% to below 80%
• Second division:	50 % to below 65%
• Pass division:	Pass marks to Below 50%

### **Certificate Awarded**

- Students who pass all the components of all subjects of all six semesters are considered to have successfully completed the course.
- Students who have successfully complete the curricular program will be awarded with a degree of "**Diploma in Automobile Engineering**".

### **Career Path**

The graduates will be eligible for the position equivalent to Non-gazetted 1st class/Level 5 (technical) as prescribed by the Public Service Commission of Nepal and other related agencies.

### **General Attitudes Required**

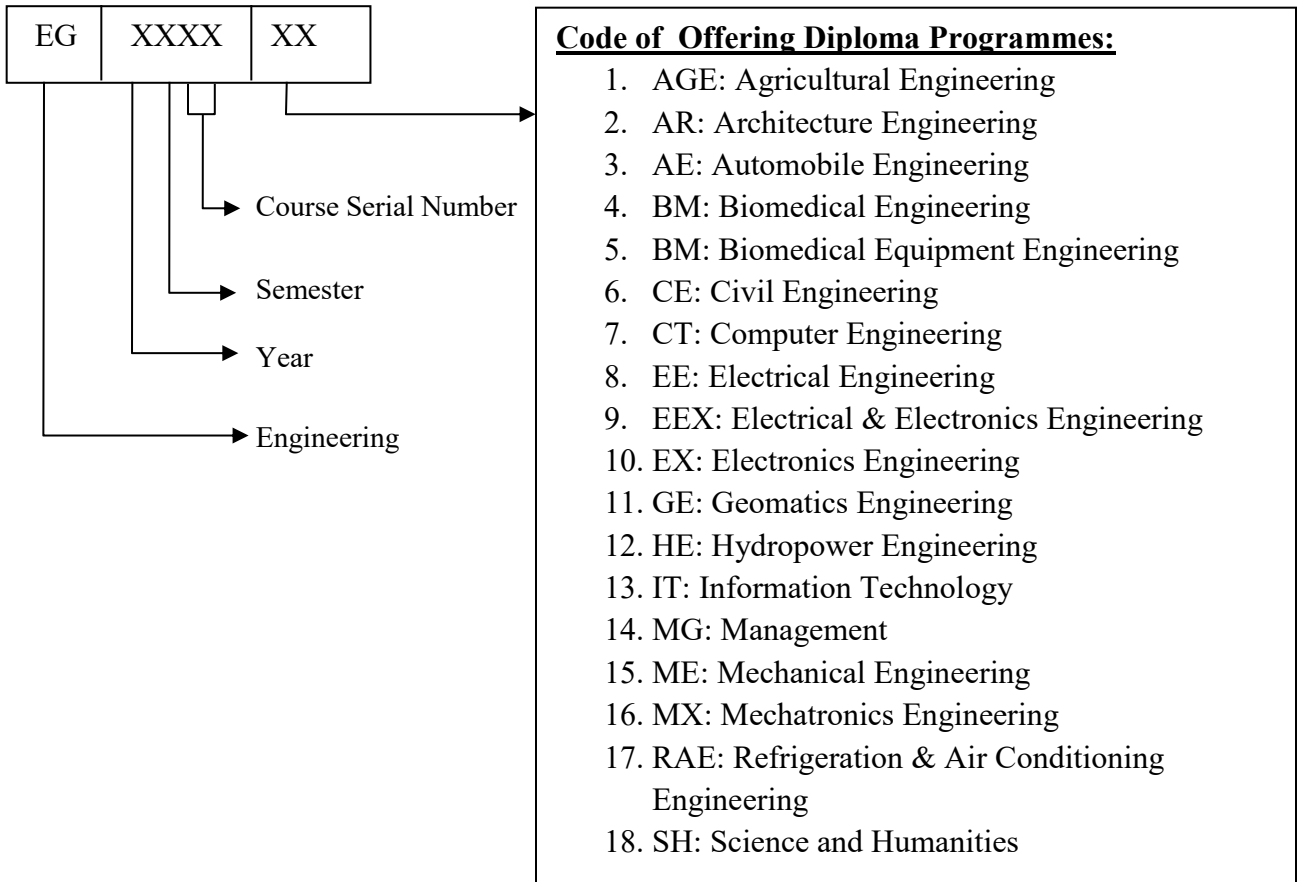
A student should demonstrate following general attitudes for effective and active learning.

Acceptance, Affectionate, Ambitious, Aspiring, Candid, Caring, Change, Cheerful, Considerate, Cooperative, Courageous, Decisive, Determined, Devoted, Embraces, Endurance, Enthusiastic, Expansive, Faith, Flexible, Gloomy, Motivated, Perseverance, Thoughtful, Forgiving, Freedom, Friendly, Focused, Frugal, Generous, Goodwill, Grateful, Hardworking, Honest, Humble, Interested, Involved, Not jealous, Kind, Mature, Open minded, Tolerant, Optimistic, Positive, Practical, Punctual, Realistic, Reliable, Distant, Responsibility, Responsive, Responsible, Self-confident, Self-directed, Self-disciplined, Self-esteem, Self-giving, Self-reliant, Selfless, Sensitive, Serious, Sincere, Social independence, Sympathetic, Accepts others points of view, Thoughtful towards others, Trusting, Unpretentiousness, Unselfish, Willingness and Work-oriented.



## Subjects Codes

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



## Curriculum Structure Diploma in Automobile Engineering

YEAR: I

PART: I

S.N	Code No.	Subjects	Teaching Scheme						Examination Scheme						Total Marks	Remarks
			Mode				Weekly Hours	Credit Hours	DISTRIBUTION OF MARKS							
			L	T	P	Lab			Theory			Practical				
									*Asmt Marks	Final Marks	Exam Hours	*Asmt Marks	Final Marks	Exam Hours		
1	EG 1101 SH	Applied Nepali	4				4	4	20	80	3				100	*Continuous assessment
2	EG 1102 SH	Applied English	4				4	4	20	80	3				100	
3	EG 1103 SH	Engineering Mathematics I	4	2			6	4	20	80	3				100	
4	EG 1104 SH	Engineering Physics I	4	2		2	8	5	20	60	3	10	10	2	100	
5	EG 1105 SH	Engineering Chemistry I	4	2		2	8	5	20	60	3	10	10	2	100	
6	EG 1101 AR	Engineering Drawing I	1		4		5	3	0	0		60	40	4	100	
7	EG 1101 CT	Computer Application	2		2		4	3	10	40	1.5	30	20	3	100	
<b>TOTAL</b>			<b>23</b>	<b>6</b>	<b>6</b>	<b>4</b>	<b>39</b>	<b>28</b>							<b>700</b>	

YEAR: I

PART: II

S.N	Code No.	Subjects	Teaching Scheme						Examination Scheme						Total Marks	Remarks
			Mode				Weekly Hours	Credit Hours	DISTRIBUTION OF MARKS							
			L	T	P	Lab			Theory			Practical				
									*Assmt Marks	Final Marks	Exam Hours	*Assmt Marks	Final Marks	Exam Hours		
1	EG 1201 SH	Engineering Mathematics II	4	2			6	4	20	80	3				100	*Continuous assessment
2	EG 1202 SH	Engineering Physics II	4	2		2	8	5	20	60	3	10	10	2	100	
3	EG 1203 SH	Engineering Chemistry II	4	2		2	8	5	20	60	3	10	10	2	100	
4	EG 1201 CE	Workshop Practice I	2		6		8	5	0	0		60	40	4	100	
5	EG 1201 AR	Engineering Drawing II	0		4		4	2	0	0		60	40	4	100	
6	EG 1202 CE	Applied Mechanics	3	2		2/2	6	4	20	60	3	20	0		100	
<b>TOTAL</b>			<b>17</b>	<b>8</b>	<b>10</b>	<b>5</b>	<b>40</b>	<b>25</b>							<b>600</b>	

## Diploma in Automobile Engineering

YEAR: II

PART: I

S.N	Code No.	Subject	Teaching Scheme					Examination Scheme						Total Marks	Remarks	
			Mode				Weekly Hours	Credit Hours	DISTRIBUTION OF MARKS							
			L	T	P	Lab			Theory			Practical				
									*Assmt Marks	Final Marks	Exam Hours	*Assmt Marks	Final Marks			Exam Hours
1	EG 2103 ME	Machine Drawing	1		3		4	3				60	40	3	100	*Continuous assessment
2	EG 2104 ME	Material Science	3			2/2	4	4	20	80	3	25			125	
3	EG 2105 ME	Thermal Engineering	3	1		2/2	5	4	20	80	3	25			125	
4	EG 2106 ME	Engineering Dynamics	2				2	2	10	40	1.5				50	
5	EG 2107 ME	Workshop Practice II	4		7		11	8	20	80	3	120	80	6	300	
6	EG 2108 ME	Industrial Engineering	3				3	3	20	80	3				100	
7	EG 2101 AE	Automotive Technology I	3		8		11	7	20	80	3	120	80	6	300	
<b>TOTAL</b>			<b>19</b>	<b>1</b>	<b>18</b>	<b>2</b>	<b>40</b>	<b>31</b>							<b>1100</b>	

YEAR: II

PART: II

S.N	Code No.	Subject	Teaching Scheme					Examination Scheme						Total Marks	Remarks	
			Mode				Weekly Hours	Credit Hours	DISTRIBUTION OF MARKS							
			L	T	P	Lab			Theory			Practical				
									*Assmt Marks	Final Marks	Exam Hours	*Assmt Marks	Final Marks			Exam Hours
1	EG 2201 AE	Basic Electronics Engineering	3			2	5	4	20	80	3	50			150	*Continuous assessment
2	EG 2202 AE	Automotive Technology II	3		8		11	7	20	80	3	120	80	6	300	
3	EG 2203 AE	Electrical Technology	3			2	5	4	20	80	3	50			150	
4	EG 2204 ME	Machine Elements and Mechanism	3				3	3	20	80	3				100	
5	EG 2205 ME	Strength of Materials	3	1		2/2	5	4	20	80	3	25			125	
6	EG 2206 ME	Fluid Mechanics and Fluid Machines	3	1		2/2	5	4	20	80	3	25			125	
7	EG 2202 ME	Computer Aided Drawing	1		3		4	3				60	40	3	100	
<b>TOTAL</b>			<b>19</b>	<b>2</b>	<b>11</b>	<b>6</b>	<b>38</b>	<b>29</b>							<b>1050</b>	

## Diploma in Automobile Engineering

YEAR: III

PART: I

S.N.	Code No.	Subject	Teaching Scheme						Examination Scheme						Total Marks	Remarks
			Mode				Weekly Hours	Credit Hours	DISTRIBUTION OF MARKS							
			L	T	P	Lab			Theory			Practical				
									*Assmt Marks	Final Marks	Exam Hour	*Assmt Marks	Final Marks	Exam Hour		
1	EG 3103 ME	Fundamentals of Hydraulics and Pneumatics	3			2	5	4	20	80	3	50			150	*Continuous assessment
2	EG 3104 ME	Machine Design, Estimating and Costing	3	1			4	3	20	80	3				100	
3	EG 3101 AE	Automotive Technology III	3		6		9	6	20	80	3	100	50	4	250	
6	EG 3102 AE	Vehicle Driving Practice			4		4	2				60	40	3	100	
4	EG 3103 AE	Automotive Electronics I	3		4		7	5	20	80	3	60	40	3	200	
5	EG 3104 AE	Occupational Hygiene and Safety	3				3	3	20	80	3				100	
7		Elective (One of the following)	2		6		8	5	10	40	1.5	100	50	4	200	
	EG 3105 AE.1	a. Body Shop Repair and Maintenance														
	EG 3105 AE.2	b. Motorcycle Repair & Maintenance														
	EG 3105 AE.3	c. Automobile Air Conditioning														
	EG 3105 AE.4	d. Automobile Service Management														
<b>TOTAL</b>			<b>17</b>	<b>1</b>	<b>20</b>	<b>2</b>	<b>40</b>	<b>28</b>							<b>1100</b>	

YEAR: III

PART: II

S.N.	Code No.	Subject	Teaching Scheme						Examination Scheme						Total Marks	Remarks
			Mode				Weekly Hours	Credit Hours	DISTRIBUTION OF MARKS							
			L	T	P	Lab			Theory			Practical				
									*Assmt Marks	Final Marks	Exam Hour	*Assmt Marks	Final Marks	Exam Hour		
1	EG 3201 MG	Entrepreneurship Development	3		2		5	4	20	60	3	10	10	2	100	*Continuous assessment
2	EG 3201 AE	Automotive Electronics II	3			3	6	5	20	80	3	50			150	
3	EG 3202 AE	Automotive Technology IV	3		8		11	7	20	80	3	120	80	6	300	
4	EG 3203 AE	Industrial Attachment			18		18	9				300	150	8	450	
<b>TOTAL</b>			<b>9</b>		<b>28</b>	<b>3</b>	<b>40</b>	<b>25</b>							<b>1000</b>	

L=Lecture, T=Tutorial, P=Practical

**First Year (First and Second Semester)**

**[See Separate Curriculum]  
First Year Engineering All  
(Year I Part I and Year I Part II)**

**Second Year  
Part I & II  
(Third and Fourth Semester)**

## **Third Semester Year II Part I**

### **Subjects:**

1. EG 2101 AE Automotive Technology I
2. EG 2103 ME Machine Drawing
3. EG 2104 ME Material Science
4. EG 2105 ME Thermal Engineering
5. EG 2106 ME Engineering Dynamics
6. EG 2107 ME Workshop Practice II
7. EG 2108 ME Industrial Engineering

# Thermal Engineering

EG 2105 ME

**Year: II**

**Part: I**

**Total: 5 Hrs/week**

**Lecture: 3 Hrs/week**

**Tutorial: 1 Hrs/week**

**Practical: Hrs/week**

**Lab: 2/2 Hrs/week**

## ***Course Description:***

This course deals with the fundamental laws of thermodynamics, basic thermodynamics processes, introduction to heat transfer, types and uses of air compressors and boilers.

## ***Course Objectives:***

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

1. Laws of thermodynamics
2. Basic thermodynamics processes
3. Heat transfer
4. The uses and operation of boilers and air compressors

## ***Course content:***

### **Unit 1: Basic concept of thermodynamics: [6 hrs]**

- 1.1 Definition and importance of thermodynamics
- 1.2 Thermodynamic system (closed, open and isolated system)
- 1.3 Properties of system (intensive and extensive properties)
- 1.4 Thermal equilibrium
- 1.5 Thermodynamic state
- 1.6 Thermodynamic process, cycle
- 1.7 Forms of energy
- 1.8 Sensible heat and latent heat

### **Unit 2: Zeroth law of thermodynamics: [2 hrs]**

- 2.1. Definition and applications
- 2.2. Different types of thermometer and their applications.

### **Unit 3: First law of thermodynamics: [7 hrs]**

- a. Statement of first law, mathematical representation
- b. Application of first law; closed system only
- c. General energy equation, internal energy, enthalpy, relationship between heat transfer and change in internal energy



<b>Unit 4: Second law of thermodynamics:</b>	<b>[7 hrs]</b>
4.1. Limitation of first law	
4.2. Statements of second law: Kelvin Planck and Clausius statement	
4.3. Concept of Carnot cycle, heat engine, heat pump and refrigerator; thermal efficiency and COP	
4.4. Reversible and irreversible processes, entropy, T-S diagram	
<b>Unit 5: Basic thermodynamic processes:</b>	<b>[5 hrs]</b>
5.1. Constant volume process	
5.2. Constant pressure process	
5.3. Constant temperature process	
5.4. Adiabatic process	
5.5. Polytropic processes	
<b>Unit 6: Heat transfer:</b>	<b>[6 hrs]</b>
6.1. Modes of heat transfer (conduction, convection and radiation)	
6.2. Fourier's law of heat conduction (Temperature gradient, Thermal conductivity)	
6.3. Newton's law of heat transfer by convection, free and forced convection	
6.4. Heat transfer by radiation, Stefan- Boltzmann law of thermal radiation	
<b>Unit 7: Air compressors:</b>	<b>[4 hrs]</b>
7.1. Classifications of Air compressors	
7.2. Uses of compressed air	
7.3. Single stage reciprocating compressors: construction, operation and care	
7.4. Centrifugal compressors: construction, operation and care	
<b>Unit 8: Boilers</b>	<b>[8 hrs]</b>
8.1. Introduction and applications	
8.2. Classifications and comparison between water tube and fire tube types of boilers	
8.3. Requirements of an ideal boiler	
8.4. Boiler mountings and accessories: water level indicator, feed check valve, Blow off cock, steam separator, safety valves, Feed pump, air preheater, super heater and economizer	
8.5. Water conditioning	
8.5.1 Water problems and Benefits of water conditioning	
8.5.2 Constituents and Characteristics of water	
8.5.3 Types and causes of scale and deposits	
8.5.4 Scale deposit prevention methods	
<b><i>Tutorials:</i></b>	<b><i>[15 hrs]</i></b>
Assist students for conceptual & critical problem solving	
1. Problems related to properties of system	[2 hrs]
2. Problems related to energy conservation equation for closed system	[4 hrs]
3. Problems on heat engine, heat pump and refrigerator	[3 hrs]
4. Problems related to different thermodynamic processes	[3 hrs]
5. Problems on conduction, convection and radiation	[3 hrs]

**Practical/Laboratory:****[15 hrs]**

- 1) Determine thermal conductivity of given specimen.
- 2) Compare different types of thermometers.
- 3) Demonstrate steam tables & charts
- 4) Study performance of air-compressor
- 5) Conduct a visit to local food processing industry/hotel to study the operation and performance of boiler

**Suggestion for instruction:**

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

**References:**

1. M. C. Luintel, "Fundamentals of Thermodynamics and Heat Transfer", Heritage Publishers & Distributors Pvt. Ltd., Nepal
2. RS Khurmi and JK Gupta, "A text book of Thermal Engineering", S. Chand Publishing, India
3. R.K. Rajput, "Thermal engineering" Laxmi Publications, New Delhi.

**Marks Specification for final examination:**

<b>Unit</b>	<b>Content</b>	<b>Course hours</b>	<b>Marks</b>
1	Basic concept of thermodynamics	6	10
2	Zeroth law of thermodynamics	2	4
3	First law of thermodynamics	7	12
4	Second law of thermodynamics	7	12
5	Basic thermodynamic processes	5	10
6	Heat transfer	6	10
7	Air compressors	4	8
8	Boilers	8	14
	<b>Total</b>	<b>45</b>	<b>80</b>

**Note:** There might be minor deviation on the above specified marks.

# Machine Drawing

EG 2103 ME

Year: II  
Part: I

Total: 4 Hrs/week  
Lecture: 1 Hrs/week  
Tutorial: Hrs/week  
Practical: 3 Hrs/week  
Lab: Hrs/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 and detail drawings of a plant or machine parts.

## *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:*

<b>Unit: 1</b>	<b>Standard symbols</b>	<b>[1 hr]</b>
	1.1 Introduction to machining symbols.	
	1.2 Introduction to surface roughness symbols and their meaning.	
	1.3 Introduction to welding symbols	
	1.4 Introduction to pipe and fittings symbols	
	1.5 Introduction to electronics and electrical symbols	
<b>Unit: 2</b>	<b>Limits, tolerances and fits</b>	<b>[2 hrs]</b>
	2.1 Introduction to Nominal and basic size, limits of size.	
	2.2 Introduction to fundamental deviations, tolerances, upper & lower deviation.	
	2.3 Introduction to clearance fit, interference fit & transition fit.	
	2.4 Introduction to hole basis & shaft basis system.	
	2.5 Introduction to go, no-go gauge, interchangeability & selective assembly.	
<b>Unit: 3</b>	<b>Gear, Pulley and Belt</b>	<b>[2 hrs]</b>
	3.1 Introduction to spur gearing, definitions of spur gear terminology & their definitions	
	▪ Construction of base circle.	
	▪ Construction of spur gear teeth (involute) profile.	

- 3.2 Introduction to Pulleys & Belts
- Fast and loose pulleys
  - V-belt pulleys
  - Rope pulleys

**Unit: 4 Working Drawing (Detail or production drawing) [3 hrs]**

- 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.

**Unit: 5 Working drawing (Assembly drawing) [7 hrs]**

- 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 Introduction to sectioning & dimensioning concept for assembly drawing.
- 5.4 Introduction to sequences of preparing the assembly drawing.
- 5.5 Introduction to plant or machine layout and installation drawing

***Practical (Class work sheet):***

**Sheet No 1: [3 hrs]**  
Exercise in machining symbols, surface roughness symbols, welding symbols, pipe and fittings symbols, electronics and electrical symbols.

**Sheet No 2: [6 hrs]**  
1. Make the complete fit analysis of hole basis system. (Not less than 3 exercises)  
2. Make the complete fit analysis of shaft basis system. (Not less than 3 exercises)

**Sheet No 3: [6 hrs]**  
1. Draw the profile of involute spur gear teeth. (Not less than 3 exercises)  
2. Draw neatly the two views of fast and loose pulleys, rope pulleys and V-belt pulleys. (Not less than three exercises)

**Sheet No 4: [9 hrs]**  
Draw the detail drawings of the different machine components. (Not less than four exercises)

**Sheet No 5: [21 hrs]**  
5.1 Draw the assembly drawing of the different machine components with full sectional and half sectional views. (Not less than five exercises)  
5.2 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.
2. W.J. Luzadder, "Fundamental of Engineering Drawing" Prentice-Hall of India Pvt-Ltd., New Delhi
3. P.S. Gill, "Engineering Drawing", S. K. Katarai & Sons, New Delhi.
4. M. C. Luintel, "Engineering Drawing II", Heritage Publishers & Distributors Pvt. Ltd., Nepal
5. K.L. Narayanan, P. Kannaiah and K. Venkata Reddy, "Machine drawing", New Age International Publishers, India.

**Mark Specification for final examination:**

<b>Unit</b>	<b>Content</b>	<b>Course hours</b>	<b>Marks</b>
1	Standard symbols	4	4
2	Limits, tolerances and fits	8	6
3	Gear, Pulley and Belt	8	4
4	Working Drawing (Detail or production drawing)	12	10
5	Working drawing (Assembly drawing)	28	16
	<b>Total</b>	<b>60</b>	<b>40</b>

*Note: There might be minor deviation on the above specified marks.*

**Material Science**  
**EG 2104 ME**

**Year: II**  
**Part: I**

**Total: 4 Hrs/week**  
**Lecture: 3 Hrs/week**  
**Tutorial: Hrs/week**  
**Practical: Hrs/week**  
**Lab: 2/2 Hrs/week**

***Course description:***

This course deals with the classification and properties of several materials. It also describes the production of steel, testing methods of different materials and heat treatment process in brief. It covers the job specific material selection for different purposes.

***Course objectives:***

After completing this course the students will be able to:

- Explain the properties of materials and their dependence on.
- Explain different types of failure and their remedies
- Understand the role of carbon in iron.
- Explain the principle of heat treatment.
- Perform different mechanical test.

***Course contents:***

**Unit 1: Introduction:**

**[6 hrs]**

1.1 Importance and Scope

1.2 Classification of materials based on:

- State
- Natural, artificial
- Metals, non-metals

1.3 Physical properties: luster, color, density

1.4 Mechanical properties: plasticity, elasticity, ductility, malleability, toughness

1.5 Electrical properties: conductivity and effect of temperature

1.6 Magnetic properties: ferro-magnet, para-magnet, dia-magnet and hysteresis loss

1.7 Thermal properties: specific heat, latent heat and thermal expansion

**Unit 2: Arrangement of atoms**

**[4 hrs]**

2.1 Crystalline and amorphous solids

2.2 Unit cell, coordination number, Atomic packing factor

2.3 Crystal structure (BCC, FCC and HCP)

2.4 Crystal imperfection: Point defect, line and surface defect in brief

<b>Unit 3: Fracture</b>	<b>[8 hrs]</b>
3.1 Introduction	
3.2 Types of failure: Ductile, Brittle, Fatigue and Creep	
3.3 Mechanism and remedies of Ductile and Brittle Fracture	
3.4 Mechanism and remedies of Fatigue Failure	
<b>Unit 4: Testing of metals</b>	<b>[8 hrs]</b>
4.1 Types of testing	
4.2 Non-destructive testing and their uses: X-ray, ultrasonic, magnetic tests	
4.3 Destructive testing	
- Tensile test	
- Fatigue test	
- Hardness test: Brinell, Vicker and Rockwell	
- Impact test: Charpy and Izod	
<b>Unit 5: Steels and cast iron</b>	<b>[7 hrs]</b>
5.1 Micro constituents in iron and cooling curve	
5.1 Effect of carbon in iron	
5.3 Difference between steels and cast iron	
5.4 Types of steels: HSLA steel, stainless steel, tool steel	
5.5 Types of cast iron: Grey, white, malleable, ductile	
5.6 Various steel making processes: Bessemer, Open hearth, Duplex	
<b>Unit 6: Heat treatment process</b>	<b>[6 hrs]</b>
6.1 Purpose of heat treatment	
6.2 Annealing	
6.3 Normalizing	
6.4 Quenching	
6.5 Tempering	
6.6 Surface hardening: Nitriding and Carburizing	
<b>Units 7: Engineering materials</b>	<b>[6 hrs]</b>
6.1 Ferrous alloys	
6.2 Non-ferrous alloys	
6.3 Polymers: Properties, classification and uses	
6.4 Rubber: Properties and uses	
6.5 Ceramics: Properties, classification and uses	
6.6 Composite materials: properties, classification and uses	
6.7 Glass: properties, classification and uses	

**Practical/Laboratory:****[15 hrs]**

Lab 1: Identification of material from physical properties such as density, color, sound etc.

Lab 2: Performing Tensile test on standard specimen and draw stress-strain diagram

Lab 3: Performing Hardness test on standard specimen (Brinell, Vicker and Rockwell)

Lab 4: Performing Fatigue test on standard specimen

Lab 5: Performing Impact test (Izod and Charpy) on standard specimen

Lab 6: Performing Heat treatment, compare its Mechanical properties.

**References:**

1. H. S. Bawa, Material and Metallurgy, TMG edition, New Delhi, India
2. K Gupta, R.C Gupta, Material Science, S. Chand and Co. Ltd, New Delhi, India
3. Sunil Risal, Khem Gyanwali, Material Science, Sigma Carts printing, Nepal

**Mark Specification for final examination:**

<b>Unit</b>	<b>Content</b>	<b>Course hours</b>	<b>Marks</b>
1	Introduction	6	12
2	Arrangement of atoms	4	6
3	Fracture	8	14
4	Testing of metals	8	14
5	Steels and cast iron	7	12
6	Heat treatment process	6	10
7	Engineering materials	6	12
	<b>Total</b>	<b>45</b>	<b>80</b>

*Note: There might be minor deviation on the above specified marks.*



# Engineering Dynamics

## EG 2106 ME

**Year: II**  
**Part: I**

**Total: 2 Hrs/week**  
**Lecture: 2 Hrs/week**  
**Tutorial: 1 Hrs/week**  
**Practical: Hrs/week**  
**Lab: Hrs/week**

### ***Course Description:***

This course provides the students with a fundamental knowledge of several motions as engineering dynamics. Also it covers the basics of work, power energy and simple machines. The students will become familiar with the basic problems of dynamics and learn the methods to solve them.

### ***Course Objectives:***

After completing the course students are able to

1. Develop the knowledge about the kinematics of particle.
2. Develop knowledge about kinetics of particle
3. Explain the concept of work, energy and power
4. Develop knowledge about circular and curvilinear motion
5. Explain the concept of simple machines.

### ***Course Content:***

#### **Unit 1. Kinematics of Particles [8 hrs]**

- 1.1 Kinematics of particles
- 1.2 Concept of Position, rest and motion, Displacement, speed, Velocity, uniform and variable velocity, Acceleration, Uniform and Variable acceleration.
- 1.3 Equation of motion and their uses.
- 1.4 Concept of Rectilinear motion of particles
- 1.5 Determination of motion of particle:
  - When acceleration in given function of time
  - When position is given function of time.
- 1.6 Concept of curvilinear motion of particles
- 1.7 Projectile motion and determination of time, range and elevation of flight.
- 1.8 Motion under gravity
- 1.9 Relative motion and dependent motion

#### **Unit 2: Kinetics [6 hrs]**

- 2.1 Introduction to kinetics
- 2.2 Newton's laws of motion
- 2.3 Gravitational and Absolute units of force

- 2.4 Law of conservation of momentum
- 2.5 Concept of Impulse and impulsive force
- 2.6 D’alembert’s principle and its uses.
- 2.7 Motion of connected bodies

**Unit 3: Work, Power and Energy** **[5 hrs]**

- 3.1 Introduction: definition, units and types
- 3.2 Graphical representation of work
- 3.3 Potential and kinetic energy
- 3.4 Law of conservation of energy

**Unit 4: Circular and Curvilinear Motion** **[5 hrs]**

- 4.1 Introduction and Definitions
- 4.2 Equations of Angular Motion
- 4.3 Equations of Linear Motion and Angular Motion
- 4.4 Relation between Linear and Angular Motion

**Unit 5: Simple Machine** **[6 hrs]**

- 5.1 Machine: Simple and compound
- 5.2 Basic Terms: Mechanical Advantages, efficiency, velocity ratio, input and output of machine, Ideal machine.
- 5.3 Relationship between Mechanical Advantages, Velocity ratio and Efficiency.
- 5.4 Condition for reversibility of a machine and Self-Locking of machine
- 5.5 Condition of maximum mechanical advantage and efficiency.

***Tutorial:*** ***[15 hrs]***

**Tutorial 1:** Simple problem to determine time, position, velocity and acceleration using equation of motion.

**Tutorial 2:** Simple problem related to determination of acceleration, velocity and position from the given equation of acceleration and position in function of time.

**Tutorial 3:** Determination of Time of flight, maximum height and range by using standard formula of projectile motion.

**Tutorial 4:** Simple problem related to motion under gravity.

**Tutorial 5:** Simple problem related to relative motion and dependent motion.

**Tutorial 6:** Problem related to determination of motion of two bodies connected by string passing over frictionless pulley (not more than two pulley)

**Tutorial 7:** Simple problem using D’Alembert’s principle.

**Tutorial 8:** Problem to determine work, energy and power

**Tutorial 9:** Problem related circular and curvilinear motion.

**Tutorial 10:** Simple problem using the relationship between Mechanical Advantages, Velocity ratio and Efficiency

**References:**

1. R.K. Rajput, "Applied Mechanics", Laxmi Publishers (P) ltd, India.
2. D.S. Kumar, "Engineering Mechanics," Kataria S.K & Sons, India.
3. S. Neupane, H. R. Parajuli, "Applied Mechanics for engineers", M.K Publishers and Distributors, Bhotahity, Kathmandu, Nepal
4. Malhotra, M.M, Subramanian, R., Gahlot Rathor, P.S, B.S, "Text book in applied mechanics", Wiley Eastern Limited, India.
5. R.S. Khurmi, "Applied Mechanics and Strength of Materials", S. Chand & Co, New Delhi India.

**Mark Specification for final examination:**

<b>Unit</b>	<b>Content</b>	<b>Course hours</b>	<b>Marks</b>
1	Kinematics of Particles	8	12
2	Kinetics	6	8
3	Work, Power and Energy	5	6
4	Circular and Curvilinear Motion	5	6
5	Simple Machine	6	8
	<b>Total</b>	<b>30</b>	<b>40</b>

*Note: There might be minor deviation on the above specified marks*

# Automotive Technology I

EG 2101 AE

Year: II  
Part: I

Total: 11 Hrs/week  
Lecture: 3 Hrs/week  
Tutorial: Hrs/week  
Practical: 8 Hrs/week  
Lab: Hrs/week

## *Course description:*

This subject deals with history of automobile including system of transmission, clutch, gearbox, propeller shaft, final drive, axle, brake, suspension, chassis and frame of automobile vehicles.

## *Course objectives:*

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

1. Understand the fundamentals of automobile transmission and mechanism, axle and steering, brakes, suspension system, wheels and tires, chassis and frames.
2. Understand the working principle and application of transmission and mechanism, steering, brakes, suspension system.
3. Maintain, repair and care the various systems of automobile transmission and mechanism, axle and steering, brakes, suspension system, wheels and tires, chassis and frames.

## *Course contents:*

### **Unit 1: Short History of Automobile**

[3 hrs]

- 1.1 Development of Automobile
- 1.2 List the nomenclature of different automobile
- 1.3 automobile aggregates and their processes
- 1.4 Classification of vehicles

### **Unit 2: Transmission system**

[21 hrs]

#### 2.1 Clutch

[4 hrs]

- 2.1.1 Introduction
- 2.1.2 Types of clutch
- 2.1.3 Working principle of clutch
- 2.1.4 Construction of clutch actuating mechanism
- 2.1.5 Uses and working of fluid or hydraulic coupling
- 2.1.6 Faults and remedies of clutch.

#### 2.2. Gear box

[8 hrs]

- 2.2.1. Introduction
- 2.2.2. Types of gearbox
- 2.2.3. Working principle of gearbox
- 2.2.4. Use and importance of gear shifting mechanism
- 2.2.5. Components of gear shifting mechanism
- 2.2.6. Operation of epicycle gear train in forward and reverse motion
- 2.2.7. Operation of torque converter
- 2.2.8. Operation of overdrive
- 2.2.9. Operation of Automatic Manual Transmission (AMT)
- 2.2.10. Fault and remedies of gear box

2.3. Transfer case and four wheels drive	[2 hrs]
2.4. Propeller shaft and universal joint	[3 hrs]
2.4.1 Introduction to Propeller shaft and Universal joint	
2.4.2 Purposes of Propeller shaft and Universal joint	
2.4.3 Types of Propeller shaft and Universal joint	
2.4.4 Construction of propeller shaft	
• Torque tube drive arrangement	
• Hutch kiss drive arrangement	
2.4.5 Fault and remedies	
2.5. Differential and Rear axle	[4 hrs]
2.5.1 Introduction	
2.5.2 Types of axle	
2.5.3 Use and importance of differential and final drive	
2.5.4 Working principle of differential	
2.5.5 Types of differential and axle housing	
• Banjo type	
• Spilt types	
2.5.6 Limited slip type differential	
2.5.7 All wheels drive system	
2.5.8 Function of axle and housing in different types of live rear axle	
2.5.9 Fault and remedies	
<b>Unit 3: Front axle and steering system</b>	<b>[6 hrs]</b>
3.1 Front axle with different types of steering head	
3.2 Different types steering linkages	
3.3 Steering geometry, wheel alignment and its importance	
3.4 Introduction to steering system	
3.5 Working principle of steering system	
3.6 Types of steering system	
• Hydraulic Assisted Power Steering	
• Electronic Power Assisted Steering ( EPAS)	
3.7 Working principle of different types of steering gear box	
3.8 Use of different types of steering gear box	
3.9 Operation of power steering	
3.10 Fault and remedies	
<b>Unit 4: Brake System</b>	<b>[6 hrs]</b>
4.1 Purpose of brakes in a motor vehicle	
4.2 Function of brake mechanisms in a motor vehicle	
4.3 Components and function of brake system	
4.4 Classification of brakes and their functions	
4.5 Working principle of disc and drum brakes	
4.6 Working principle of hydraulic brake system with Anti lock braking system	
4.7 Working principle of pneumatic brake system with Anti-Lock Braking System	
4.8 Fault and remedies of brake system	
<b>Unit 5: Suspension system</b>	<b>[4 hrs]</b>
5.1 Introduction and use of suspension system	
5.2 Classification of suspension system	

- 5.3 Working principle and types of shock absorber
- 5.4 Fault and remedies of suspension system
- 5.5 Air Suspension system

**Unit 6: Wheels and tyres** **[3 hrs]**

- 6.1 Introduction and features of wheel and tyres
- 6.2 Types of wheel and tyres
- 6.3 Advantages and disadvantages of radial ply and cross ply tyres
- 6.4 Rating of tyres
- 6.5 Importance of rotation of tyres
- 6.6 Fault and remedies of wheel and tyres

**Unit 7: Chassis and frames** **[2 hrs]**

- 7.1 Introduction of chassis and frame
- 7.2 Different types of chassis and frames
- 7.3 Defects on chassis and frame

**Practical/Laboratory:** **[120 Hrs]**

**1 Transmission System**

**1.1 Clutch** **[10 hrs]**

- Identification and function of clutch system components.
- Demonstration of operation of different types of clutch.
- Remove different types of clutch system components from vehicle.
- Inspection of different types of clutch components
- Replace different types of clutch system components
- Repair and maintenance of different types of clutch.
- Trouble shooting in clutch system.
- Safety precaution.

**1.2 Gearbox and transfer case** **[20 hrs]**

- Safety precaution
- Dismantling of gear boxes.
- Identification and function of gear box components.
- Demonstration of the operation of gear box
- Inspection of gear box components.
- Selection of shims for counter shaft, drive shaft and main shaft.
- Assembly of gear box
- Dismantling of transfer cases.
- Identification and function of transfer case components.
- Inspection of transfer case components.
- Repair and maintenance of different types of transfer case.
- Assembly of Transfer case
- Trouble shooting in different types of gear box and transfer case.

**1.3 Propeller shaft** **[8 hrs]**

- Safety precaution
- Identification and function of propeller shaft components,

- Demonstration of operation of propeller shaft.
- Remove replace propeller shaft components.
- Inspection of propeller shaft components.
- Repair and maintenance of propeller shaft.
- Safety and precaution.

#### **1.4 Differential and Rear Axle**

**[16 hrs]**

- Safety precaution
- Removal of rear axle and differential from the vehicle.
- Dismantling of differential.
- Identification and function of differential components.
- Demonstration of operation of differential.
- Inspection of differential components
- Adjustment of tail pinion bearing preload, tail pinion depth, back lash between axle shaft side gears and differential pinions, backlash between tail pinion and ring gear and clearance between thrust pad and ring gear.
- Assembly of differential.
- Removal of wheel hub from the vehicle.
- Grease wheel hub bearings
- Adjust wheel hub bearing play.
- Refit axles.
- Trouble shooting of differential and rear axle.

#### **2. Front Axle and Steering**

**[12 hrs]**

- Safety precaution
- Dismantling of steering system components.
- Identification and function of steering system components,
- Inspection of steering system components.
- Demonstration of operation of steering system
- Assembling of steering system components.
- Repair and maintenance of steering system.
- Trouble shooting of steering system.

#### **3. Suspension System**

**[12 hrs]**

- Safety precaution
- Identification and function of suspension system.
- Demonstration of operation of suspension system.
- Dismantling of suspension system components.
- Inspection of suspension system components.
- Assembling of suspension system components.
- Trouble shooting of suspension system.

#### **4. Brake System**

**[30 hr]**

- Safety precaution.
- Identification and function of conventional hydraulic brake system components.
- Dismantling of brake system components.
- Inspection of brake system components.

- Demonstration of operation of hydraulic brake system.
- Assembling of hydraulic brake system components.
- Repair and maintenance of hydraulic brake system.
- Trouble shooting of hydraulic brake system.
- Identification and function of Anti-lock brake system components.
- Operation antilock brake system.
- Fault finding in antilock brake system by using multi-meter and diagnostic tool.
- Identification and function of pneumatic brake system components.
- Dismantling of pneumatic brake system components.
- Inspection of pneumatic brake system components.
- Operation of pneumatic brake system.
- Assembling of pneumatic brake system components.
- Repair and maintenance of pneumatic brake system.
- Trouble shooting of pneumatic brake system.

### 5. Wheels and Tyres

[12 hrs]

- Safety precaution.
- Function of wheel and tyres.
- Checking defective tyre repair and replacement.
- Fitting of tyre to the vehicle.
- Checking tyre pressure.
- Rotation of wheel in vehicle.
- Wheel balancing.
- Trouble shooting.
- Safety precaution.

### *References:*

1. William H. Crouse and Anglin, "Automotive Mechanics", Tata McGraw Hill Company, New Delhi
2. T.R. Banga, Nathu Singh, "A text book of Automobile Engineering",
3. Frederick C. Nash, Kalman Banitz, "Automotive Technology"
4. K. M. Moeed, "Automobile Engineering ", S. K. Kataria and sons, Ansari Road, Daryagunj, New Delhi, 110002
5. R.K. Mohanty, "Automobile Engineering Volume I", Standard Book House, 1705A Naisarak, Delhi, 110006
6. P. S. Gill, "A Text book of Automobile Engineering Volume I", S. K. Kataria and sons, Ansari Road, Daryagunj, New Delhi, 110002
7. Dr. Kripal Singh, "Automobile Engineering Volume I", Standard Publishers Distributors, Naisarak, Post box 1066, Delhi, 110006
8. G.B. S. Narang, "Automobile Engineering", Khanna Publishers



***Mark Specification for final examination:***

<b>Unit</b>	<b>Content</b>	<b>Course Hours</b>	<b>Mark</b>
1	Short History of Automobile	3	4
2	Transmission system		
2.1	Clutch	4	8
2.2	Gear box	8	12
2.3	Transfer case and four wheels drive	2	4
2.4	Propeller shaft and universal joint	3	4
2.5	Differential and Rear axle	4	8
3	Front axle and steering system	6	12
4	Brake System	6	12
5	Suspension system	4	8
6	Wheels and tyres	3	4
7	Chassis and frames	2	4
	<b>Total</b>	<b>45</b>	<b>80</b>

***Note: There might be minor deviation on the above specified marks***

## Workshop Practice II

EG 2107 ME

Year: II  
Part: I

Total: 11 Hrs/week  
Lecture: 4 Hrs/week  
Tutorial: Hrs/week  
Practical: 7 Hrs/week  
Lab: Hrs/week

### *Course Description:*

This course is the extension one for the students who have undergone Workshop Practice-I. The course deals with basics of mechanical measuring instruments, plumbing works, foundry, casting, forging and different types of metal joining processes. It covers the component description, basic working and handling procedures of different equipment at mechanical fabrication shop.

### *Course Objectives:*

After completing this course the students will be able to

1. Use the basic mechanical measuring instruments.
2. Handle and explain the pipe fittings.
3. Understand and follow the safety rules in foundry and welding shops;
4. Produce simple casting parts as per supplied drawing;
5. Produce parts as per specification using forging hand tools in forging Shop;
6. Perform the heat treatment of forged parts;
7. Describe the different types of welding methods and processes.
8. Weld the given job (mild steel plates, rods) as per supplied drawing.
9. Connect and disconnect/dismantle oxyacetylene welding equipment set;
10. Weld the given job in flat position using oxyacetylene flame with or without filler rod;
11. Solder and Braze the given job by selecting hard solders, fluxes

### *Course contents:*

#### **Unit 1: Introduction to Metrology**

**[6 hrs]**

- 1.1 Units, Dimensions and Standards
- 1.2 Types and Scope of Metrology
- 1.3 Metrological terminology: Accuracy, Precision, Repeatability, Reproducibility, Sensitivity, Resolution, Calibration, Magnification, Backlash, Range, Span, Traceability, Drift, Response, Stability
- 1.4 Errors: types and sources
- 1.5 Types of mechanical measuring instruments: precision and non-precision, linear and angular.

#### **Unit 2: Plumbing works**

**[4 hrs]**

- 2.1 Introduction
- 2.2 Plumbing tools: types, materials, use and care.

- 2.3 Pipes:
  - 2.3.1 Types: polythene, GI, CI
  - 2.3.2 Operations (bending, thread cutting, joining)
  - 2.3.3 Applications
- 2.4 Pipe fittings: types and uses
- 2.5 Introduction to water supply system: city and domestic
- 2.6 Importance and general layout of Domestic sewerage and drainage system

### **Unit 3: Foundry**

**[6 Hrs]**

#### **3.1 Introduction to foundry:**

- 2.1.1 Describe introduction to foundry practice
- 2.1.2 Development, advantages and uses of casting
- 2.1.3 Describe safety in foundry practice

#### **3.2 Casting**

- 3.2.1 Types of casting process (permanent mould, centrifugal, die, shell moulding, investment)
- 3.2.2 Types and properties of casting materials
- 3.2.3 Types and properties of casting materials
- 3.2.4 Construction and uses of Melting furnace (Cupola, induction and crucible)

#### **3.3 Sand casting**

- 3.3.1 Pattern making:
  - Types & Materials of Pattern
  - Consideration for Pattern making allowances
- 3.3.2 Sand Moulding
  - Introduction: Sand Mould, Cope & Drag
  - Use of different hand tools and applications
  - Types of Sand and binders
  - Core making and application
  - Finishing process

### **Unit 4: Forging**

**[4 hrs]**

#### **4.1 Introduction to forging**

- 4.1.1 Introduce to hand forging, its applications, advantages and limitations
- 4.1.2 Forging materials
- 4.1.3 Safety in forging practice

#### **4.2 Hand forging operations**

- 4.2.1 Tools: nomenclature, application
- 4.2.2 Operations: Bending, Cutting down, Setting down, Swaging, Squeezing, drawing, twisting, Upsetting, Punching, Fullering and drifting, Forge welding

### **4.3 Power forging**

- 4.3.1 Power hammer: types, working, application and care (drop, press machine)
- 4.3.2 Defects on forging process, cause and their possible remedies

### **4.4 Heat treatment of forged materials**

- 4.4.1 Introduction and purposes of heat treatment
- 4.4.2 Types and uses (Annealing, Hardening, Tempering)

## **Unit 5: Arc Welding**

**[16 Hrs]**

### **5.1 Introduction to welding**

- 5.1.1 Introduction to welding
- 5.1.2 Classification of welding
- 5.1.3 Selection of different types of welding processes

### **5.2 Introduction to arc welding**

- 5.2.1 Introduction to arc welding
- 5.2.2 Arc column theory
- 5.2.3 Power sources for arc welding
- 5.2.4 Types of welding: SMAW, GMAW, GTAW
- 5.2.5 Safety precautions in arc welding

### **5.3 Arc Welding equipment and accessories**

- 5.3.1 Arc welding machines: types, uses and care
- 5.3.2 Problems in welding machines: troubles, causes and remedies
- 5.3.3 Arc welding machine and operators' accessories.

### **5.4 Arc welding electrode: classification, application and care**

### **5.5 Arc Welding fundamentals and techniques:**

- 5.5.1 Condition of welding table and welding machine
- 5.5.2 Influencing factors in arc welding: position, face protection, arc length, Angles of electrode, Travel speed of electrode, amperage
- 5.5.3 Method, application and advantages of striking an arc (tap, Scratch)
- 5.5.4 Weld movement: types, application and advantages
- 5.5.5 Welding joints: types and application
- 5.5.6 Defects on welding process, cause and their possible remedies

## **Unit 6: Gas welding**

**[20 Hrs]**

### **6.1 Introduction to oxyacetylene (Gas) welding:**

- 6.1.1 Oxy-acetylene welding principle
- 6.1.2 Advantages and application of oxy-acetylene welding
- 6.1.3 Safety precaution in oxy-acetylene welding
  - Personnel safety

- Fire prevention
- Care of cylinders, hoses, acetylene generators
- Lighting of welding torch
- Safety accessories

## **6.2 Properties, uses, storages and handling of oxygen and acetylene gases**

### **6.3 Oxyacetylene welding equipment and accessories**

- 6.3.1 Oxygen cylinder
- 6.3.2 Acetylene cylinder/generator
- 6.3.3 Acetylene cylinder/generator
- 6.3.4 Oxygen and acetylene regulator
- 6.3.5 Wrenches
- 6.3.6 Hoses, hose clips and hose coupler
- 6.3.7 Welding torch-low pressure, equal pressure
- 6.3.8 Welding nozzle-solid piece, multiple piece
- 6.3.9 Filler rod holder
- 6.3.10 Gas lighter
- 6.3.11 Operator's safety accessories

### **6.4 Filler rod and flux: classification, selection, use and storages**

### **6.5 Oxy-acetylene flame: types, properties and use**

### **6.6 Oxy-acetylene welding operations and welding techniques**

- 6.6.1 Equipment set up
- 6.6.2 Testing for leaks
- 6.6.3 Lighting the torch and flame adjustment
- 6.6.4 Shutting off equipment
- 6.6.5 Running a bead with filler rod
- 6.6.6 Backfire and flashback
- 6.6.7 Restarting the weld
- 6.6.8 Welding techniques-leftward and rightward welding
- 6.6.9 Weld movements

### **6.7 Welding joints, welding position and types of welds**

- 7.7.1 Welding joints, their types and application
- 7.7.2 Welding positions, their types and application
- 7.7.3 Types of weld and their applications

### **6.8 Distortion in welding: types and their control**

### **6.9 Testing of welding joints: types and process**

### **6.10 Oxygen gas cutting**

- 6.10.1 Gas cutting principle
- 6.10.2 Major influencing factors of gas cutting
- 6.10.3 Composition of steel
- 6.10.4 Temperature of work-piece

- 6.10.5 Thickness of work- piece
- 6.10.6 Surface defects
- 6.10.7 Purity of oxygen
- 6.10.8 Temperature of oxygen

**6.11 Cutting methods**

- 6.11.1 Oxygen cutting: manual and machine
- 6.11.2 Oxygen de-seaming
- 6.11.3 Oxygen gauging and lancing

- 6.12** Selecting of tip and working pressure in manual gas cutting
- 6.13** Cleaning of the cutting tips
- 6.14** Examples of correct and incorrect techniques in manual gas cutting

**Unit 7: Soldering and Brazing**

**[4 hrs]**

- 7.1 Soldering: principle, application and advantages
- 7.2 Brazing: principle, application and advantages
- 7.3 Soldering and Brazing equipment and materials
- 7.4 Difference between welding, soldering and brazing
- 7.5 Brazing procedures
- 7.6 Requirement for a successful brazing

***Practical/Laboratory:***

***[105 Hrs]***

**1. Sheet Metal Practice:**

**[14 hrs]**

- Sheet metal working: Hands pipe bend plot, blow horn, groove and seaming
- Sheet Developing: Patterns, templates, for the sheet boxes, book stand, scoop funnel, pipe and the machine guards

**2. Foundry exercise:**

- Single Wood pattern making [4 hrs]
- Split wood pattern making [4 hrs]
- Core box making [4 hrs]

**3. Forging exercise:**

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

**4. Arc welding exercise:**

- Safety precaution and familiarization with welding machine and accessories [2 hrs]
- Striking an arc welding on plate [1 hr]
- Padding on flat surface [3 hrs]
- Closed and Square butt joint [4 hrs]
- Corner joint [4 hrs]

- Tee joint [4 hrs]
  - Lap joint [4 hrs]
  - V-butt joint [4 hrs]
  - Vertical & Over Head Welding [6 hrs]
  - Arc cutting on mild steel plate [4 hrs]
5. **Gas Welding Exercise:**
- Lining without filler rod [4 hrs]
  - Lining with filler rod [4 hrs]
  - Butt joint [3 hrs]
  - Corner joint [3 hrs]
  - Lap joint [2 hrs]
  - Tee joint [2 hrs]
  - Straight gas cutting [3 hrs]
  - Circular gas cutting [2 hrs]
6. **Soldering and Brazing Exercise:**
- Closed square butt joint [3 hrs]
  - Lap joint [2 hrs]
  - Tee joint [2 hrs]
  - Circular Brazing [2 hrs]

***References:***

1. R. K. Jain, "Engineering Metrology", Khanna Publishers.
2. Manohar Mahajan, "A Text book of Metrology", Dhanapat Rai & Co. (P) Ltd., Delhi.
3. S. K. Hajra Choudhary, A. K. Hajra Choudhary, "Elements of workshop technology Vol. I: Manufacturing Processes" Media Promoter & Publishers Pvt. Ltd., Bombay, India.
4. R. S. Khurmi & J. K. Gupta, "A textbook of workshop technology, manufacturing processes", Publication division of Nirja construction & development co. Pvt. Ltd.
5. K. Vara Prasada Rao, "Manufacturing science technology [manufacturing processes & machine tools", New age international publishers, Daryaganj, New Delhi-110 002
6. B. S. Raghuvanshi, "A Course in Workshop Technology, Vol. I", Dhanpat Rai and Co. (P) Ltd, Delhi, India.
7. H. S. Bawa, "Workshop Technology, Vol. I", Tata McGrawHill publishing company Limited, New Delhi, India.

*Marks Specification for final examination*

<b>Unit</b>	<b>Content</b>	<b>Course Hours</b>	<b>Marks</b>
1	Introduction to Metrology	6	8
2	Plumbing works	4	4
3	Foundary	6	8
4	Forging	4	4
5	Arc Welding	16	24
6	Gas welding	20	28
7	Soldering and Brazing	4	4
	<b>Total</b>	<b>60</b>	<b>80</b>

*Note: There might be minor deviation on above specified marks*



# Industrial Engineering

## EG 2108 ME

**Year: II**  
**Part: I**

**Total: 3 Hrs/week**  
**Lecture: 3 Hrs/week**  
**Tutorial: Hrs/week**  
**Practical: Hrs/week**  
**Lab: Hrs/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 and basics of engineering economics 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 basic engineering economics

### ***Course contents:***

<b>Unit 1 Industrial Engineering</b>	<b>[2 hrs]</b>
1.1 Definition and evolution of industrial engineering	
1.2 Functions of industrial engineering: problem solving and decision making	
1.3 Broad functional areas of industrial engineering	
<b>Unit 2 Organization and Management</b>	<b>[10 hrs]</b>
2.1 Introduction to Organization	[4 hrs]
2.2 Classification of Organization (basic concept, advantages and disadvantages)	
- Single ownership	
- Partnership	
- Joint stock company	
- Cooperative	
- Public	
2.3 Organization Structure	[2 hrs]
- Line organization	
- Line and staff organization	
- Functional organization	
- Departmentalization	

- 2.4 Management [4 hrs]
- Introduction
  - Functions of management
  - Level of management
  - Managerial skills
  - Theory of management: Scientific, Administrative, Behavioral, Contingency

**Unit 3: Leadership and motivation [3 hrs]**

- 3.1 Definition of leadership and motivation
- 3.2 Qualities of good leaders
- 3.3 Difference between manager and leader
- 3.4 Leadership styles
- 3.5 Theories of motivation: Theory X and Y, Maslow's hierarchy of needs

**Unit 4: Introduction to Production system [7 hrs]**

- 4.1 Introduction to a manufacturing plant
- 4.2 Classification of manufacturing processes
- 4.3 Plant location
  - Importance of plant location
  - Factors affecting plant location
- 4.4 Factory building and plant layout
  - Types of factory building (basic features, pros and cons)
  - Importance of plant layout
  - Types of plant layout (basic features, pros and cons)
- 4.5 Material handling
  - Factors affecting material handling (engineering and economics)
  - Classification of material handling equipment
- 4.6 Store management: meaning, objectives, function of store

**Unit 5: Production Planning and Control (PPC) [10 hrs]**

- 3.1 Introduction
- 3.2 Principle and objectives and functions of PPC
- 3.3 Types of production system (job, batch, continuous)
- 3.4 Forecasting methods, techniques and types
- 3.5 Inventory control (economic order quantity, ABC analysis)
- 3.6 Network techniques
  - Critical path method (CPM)
  - Program evaluation and review technique (PERT)
- 3.7 Definition and concept of quality, Quality control and Quality Assurance
- 3.8 Definition and concept of productivity
  - Measurement of productivity
  - Factors affecting productivity
  - Productivity improvement techniques

**Unit 6: Marketing of Product or Services****[3 hrs]**

- 6.1 Definitions of market and marketing
- 6.2 Concept of marketing mix: product, price, place, promotion
- 6.3 Understanding consumer behavior
- 6.4 Functions of marketing

**Unit 7: Maintenance Engineering****[5 hrs]**

- 7.1 Introduction
- 7.2 Objectives of maintenance
- 7.3 Types of maintenance: Breakdown, Preventive, Reliability-centered, Risk based maintenance
- 7.4 Maintenance activities: Inspections, Adjustment, Testing, Calibration, Rebuilt and Replacement

**Unit 8: Engineering Economics****[5 hrs]**

- 8.1 Introduction to engineering economic decision
- 8.2 Concept of time value of money
- 8.3 Concept of Simple and compound interest rates, effective interest
- 8.4 Depreciation methods, straight line, declining balance method
- 8.5 Project Evaluation Techniques: simple payback period, NPV, IRR, MARR

**References:**

1. KK. Ahuja, "Industrial Management ", CBS Publishers and Distributors, India
2. R. Panneerselvam, "Production and Operations management", Prentice-Hall of India, Private Limited, Delhi.
3. S.K Sharma and Savita Sharma, "Industrial Engineering and Organization management", S.K. Kataria and Sons

**Marks Specification for final examination:**

Unit	Content	Course Hours	Marks
1	Industrial Engineering	2	4
2	Organization and Management	10	20
3	Leadership and motivation	3	12
4	Introduction to Production system	7	12
5	Production Planning and Control (PPC)	10	8
6	Marketing of Product or Services	3	6
7	Maintenance Engineering	5	8
8	Engineering Economics	5	10
	<b>Total</b>	<b>45</b>	<b>80</b>

**Note: There might be minor deviation on the above specified marks**

## **Fourth Semester Year II Part II**

### **Subjects:**

1. EG 2201 AE Basic Electronics Engineering
2. EG 2204 ME Machine Elements and Mechanism
3. EG 2205 ME Strength of Materials
4. EG 2202 AE Automotive Technology II
5. EG 2206 ME Fluid Mechanics and Fluid Machines
6. EG 2202 ME Computer Aided Drawing
7. EG 2203 AE Electrical Technology

# Basic Electronics Engineering

EG 2201 AE

Year: II  
Part: II

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

## *Course Description:*

This course deals with various types of electronic components, devices and circuits with their basic application required for the diploma in mechanical/automobile 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** [2 hrs]

- 1.1 Status of electronics in Nepal
- 1.2 Basic electronics components and their application in the field of mechanical and automobile engineering

### **Unit 2: Semiconductor diode and applications** [9 hrs]

- 2.1 Basic concept of semiconductors, intrinsic and extrinsic semiconductor
- 2.2 Types of semiconductor (N type and P type)
- 2.3 Introduction to PN junction diode: Basic structure, biasing, VI characteristics
- 2.4 Application of diode: Half and full wave rectifier circuit and their operation with filter
- 2.5 Zener diode: Basic construction, principle of operation, VI characteristics, Zener diode as voltage regulator
- 2.6 Introduction of LED, Photodiode, Varactors diode, Tunnel diodes

### **Unit 3: Introduction to bipolar junction transistor (BJT)** [8 hrs]

- 3.1 Basic structure of BJT, principle of PNP and NPN configuration
- 3.2 Concept of BJT biasing, load line and Q-point, general characteristics of BJT
- 3.3 BJT as an amplifier and switch
- 3.4 Basic configuration of transistor circuits (CE, CB, CC), VI characteristics of CE, CB, CC and their comparison

<b>Unit 4: Introduction to special semiconductor devices</b>	<b>[4 hrs]</b>
4.1 Basic construction, features, and uses of:	
4.1.1 Silicon controlled rectifier	
4.1.2 UJT (unijunction transistor)	
4.1.3 JFET (junction field effect transistor)	
4.1.4 MOSFET (metal oxide semiconductor)	
4.1.5 Photo diode and optocoupler	
<b>Unit 5: Introduction to integrated circuit</b>	<b>[2 hrs]</b>
5.1 Introduction	
5.2 Schematic symbol	
5.3 Introduction to SSI, LSI, VLSI	
<b>Unit 6: Fundamentals of Digital Electronics</b>	<b>[10 hrs]</b>
6.1 Number systems: Decimal, Binary, Octal and Hexa- decimal, conversion of number system	
6.2 Binary arithmetic: Addition, subtraction, multiplication and division of binary numbers	
6.3 Logic gates: Symbols, truth table, Boolean expression of OR, NOT, NOR, AND, NAND, XOR and XNOR gates	
6.4 Boolean algebra and associated rules	
6.5 De-Morgan's theorem (statement only)	
6.6 Introduction to universal gate	
<b>Unit 7: Introduction to combinational logic devices</b>	<b>[5 hrs]</b>
7.1 Encoder/decoder	
7.2 Multiplexer and de-multiplexer	
7.3 Adder and sub-tractor	
<b>Unit 8: Introduction to sequential logic devices</b>	<b>[5 hrs]</b>
8.1 Introduction to latches and flip flops	
8.2 Basic construction, symbol and truth table of SR, JK, D, T flip flop	
8.3 Introduction to counters: Synchronous and asynchronous counters (ring counter)	
8.4 Shift registers: shift left and shift right	
<b><i>Practical/ Laboratory:</i></b>	<b><i>[30 hrs]</i></b>
1. Study of VI characteristics of PN junction diode	[3 hrs]
2. Design and study of rectifier circuits	[3 hrs]
3. Study of VI characteristics of CE, CB and CC configuration of transistor	[6 hrs]
4. Study of logic gates using trainer kits	[6 hrs]
5. Study of encoder and decoder	[3 hrs]
6. Study of multiplexer and de- multiplexer	[3 hrs]
7. Study of adder and sub-tractor	[3 hrs]
8. Study of counter and register	[3 hrs]

**References:**

1. T.F. Bogard, "Electronics device and circuit", Pearson Publication
2. M. Morris Mano, "Digital Logic and Computer Design", Pearson Publication
3. J.B Gupta, "Electronics devices and circuits", S.K. Kataria and Sons
4. V.K Mehta, "Principle of electronics", S. Chand and Company.
5. Malvino Brown, "Fundamentals of digital electronics" Tata McGraw-Hill.

**Mark Specification for final examination:**

<b>Unit</b>	<b>Content</b>	<b>Course hours</b>	<b>Marks</b>
1	Introduction	2	4
2	Semiconductor diode and applications	9	16
3	Introduction to bipolar junction transistor (BJT)	8	16
4	Introduction to special semiconductor devices	4	8
5	Introduction to integrated circuit	2	4
6	Fundamentals of Digital Electronics	10	16
7	Introduction to combinational logic devices	5	8
8	Introduction to sequential logic devices	5	8
	<b>Total</b>	<b>45</b>	<b>80</b>

**Note: There might be minor deviation on the above specified marks.**

# Machine Elements and Mechanism

EG 2204 ME

**Year: II**  
**Part: II**

**Total: 3 Hrs/week**  
**Lecture: 3 Hrs/week**  
**Tutorial: Hrs/week**  
**Practical: Hrs/week**  
**Lab: Hrs/week**

## ***Course Description:***

This course deals with the basic components and their application in different mechanism or machines. The main emphasis is given on component description and working principle of different machines and covers simple numerical examples on power transmission. It also introduces the types of joints and balancing of mechanism and machines.

## ***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.
3. Calculate basic transmission ratio of different mechanism.

## ***Course contents:***

### **Unit 1: Machine Elements**

**[22 hrs]**

- 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, nomenclature
- 1.6 Chains: types, application
- 1.7 Ropes: types, application
- 1.8 Power transmission: speed calculation of belt, gear and chain drive
- 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 hrs]**

- 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
  - 2.1.6 Splines: description and application



- 2.2 Permanent 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: Working of Mechanisms**

**[8 hrs]**

- 3.1 Mechanical advantages, velocity ratio and efficiency: related problems
- 3.2 Crank mechanism
- 3.3 Cam mechanism
- 3.4 Wedge and screw mechanism
- 3.5 Gear mechanism
- 3.6 Friction mechanism
- 3.7 Belt mechanism
- 3.8 Electro mechanical mechanisms
- 3.9 Watt Governor mechanism

**Unit 4: Introduction to Balancing**

**[3 hrs]**

- 4.1 Introduction
- 4.2 Static: principle and application
- 4.3 Dynamic: principle and application

***List of Demonstrations:***

- 1. Geometry of machine elements
  - 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. Mechanisms
  - 2.1 Crank mechanisms
  - 2.2 Cam mechanisms
  - 2.3 Wedge & screw mechanism
  - 2.4 Gear mechanism
  - 2.5 Friction mechanism
  - 2.6 Belt mechanism
  - 2.7 Electro-mechanical mechanism
  - 2.8 Watt Governor mechanism

***References:***

1. J. S. Rao & R. V. Dukkipati, "Mechanism & Machine Theory", New Age International, India
2. J.E. Shigley & J.J. Uicker, "Theory of Machines and mechanisms", McGraw Hill, Singapore.
3. R.S. Khurmi, J.K. Gupta, " A textbook of Machine design", S. Chand and Company Ltd. India.

***Marks Specification for final examination:***

<b>Unit</b>	<b>Content</b>	<b>Course Hours</b>	<b>Marks</b>
1	Machine Elements	22	36
2	Joints/Connection	12	24
3	Working of Mechanisms	8	16
4	Introduction to Balancing	3	4
	<b>Total</b>	<b>45</b>	<b>80</b>

***Note: There might be minor deviation on the above specified marks***

# Strength of Materials

## EG 2205 ME

**Year: II**  
**Part: II**

**Total: 5 Hrs/week**  
**Lecture: 3 Hrs/week**  
**Tutorial: 1 Hrs/week**  
**Practical: Hrs/week**  
**Lab: 2/2 Hrs/week**

### *Course description:*

This course deals with the concept of stress and strain applicable in different cases of material loading condition. It also covers the explanation and numerical problems of bending, shear stress, torsion and column with different supports.

### *Course Objectives:*

After completing this course the students will be able to

1. Understand the concept of stress and strain
2. Understand the concept of bending stress and bending equation.
3. Understand the concept of torsion and buckling of column

### *Course contents:*

<b>Unit 1: Introduction to strength of materials and its scope</b>	<b>[1 hr]</b>
<b>Unit 2: Concept and stress and strain</b>	<b>[16 hrs]</b>
2.1 Direct stress and direct strain – compressive and tensile.	
2.2 Determination of direct stresses and strains for uniform sections	
2.3 Determination of direct stresses and strains for stepped sections.	
2.4 Statement of Hooke's law and definition of Young's Modulus of Elasticity.	
2.5 Stress-strain diagram for tensile test on mild steel, explanation of elastic limit.	
2.6 Limit of proportionality, yield point, ultimate stress, and breaking stress – actual and nominal.	
2.7 Factor of safety.	
2.8 Applications of Hooke's law to homogeneous and composite section.	
2.9 Temperature stresses and strains for homogenous and composite section	
2.10 Definition of shear stress, shear strain and modulus of rigidity.	
2.11 Concept of single shear and double shear.	
2.12 Determination of shear stress and shear strain for homogeneous sections.	
2.13 Definition of linear strain, lateral strain and poisson's ratio, volumetric strain, bulk modulus.	
2.14 Relationship between elastic constants	
<b>Unit 3. Simple Bending</b>	<b>[8 hrs]</b>
3.1 Theory of simple bending	

- 3.2 Definition of moment of resistance, neutral axis, Section modulus.
- 3.3 Assumptions in simple theory of bending
- 3.4 Derivation and use of Theory of Bending Equation

**Unit 4: Shear stress in beam** **[6 hrs]**

- 4.1 Shear stress formula and its application
- 4.2 Calculation and distribution of shear stress in (a) Rectangular (b) I – section (c) T –section

**Unit 5: Torsion** **[8 hrs]**

- 5.1 Introduction
- 5.2 Definition of torque and angle of twist
- 5.3 Power transmitted by shaft
- 5.4 Derivation of torsional equation

**Unit 6: Columns** **[6 hrs]**

- 6.1 Definition of column and strut
- 6.2 Columns with different support conditions
- 6.3 Euler’s formula and its assumption.
- 6.4 Effective length, Critical load and Slenderness ratio
- 6.5 Problem related to critical load with different support condition.

***Tutorial:*** ***[15 hrs]***

- Tutorial 1:** Simple problem of calculation of stress and Strain in Uniform section and Step Section of homogeneous material. [2 hrs]
- Tutorial 2:** Simple problem of calculation of stress and strain in Uniform and Stepped Section with the use of principle of superposition. [2 hrs]
- Tutorial 3:** Problem to find yield stress, ultimate stress, strain, modulus of elasticity, factor of safety from tensile test data. [2 hrs]
- Tutorial 4:** Problem related to find linear strain, lateral strain and poisson’s ratio, volumetric strain, bulk modulus [2 hrs]
- Tutorial 5:** Problem to find modulus of elasticity from relationship between elastic constants. [1 hr]
- Tutorial 6:** Simple problem using bending equation. [2 hrs]
- Tutorial 7:** Simple problem using torsion equation. [2 hrs]
- Tutorial 8:** Problem related to critical load on column with different support condition. [2 hrs]

***Practical/Laboratory:*** ***[15 hrs]***

- Lab 1: Tensile and compression test to find the tensile and compressive strength of different material.
- Lab 2: Torsion test to demonstrate the behavior of ductile and brittle materials in torsion.
- Lab 3: Bending test of steel bar.
- Lab 4: Demonstration of Column behavior and buckling: effect of end conditions on buckling load of beams.
- Lab 5: Demonstration of stress develop in compound bar due to temperature effect.

**References:**

1. R.K. Bansal, "A text book of Strength of material", Laxmi publications (p) ltd
2. S.S. Bhavikatti, "Strength of Materials", Vikas Publishing House, New Delhi.
3. R.S. Khurmi, "Applied Mechanics and Strength of Materials", S. Chand & Co, Delhi

**Marks Specification for final examination:**

<b>Unit</b>	<b>Content</b>	<b>Course Hours</b>	<b>Marks</b>
1	Introduction to strength of materials and its scope	1	2
2	Concept and stress and strain	24	32
3	Simple Bending	10	12
4	Shear stress in beam	7	10
5	Torsion	10	12
6	Columns	8	12
	<b>Total</b>	<b>60</b>	<b>80</b>

**Note: There might be minor deviation on the above specified marks**

# Automotive Technology II

EG 2202 AE

Year: II  
Part: II

Total: 11 Hrs/week  
Lecture: 3 Hrs/week  
Tutorial: Hrs/week  
Practical: 8 Hrs/week  
Lab: Hrs/week

## *Course description:*

This course includes automobile engine, cooling and lubrication system, fuels, electricity, magnetism, battery, ignition system, starter, alternator and automobile accessories.

## *Course objectives:*

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

1. Understand engine and their types
2. Explain working principle of engine
3. Understand fuel, lubrication, cooling and their properties
4. Describe construction and application of alternator and Starter motor, battery and ignition system
5. Dismantle and Assemble of petrol engine and measure of engine component.

## *Course contents:*

### **Unit 1: Engine Fundamentals**

**[6 hrs]**

#### 1.1 Engine

- 1.1.1. Introduction to engine
- 1.1.2. Classification of engine
- 1.1.3. Spark ignition (SI) and Compression Ignition (CI) engine
- 1.1.4. Working principle of two stroke cycle and four stroke cycle engine
- 1.1.5. Engine components and their function
- 1.1.6. Valve and valve mechanism and valve timing diagram
- 1.1.7. Fault and remedies

#### 1.2 Engine Terminology

- 1.2.1. Bore
- 1.2.2. Stroke
- 1.2.3. TDC/BDC
- 1.2.4. Engine Capacity
- 1.2.5. Mean effective pressure
- 1.2.6. Indicated power
- 1.2.7. Brake power
- 1.2.8. Friction power
- 1.2.9. Indicated thermal efficiency
- 1.2.10. Brake Thermal Efficiency
- 1.2.11. Mechanical Efficiency
- 1.2.12. Indicated Mean Effective pressure
- 1.2.13. Brake Mean Effective Pressure
- 1.2.14. Friction Mean Effective Pressure
- 1.2.15. Specific fuel consumption

**Unit 2: Fuel****[3 hrs]**

- 2.1. Introduction and types of fuel
- 2.2. Fuel structure
  - 2.2.1 Combustion equation
  - 2.2.2 Combustion characteristic of Petrol and Diesel fuel
- 2.3. Properties of liquid fuel
  - Volatility of fuel
  - Flash point
  - Fire Point
  - Ignition temperature
  - Calorific value
  - Octane number
  - Cetane number
  - Antiknock value and ignitability of fuel

**Unit 3: Petrol Fuel System****[8 hrs]**

- 3.1. Introduction and layout of carbureted petrol fuel system
- 3.2. Working principle, components and function of carburetor fuel system
- 3.3. Systems of carburetor
- 3.4. Drawbacks of carburetor
- 3.5. Components of EFI/Gasoline Engine Management System (EMS)
- 3.6. Working Principles of EFI/Gasoline Engine Management System (EMS)
- 3.7. Types of EFI systems: SPI, MPFI and GDI system
- 3.8. Fault and remedies

**Unit 4: Lubrication System****[3 hrs]**

- 4.1. Lubricants, its types functions and properties
- 4.2. Introduction to lubrication system
- 4.3. Importance, purpose and uses of lubrication system
- 4.4. Working principle and function of lubrication system
- 4.5. Types of lubrication system
- 4.6. Types of Lubricants and grading
- 4.7. Parts and components of lubrication system
- 4.8. Fault and remedies

**Unit 5: Cooling System****[3 hrs]**

- 5.1. Introduction to cooling system
- 5.2. Importance, purpose and uses of cooling system
- 5.3. Working principle of cooling system
- 5.4. Types of Cooling System
- 5.5. Components of cooling system
- 5.6. Types and grading of coolant
- 5.7. Fault and remedies

**Unit 6: Automobile Battery****[2 hrs]**

- 6.1 Introduction
- 6.2 Construction of battery

- 6.3 Function of lead acid battery
- 6.4 Battery capacity
- 6.5 Charging and discharging process of battery
- 6.6 Battery Charging methods
- 6.7 Faults and remedies

**Unit 7: Ignition System**

**[6 hrs]**

- 7.1 Introduction, purpose and uses of ignition system,
- 7.2 Types of ignition system, conventional and electronic ignition system
- 7.3 Working principle of ignition system
- 7.4 Components of ignition system
- 7.5 Working principle and function of battery coil ignition system
- 7.6 Ignition timing and firing order
- 7.7 Introduction and types of advance mechanism
- 7.8 Introduction to magneto ignition system
- 7.9 Working principle of magneto ignition system
- 7.10 Merits and demerits of coil ignition and magneto ignition system
- 7.11 Transistorized ignition system
- 7.12 Distributor less ignition system.
- 7.13 Faults and remedies

**Unit 8: Automobile Starting System**

**[4 hrs]**

- 8.1 Introduction and function of starting system
- 8.2 Working principle of starter motor
- 8.3 Function of main components of starting system
- 8.4 Types of starter motors
- 8.5 Faults and remedies

**Unit 9: Automobile Charging System**

**[4 hrs]**

- 9.1 Introduction to charging system
- 9.2 Working principle of alternator
- 9.3 Function of different parts of alternator
- 9.4 Importance and function of regulator
- 9.5 Faults and remedies

**Unit 10: Auto Electrical Wiring**

**[6 hrs]**

- 10.1 Symbols used in car wiring
- 10.2 Lighting systems
- 10.3 Harness and color coding in automobile wiring
- 10.4 Electric circuit of an automobile
- 10.5 Accessory circuit
- 10.6 Types of bulbs of an automobile
- 10.7 Headlights and parking light
- 10.8 Side lights, reverse light, brake light, fog light, horn
- 10.9 Interior lights
- 10.10 Fault findings
- 10.11 Wiper System
- 10.12 Power Window



***Practical/ Laboratory:***

***[120 hrs]***

**1. Petrol engine**

**[24 hrs]**

- Safety precaution.
- Dismantling of engine.
- Identification and function of engine components
- Demonstration of operation of spark ignition engine.
- Operation of cooling system.
- Operation of lubrication system.
- Operation of air intake system.
- Inspection of engine components.
- Measurement of engine components (piston, crank shaft main and big end journals, cylinder bore, and cam shaft) by using micrometer and bore gauges.
- Assembling of engine, (valve timing, ignition timing and valve clearance adjustment)

**2. Fuel system**

**[16 hrs]**

- Safety precaution.
- Demonstration of systems of Carburetor
- Identification and function of multipoint fuel injection system components.
- Lay out of multipoint fuel injection system.
- Working principle of MPFI system.
- Block diagram of MPFI
- Circuit diagram of MPFI system
- Continuity, voltage, resistance and short circuit test in MPFI system by using multi meter.
- Fault finding by using diagnostic tool.

**3. Battery**

**[8 hrs]**

- Safety precaution.
- Construction of battery
- Battery capacity.
- Checking electrolyte level.
- Testing specific gravity of electrolyte.
- Load (high discharge) test.
- Removal and installation of battery.
- Slow charging
- Quick charging.

**4. Ignition system**

**[12 hrs]**

- Safety precaution
- Identification and function of ignition system components.
- Lay out of ignition system
- Circuit diagram of ignition system.
- Inspection of ignition system components (battery. Ignition switch, ignition coil, condenser high tension cables and spark plugs).
- Basic ignition timing setting
- Use of timing light and inspection of Ignition advance mechanism

- Continuity, voltage, resistance and short circuit test by multimeter in ignition system.
- Fault finding in ignition system by diagnostic tool.

## **5. Charging system** **[10 hrs]**

- Safety precaution.
- Dismantling of alternator.
- Identification and function of charging system components.
- Inspection of charging system components.
- Charging system circuit diagram.
- Operation of charging system
- Assembling of alternator.
- Alternator output test.
- Voltage regulator test
- Trouble shooting of charging system.

## **6. Starting system** **[10 hrs]**

- Safety precaution.
- Dismantling of starter motor.
- Identification and function of starting system components.
- Circuit diagram of starting system.
- Operation of starting system.
- Testing of starting circuit by multimeter.
- Inspection of starting system components-ignition switch, relays, carbon brushes, springs, field coils, armature winding, commutator, solenoid switch and drive pinion.)
- Assembling of starter motor.
- Testing of starter on test bench and on car

## **7. Auto-Electric Wiring** **[20 hrs]**

- Safety precautions
- Wiring symbols
- Circuit diagram

### **7.1 Head light system**

- Head light wiring layout
- Identification of head light components
- Checking of components and circuits.
- Head light adjustment, repair and maintenance

### **7.2 Parking Light System**

- Parking light wiring layout
- Identification of parking light components
- Checking of components and circuits, repair and maintenance

### **7.3 Back Light System**

- Back light wiring layout
- Identification of back light components
- Checking of components and replace
- Repair and maintenance of circuits

#### **7.4 Flasher and side indicator**

- Flasher system wiring layout
- Identification of flasher system components
- Checking of components and replace
- Repair and maintenance of circuits

#### **7.5 Cabin light, baggage compartment, bonnet and dashboard light**

- Identification of components
- Wiring layout
- Checking/replace of components and circuits
- Repair and maintenance

#### **7.6 Brake Light**

- Wiring layout
- Identification of components
- Checking/replace components
- Repair and maintenance

#### **7.7 Horn System**

- Wiring layout
- Identification of components
- Checking/replace components
- Repair and maintenance
- Adjusting horn

### **8. Instruments and Indicators**

[12 hrs]

#### **8.1 Water Temperature Indicator**

- Wiring layout
- Identification of components
- Checking/replace of components
- Repair and maintenance

#### **8.2 Oil pressure indicator system**

- Wiring layout
- Identification of components
- Checking/replace of components
- Repair and maintenance

#### **8.3 Fuel indicator gauge system**

- Wiring layout
- Identification of components
- Checking/replace of components
- Repair and maintenance

### **9. Wiper System**

[4 hrs]

- Wiring layout
- Identification of components

- Checking and replace of components
- Repair and maintenance of circuit

#### 10. Power windows

[4 hrs]

- Wiring layout
- Identification of components
- Checking and replace of components
- Repair and maintenance of circuit

#### *References:*

1. William H. Crouse, "Automotive Engines", Tata McGraw Hill Company, New Delhi
2. Crouse, Anglin, "Automotive Mechanics", Tata McGraw Hill Company, New Delhi
3. K. M. Moeed, "Automobile Engineering", S. K. Kataria and sons, Ansari Road, Daryagunj, New Delhi, 110002
4. P. S. Gill, "A Text book og Automobile Engineering Volume I & II", S. K. Kataria and sons, Ansari Road, Daryagunj, New Delhi, 110002
5. Dr. Kripal Singh, "Automobile Engineering Volume I & II", Standard Publishers Distributors, Naisarak, Post box 1066, Delhi, 110006
6. Willard W. Pulkrabek, "Engineering Fundamentals of Internal Combustion Engine", Prentice-Hall of India P. Ltd., New Delhi
7. V.M. Domkundwar, "A Course in International Combustion Engine", DhanpatRai& Company, New Delhi
8. P. L. Kohli, "Automotive Electrical Equipment", Tata McGraw Hill Publishing Company Limited, New Delhi

#### *Mark Specification for final examination:*

Unit	Content	Course hour	Marks
1	Engine Fundamentals	6	8
2	Fuel	3	4
3	Petrol Fuel System	8	16
4	Lubrication System	3	4
5	Cooling System	3	4
6	Automobile Battery	2	4
7	Ignition System	6	12
8	Automobile Starting System	4	8
9	Automobile Charging System	4	8
10	Electrical Wiring	6	12
<b>Total</b>		<b>45</b>	<b>80</b>

*Note: There might be minor deviation on the above specified marks*

# Fluid Mechanics and Fluid Machines

EG 2206 ME

Year: II  
Part: II

Total: 5 Hrs/week  
Lecture: 3 Hrs/week  
Tutorial: 1 Hrs/week  
Practical: Hrs/week  
Lab: 2/2 Hrs/week

## *Course Description:*

This course deals with the general theories and equations of fluid mechanics with application. 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 losses on pipe flow
5. Dynamic action of fluid
6. Basic theories and working principles of fluid machines

## *Course contents:*

<b>Unit: 1</b>	<b>Properties of Fluid</b>	<b>[3 hrs]</b>
	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 numerical examples	
<b>Unit 2:</b>	<b>Fluid Static</b>	<b>[8 hrs]</b>
	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	
	2.4 Simple type manometer: classification and working	
	2.5 Force on plane submerged bodies	
	2.6 Buoyancy, flotation and stability	
	2.7 Related numerical examples	
<b>Unit 3:</b>	<b>Kinematics of Fluid</b>	<b>[2 hrs]</b>
	3.1 Reynold's number	
	3.2 Description of fluid motion, path line and stream line	
	3.3 Types of fluid displacement	
	3.4 General types of fluid flow	

<b>Unit 4:</b>	<b>Basic Equations of Fluid Flow</b>	<b>[6 hrs]</b>
4.1	Continuity equation: Statement and application on pipe flow	
4.2	Bernoulli's equation: Statement and application on pipe flow	
4.3	Momentum equation: Statement and application on pipe flow	
4.4	Related numerical examples	
<b>Unit 5:</b>	<b>Losses on Pipe Flow</b>	<b>[4 hrs]</b>
5.1	Major loss: Darcey-Weisbach Equation and Moody diagram	
5.2	Minor losses: contraction, expansion, bend, obstruction	
5.3	Related numerical examples	
<b>Unit 6:</b>	<b>Flow Measurement</b>	<b>[4 hrs]</b>
6.1	Coefficients: velocity, contraction, discharge	
6.2	Flow measuring devices: orifice, venturi-meter, notches	
6.3	Related problems on flow over rectangular and triangular notches	
<b>Unit 7:</b>	<b>Dynamic Action of Fluid</b>	<b>[4 hrs]</b>
7.1	Dynamic force and power	
7.2	Force exerted by fluid jet on stationary and moving flat plates	
7.3	Related numerical examples	
<b>Unit 8:</b>	<b>Water Turbines</b>	<b>[8 hrs]</b>
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	Characteristics curve of turbine on 8.4: Head, discharge, efficiencies, specific speed	
8.6	Introduction of water turbine governor and their functions	
<b>Unit 9:</b>	<b>Pumps</b>	<b>[6 hrs]</b>
9.1	Classification of pumps (positive displacement and roto-dynamic pumps)	
9.2	Working of centrifugal and piston pumps	
9.3	Pump characteristics and selection of pump	
9.4	Working principle of Hydraulic ram pump	

**Tutorial:****[15 Hrs]**

1. Properties of fluid: Density, specific volume, specific weight, specific gravity, surface tension [2 hrs]
2. Fluid Static: pressure measurement, simple manometers, force on plane submerged bodies [3 hrs]
3. Basic equations of fluid flow: Continuity, Bernoulli's and Momentum equation for pipe flow cases [4 hrs]
4. Losses on Pipe flow: Darcey-Weisbach Equation and Moody diagram [2 hrs]
5. Flow measurement: rectangular and triangular notches [2 hrs]
6. Dynamic action of fluid: Force exerted by fluid jet on stationary and moving flat plates [2 hrs]

**Practical/Laboratory:****[15 Hrs]**

1. Study of properties of fluid [1 hr]
2. Validity of Bernoulli's theorem [3 hrs]
3. Losses in pipe flow through bends and fittings [2 hrs]
4. Discharge measurement through rectangular/triangular notch [3 hrs]
5. Study/Performance test of Pelton/Francis turbine [3 hrs]
6. Study/Performance test of centrifugal/piston pump [3 hrs]

**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, "Fluid Mechanics", English Language Book Society and Van Nostrand Reinhold Company, London
2. F.M. White, "Fluid Mechanics", Mc Graw-Hill Book Company, Singapore
3. J.F. Douglas, J. M. Gasiorek and J. A. Swaffield., "Fluid Mechanics", Person Education Pvt. Ltd., Singapore
4. Dr. Jagdish Lal, "Fluid Mechanics and Hydraulics", Metropolitan Book Co. Private Ltd., New Delhi India
5. Dr. Jagdish Lal, "Hydraulic Machines", Metropolitan Book Co. Private Ltd., New Delhi India
6. R. K. Rajput, "Fluid Mechanics and Hydraulics Machines", S Chand and Company Ltd., New Delhi

***Marks Specification for final examination:***

<b>Unit</b>	<b>Content</b>	<b>Course Hours</b>	<b>Marks</b>
1	Properties of Fluid	5	4
2	Fluid Static	11	16
3	Kinematics of Fluid	2	4
4	Basic Equations of Fluid Flow	10	16
5	Losses on Pipe Flow	6	6
6	Flow Measurement	6	6
7	Dynamic Action of Fluid	6	8
8	Water Turbines	8	12
9	Pumps	6	8
	<b>Total</b>	<b>60</b>	<b>80</b>

***Note: There might be minor deviation on the above specified marks***



# Computer Aided Drawing

EG 2202 ME

**Year: II**  
**Part: II**

**Total: 4 Hrs/week**  
**Lecture: 1 Hrs/week**  
**Tutorial: Hrs/week**  
**Practical: 3 Hrs/week**  
**Lab: Hrs/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 as well as plotting of the drawing.

## ***Course objectives:***

After completing this course the students will be able to:

1. draw two dimensional objects using AutoCAD,
2. draw three dimensional objects using solid modeling, and
3. Insert dimension and text on drawing.
4. Plot the drawing

## ***Course contents:***

### **Unit 1: Introduction**

**[1 hr]**

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

### **Unit 2: Basic Drawing Commands**

**[2 hrs]**

- 2.1 LINE command and its options
- 2.2 POINT command
- 2.3 XLINE command and its options
- 2.4 ARC command and its options
- 2.5 CIRCLE command and its options
- 2.6 POLYGON command and its options
- 2.7 PLINE command and its options
- 2.8 MLINE command and its options
- 2.9 SPLINE command and its options

<b>Unit 3: Modifying commands</b>	<b>[2 hrs]</b>
3.1 Object selection methods	
3.2 ERASE, OOPS, UNDO, REDO commands	
3.3 OFFSET command	
3.4 COPY, MOVE, ROTATE, MIRROR, ARRAY commands	
3.5 SCALE, STRETCH commands	
3.6 CHAMFER, FILLET commands	
3.7 TRIM, EXTEND commands	
3.8 EXPLODE, BREAK, LENGTHEN, DIVIDE commands	
3.9 PEDIT command	
3.10 CHPROP command, ltype, ltscale, lweight and color	
3.11 DDSELECT, DDMODIFY commands	
3.12 Use of Grips	
<b>Unit 4: Drawing Aids in AutoCAD</b>	<b>[1 hr]</b>
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	
<b>Unit 5: Display commands</b>	<b>[1 hr]</b>
5.1 ZOOM, PAN, VIEW commands	
5.2 REGEN command	
5.3 Creating Viewports	
<b>Unit 6: Inquiry Commands</b>	<b>[1 hr]</b>
6.1 HELP command	
6.2 ID, DIST, AREA commands	
6.3 MASSPROP command	
6.4 LIST, DBLIST, STATUS commands	
6.5 TIME command	
<b>Unit 7: Fine tuning drawings</b>	<b>[1 hr]</b>
7.1 HATCH and BHATCH commands	
7.2 Creating Isometric drawing	
<b>Unit 8: Grouping in AutoCAD</b>	<b>[1 hr]</b>
8.1 BLOCK, WBLOCK commands	

8.2	INSERT, MINSERT commands	
8.3	EXPLODE, BASE commands	
<b>Unit 9: Working with text in AutoCAD</b>		<b>[1 hr]</b>
9.1	TEXT, MTEXT, DTEXT commands	
9.2	Justifying text and text fonts	
9.3	STYLE command	
<b>Unit 10: Dimensioning in AutoCAD</b>		<b>[1 hr]</b>
10.1	Dimensioning commands	
10.2	Dimension styles and dimension setup	
10.3	Dimension scale	
<b>Unit 11: 3-D solid modeling</b>		<b>[2 hrs]</b>
11.1	Creating solid box, solid cylinder, solid cone and solid sphere	
11.2	Boolean operations: Union, Subtraction, Intersection	
11.3	EXTRUDE command	
<b>Unit 12: Plotting drawings</b>		<b>[1 hr]</b>
12.1	Title block and layout management	
12.2	Device information, pen parameters, paper size and orientation	
12.3	Scale, rotation and origin	
12.4	MVIEW, MVSETUP commands	
<b><i>Practical/Laboratory:</i></b>		<b><i>[45 hrs]</i></b>
<b>Unit 1: Introduction</b>		<b>[3 hrs]</b>
1.1	Familiarization with Software Environment, Setting up Drawing	
<b>Unit 2: Basic Drawing Commands</b>		<b>[9 hrs]</b>
2.1	2D Drawing Consisting Straight Lines	
2.2	2D Drawing Consisting Circle and Arc	
2.3	2D Drawing Consisting Ellipse, spline and Polygon	
<b>Unit 3: Modifying commands</b>		<b>[3hrs]</b>
3.1	2D Drawing Using Modifying Commands complex objects drawings	
<b>Unit 4: Fine tuning drawings</b>		<b>[6 hrs]</b>
4.1	Creating Hatch, Working with Layers, Group and Blocks	
4.2	Isometric Drawing: Object and Text	

- Unit 5: 3-D solid modeling** [6 hrs]  
5.1 3D Drawing: Solid Modeling  
5.2 3D Drawing: Solid Editing and 3D Operations
- Unit 6: Plotting drawings** [6 hrs]  
6.1 Plotting 2D and 3D Drawings
- Project 1: Drawing of standard mechanical components:** [6 hrs]  
Spring, Nut Bolt, Gear, Cam Profile, etc
- Project 2: Drawing of assembly and detailed drawing of simple mechanical systems.**[6 hrs]

***References:***

1. G. Omura, "Mastering AutoCAD", Latest Edition
2. "AutoCAD User's Guide", Autodesk, Latest Edition

***Marks specification for final examination***

1. 2D Drawing including drawing setup by using 2D Draw and Modify Command and dimension [15 marks]
2. Isometric Drawing including drawing setup by using 2D Draw and Modify Command and dimension [10 marks]
3. 3D Drawing including drawing setup by using 3D Draw and operator Command and dimensions [15 marks]

***Note: There might be minor deviation on above specified marks.***

# Electrical Technology

## EG 2203 AE

**Year: II**  
**Part: II**

**Total: 5 Hrs/week**  
**Lecture: 3 Hrs/week**  
**Tutorial: Hrs/week**  
**Practical: Hrs/week**  
**Lab: 2 Hrs/week**

### ***Course Description:***

This course provides a basic framework for understanding the fundamental concept of single and three phase electric circuits. The course deals with circuit fundamentals and electric machines.

### ***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 AC and DC systems
3. Understand the DC and AC electrical machines.

### ***Course contents:***

#### **Unit 1: Introduction**

**[4 hrs]**

- 1.1 Electric sources: Current and Voltage Source, AC and DC sources
- 1.2 Concept of electric charge and current flows in a circuit
- 1.3 Emf and potential differences
- 1.4 Concept of generation, transmission and distribution system of electricity in Nepal
- 1.5 Concept of resistance, inductance and capacitance
- 1.6 Resistance, resistivity, temperature coefficient of resistance, variation of resistance with temperature
- 1.7 Series and parallel combination of resistors, inductors and capacitors

#### **Unit 2: Electric Circuit and Theorem**

**[7hrs]**

- 2.1 Electric circuit, series and parallel circuit
- 2.2 Ohm's law, its application and limitations
- 2.3 Electrical Power & Energy
- 2.4 Kirchhoff's Law and their application using mesh analysis and nodal analysis method
- 2.5 Ideal and practical sources
- 2.6 Condition for maximum power transfer

#### **Unit 3: AC Circuit Analysis**

**[9 hrs]**

- 3.1 Generation of 1-phase AC voltage and current
- 3.2 Waveform and terms used in AC: Cycle, frequency, time period, amplitude, phase and phase difference
- 3.3 Average and r.m.s, peak and peak-to-peak value of current and voltage
- 3.4 AC in pure resistance, inductance and capacitance (equation and waveform of current, voltage and average power)

- 3.5 AC in RL, RC and RLC series circuit (equation and waveform of current and voltage; analysis of power and power factor)
- 3.6 Types of power in AC, power factor, its practical importance and power factor improvement
- 3.7 Measurement of power in single phase AC circuit
- 3.8 Basic concept and advantages of 3-phase system, phase and line quantities

**Unit 4: Lighting devices, Wiring system, Electrical safety and Protection [3 hrs]**

- 4.1 Different types of lighting system: Incandescent, Tungsten- halogen, Compact florescent, Tubular Florescent and LED lamp
- 4.2 Types of wiring: Open wiring vs Conceal wiring
- 4.3 Grounding, Earthing and its importance, system grounding vs equipment grounding
- 4.4 Definition and function of protection devices: Fuse, MCB, Lightning arrestor
- 4.5 Electric shock, preventive method and first aid to be taken in electrical accident

**Unit 5: Transformer [3 hrs]**

- 5.1 Transformer: construction and working principle
- 5.2 Emf equation of transformer
- 5.3 Voltage and current transformation ratio of transformer
- 5.4 Basic concept on losses and efficiency of transformer

**Unit 6: DC Machines [7 hrs]**

- 6.1 DC Generators: operating principle of dc generator, method of excitation, armature reaction
- 6.2 DC Motor: Operating principle of dc motor, back emf in dc motor, types of dc motor
- 6.3 Speed and direction control of DC motor

**Unit 7: AC Machines [9 hrs]**

- 7.1 Construction of AC machine
- 7.2 Synchronous Machine:
  - 7.2.1 Synchronous Generator: Construction and operating principle, application, advantages and disadvantages.
  - 7.2.2 Synchronous Motor: Synchronous speed, construction and operating principle, application, advantages and disadvantages.
- 7.3 Induction motor: Introduction and construction, operating principle, application, advantages and dis-advantages.

**Unit 8: Selection of Motor [3 hrs]**

- 8.1 Relationship between force, torque, rpm and power of motors
- 8.2 Sizing and selection of motors
- 8.3 Practical applications with examples.

**Practical/ Laboratory:****[30 hrs]**

- |  |         |
|--|---------|
| 1. Use of ammeter and voltmeter to measure current and voltage               | [3 hrs] |
| 2. Verification of ohm's law.  | [3 hrs] |
| 3. Verification of KCL and KVL.  | [3 hrs] |
| 4. Measurement of AC circuit parameters using RLC series circuit.            | [6 hrs] |
| 5. Voltage, current and power measurements in 1- $\phi$ and 3- $\phi$ system | [3 hrs] |
| 6. Measurement of power factor of ac loads                                   | [3 hrs] |
| 7. Demonstration of various parts of AC and DC machine.                      | [3 hrs] |
| 8. Basic design and selection of motors for practical applications           | [6 hrs] |

**References:**

1. B L Thareja & A.K. Thareja, "A text book of electrical technology Volume I and II", S. Chand and Company, India
2. S.K. Sahdev, "Fundamentals of Electrical Engineering & Electronics", Dhanapati Rai & Company, India.
3. J.B. Gupta, "Fundamentals of Electrical Engineering and Electronics", S.K. Kataria & Sons.

**Mark Specification for final examination:**

Unit	Content	Course hours	Marks
1	Introduction	4	8
2	Electric Circuit and Theorem	7	12
3	AC Circuit Analysis	9	20
4	Lighting devices, Wiring system, Electrical safety and Protection	3	4
5	Transformer	3	4
6	DC Machines	7	12
7	AC Machines	9	16
8	Selection of Motor	3	4
	<b>Total</b>	<b>45</b>	<b>80</b>

**Note: There might be minor deviation on the above specified marks.**

**Second Year  
Part I & II  
(Third and Fourth Semester)**



## **Fifth Semester Year III Part I**

### **Subjects:**

1. EG 3103 ME Fundamental of Hydraulics & Pneumatics
2. EG 3104 ME Machine Design, Estimating & Costing
3. EG 3101 AE Automotive Technology III
4. EG 3103 AE Automotive Electronics I
5. EG 3104 AE Occupational Hygiene and Safety
6. EG 3102 AE Vehicle Driving Practice
7. Elective (One of the following)
  - EG 3105 AE.1 a. Body Shop Repair and Maintenance
  - EG 3105 AE.2 b. Motorcycle Repair & Maintenance
  - EG 3105 AE .3 c. Automobile Air Conditioning
  - EG 3105 AE.4 d. Automobile Service Management

# Fundamentals of Hydraulics and Pneumatics

EG 3103 ME

Year: III  
Part: I

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

## ***Course Description:***

This course deals with the fundamentals of industrial hydraulics and pneumatics. It describes the general application of components, mechanism and working principle of the hydraulic and pneumatic system. It also covers the basic diagnostic steps for problem solving on the systems.

## ***Course Objectives:***

After completing this course the student will be able to:

1. describe the uses of various kinds of hydraulic and pneumatic components
2. explain the operation of various kinds of hydraulic and pneumatic components
3. demonstrate basic knowledge of service, check, maintenance, diagnosis and testing of hydraulic and pneumatic system

## ***Course contents:***

### **Unit 1. Fundamental of Hydraulics and Pneumatics [4 hrs]**

- 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 [16 hrs]**

- 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: construction and working
  - 2.6.3 Vane motor: construction and working
  - 2.6.4 Piston motor: construction and working
  - 2.6.5 Selection of motor
- 2.7 Accumulator
  - 2.7.1 Purpose and functions of accumulator
  - 2.7.2 Spring loaded accumulator: construction and working
  - 2.7.3 Weight loaded accumulator: construction and working
  - 2.7.4 Pneumatic accumulator: construction and working
- 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**

**[12 hrs]**

- 3.1 Pneumatic system
  - 3.1.1 Introduction and types of pneumatic system
  - 3.1.2 Components of pneumatic system and working principle
- 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: components and working principle
  - 3.3.2 Vane type compressors: components and working principle
  - 3.3.3 Helical compressors: components and working principle
  - 3.3.4 Centrifugal compressors: components and working principle
- 3.4 Air Cylinder and Air Motors
  - 3.4.1 Introduction
  - 3.4.2 Types and construction
- 3.5 Valves
  - 3.5.1 Pressure control valve: function and construction
  - 3.5.2 Flow control valve: function and construction
  - 3.5.3 Direction control valve: function and construction
- 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 Contaminants in a pneumatic system
  - 3.9.2 Types and purpose
  - 3.9.3 Selection of filters

**Unit 4. Hydraulic and Pneumatic Circuits** **[5 hrs]**

- 4.1. Hydraulic and pneumatic symbols
- 4.2. Drawing of hydraulic and pneumatic circuits: open and closed center system
- 4.3. Basic requirement for pipeline and layout

**Unit 5. Introduction to General maintenance of hHydraulic system and Pneumatic system** **[8 hrs]**

- 5.1. Preventive Maintenance
  - 5.1.1 Flow pipe lines cleaning
  - 5.1.2 Overhauling of system
  - 5.1.3 Preventing leaks, air-in-oil problems
  - 5.1.4 Prevention on pipe line and fittings
- 5.2. Diagnosis and Testing of Hydraulic system and Pneumatic system
  - 5.2.1 Introduction
  - 5.2.2 Basic steps
  - 5.2.3 Inspection format

**Practical/Laboratory:****[30 hrs]**

1. Components identification and operation on hydrostatic and pneumatic work bench
2. Understanding the layout and operation of open and closed hydraulic system
3. Components identification and operation of different hydraulic pumps
4. Components identification and operation of hydraulic cylinder and motors
5. Components identification and operation of different valves
6. Components identification and operation of accumulator
7. Components identification and operation of different Compressors
8. Identification of hydraulic and pneumatic symbols and basic circuit
9. Demonstration of speed control of hydraulic and pneumatic cylinder/motor
10. Exercises on hydraulic and pneumatic pipe fittings

**References:**

1. Andrew Parr, "Hydraulics and Pneumatics: A Technicians and Engineers Guide", Butterworth-Heinemann, ISBN-10: 0750644192
2. Anthony Esposito, "Fluid Power with Applications", 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",
6. S. R. Majumdar, "Oil hydraulic Systems, Principles and Maintenance", McGrawHill Education, India.
7. S. R. Majumdar, "Pneumatic Systems, Principles and Maintenance", McGrawHill Education, India.

**Marks Specification for final examination:**

<b>Unit</b>	<b>Content</b>	<b>Course Hour</b>	<b>Marks</b>
1	Fundamental of Hydraulics and Pneumatics	4	4
2	Industrial Hydraulics	16	32
3	Industrial Pneumatics	12	20
4	Hydraulic and Pneumatic Circuits	5	8
5	Introduction to General maintenance of hHydraulic system and Pneumatic system	8	16
	<b>Total</b>	<b>45</b>	<b>80</b>

**Note: There might be minor deviation on the above specified marks**

# Machine Design, Estimating and Costing

EG 3104 ME

Year: III  
Part: I

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

## *Course Description:*

This course deals with the basic design of common machine element along with estimating and costing of different mechanical operations. It also explains briefly about the documentation process for a tender.

## *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.
4. Basic knowledge of writing specification and concept of tender document.

## *Course contents:*

### **Unit 1. Introduction**

**[6 hrs]**

- 1.1 Introduction to Machine Design
- 1.2 Design procedure, Gathering information and formulating design problems.
- 1.3 Manufacturing considerations in design
- 1.4 Concept of mechanism, machine element, and machine.
- 1.5 Basic requirements of machine elements, strength, stiffness, rigidity, wear resistance
- 1.6 Types of loads (axial, bending, torsion and combined load)
- 1.7 Mechanical properties of material
- 1.8 Bearing stress and Stress concentration.
- 1.9 Failures and their cause and effect (Ductile, Brittle, Fatigue, Creep)

### **Unit 2. Design consideration in machine element (types of failures and remedies)**

**[10 hrs]**

- 2.1 Riveted joints lap and butt
- 2.2 Welded connections (lap and butt weld)
- 2.3 Turn buckle
- 2.4 Rectangular sunk key
- 2.5 Rigid flange coupling
- 2.6 Straight armed cast iron pulley

### **Unit 3. Design of the machine element**

**[10 hrs]**

#### 3.1 Shaft

- Torsion in shaft
- Power transmitted by shaft
- Simple problem of shaft under torsional loading using torsion equation.

#### 3.2 Bearing

- Selection criteria of bearing of different types.
- Bearing life and equivalent bearing load
- Simple problem related to bearing life and reliability

#### 3.3 Spring

- Close coil and open coil helical spring
- Simple problem of deflection and proof load of close coil helical spring.

### **Unit 4. Estimating and Costing**

**[8 hrs]**

- 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.
- 4.6 Problem related to calculate selling price form ladder of cost.

### **Unit 5. Estimation of Cost**

**[12 hrs]**

- 5.1 Estimation of material cost by volume and weight.
- 5.2 Factor to be considered in estimation in cost in welding, casting and forgoing shop.
- 5.3 Related problem of material cost estimation of simple combined shapes (cylinder, conical, circular, Tapered, Truncated, Rectangular Shape)
- 5.4 Related problem in welding cost estimation in welding shop (gas welding and arc welding)
- 5.5 Related problem in welding cost estimation in welding shop (gas welding and arc welding)
- 5.6 Related Problem in cost estimation in foundry shop (Casting and forging)

### **Unit 6. Estimation in Machine Shop**

**[10 hrs]**

- 6.1 Concept of Set up time, machining time, down time.
- 6.2 Estimation of operation time: machine time for various operations – turning, facing, threading, drilling, milling and shaping.
- 6.3 Related problem of estimation in various operation such as turning, step turning, facing, milling, drilling and shaping.

**Unit 7. Documentation****[4 hrs]**

- 7.1 Writing of specification of welding and machining shop.
- 7.2 Practices on preparing Bill of Quantities (BoQ), calculating the total cost, including tax and profit for given mechanical project.
- 7.3 Basic concept of tender document.
- 7.4 Essential components of tender document.

**References:**

1. Banga and Sharma, "Estimating and Costing", Khanna Publishers Delhi.
2. TTTI Madras, "Mechanical Estimating and Costing".
3. R.S. Khurmi: A Text Book of Machine Design,
4. V.B. Bhandari, "Design of Machine Elements"
5. P.C. Sharma and Dr. D.K. Agrawal, "Machine Design",

**Marks Specification for final examination:**

<b>Unit</b>	<b>Content</b>	<b>Course Hours</b>	<b>Marks</b>
1	Introduction	6	8
2	Design consideration in machine element (types of failures and remedies)	10	12
3	Design of the Machine Element	10	8
4	Estimating and Costing	8	12
5	Estimation of Cost	12	18
6	Estimation in Machine Shop	10	14
7	Documentation	4	8
	<b>Total</b>	<b>60</b>	<b>80</b>

**Note: There might be minor deviation on the above specified marks**



# Automotive Technology III

## EG 3101 AE

**Year: III**  
**Part: I**

**Total: 9 Hrs/week**  
**Lecture: 3 Hrs/week**  
**Tutorial: Hrs/week**  
**Practical: 6 Hrs/week**  
**Lab: Hrs/week**

### ***Course description:***

This course includes diesel engines, other small engines and appliances, farm equipment, construction equipment, air pollution and vehicle wiring system.

### ***Course objectives:***

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

- Understand diesel engines
- Understand electronic diesel control and common rail direct injection system
- Understand small engines, farm and construction equipment
- Understand the working principle of supercharger, turbocharger and inertia charger and their construction and applications.
- Understand air pollution by vehicles and its regulation

### ***Course contents:***

#### **Unit 1. Diesel Engine and Fuel System [6 hrs]**

- 1.1 Operation of diesel engine and major components of diesel engine
- 1.2 Components of diesel fuel system
- 1.3 Operation of fuel feed pump, fuel injection pump and injection nozzle
- 1.4 Types of fuel injection pump
- 1.5 Types of fuel injector
- 1.6 Governor, types and its working
- 1.7 Electronic diesel control system (EDC)
- 1.8 Common rail direct injection system (CRDI)

#### **Unit 2. Combustion Chambers of Diesel Engine [5 hrs]**

- 2.1 Introduction to combustion chambers
- 2.2 Types of combustion chambers
- 2.3 Direct injection combustion chamber
- 2.4 Indirect injection combustion chamber
- 2.5 Advantages of DI combustion chamber
- 2.6 Disadvantages of DI combustion chamber
- 2.7 IDI swirl type chamber
- 2.8 IDI pre chamber system type
- 2.9 Advantage and disadvantages of IDI combustion chamber
- 2.10 Fault findings

<b>Unit 3: Pre-Heating System (Diesel Engine/Glow Plug)</b>	<b>[2 hrs]</b>
3.1 Introduction of Pre-heating system	
3.2 Circuit layout of Pre-heating system	
3.3 Function of pre-heating system	
3.4 Working principle, Purposes and uses	
3.5 Fault findings	
<b>Unit 4: Super Charging and Turbo Charging System</b>	<b>[4 hrs]</b>
4.1. Introduction, purpose and function of super charger and turbo charger	
4.2. Principle, components and application of super charging system	
4.3. Principle, components and application of turbo charging system	
4.4. Principle, components and application of inertia super charging system	
4.5. Fault and remedies	
<b>Unit 5: Emission Control System</b>	<b>[8 hrs]</b>
5.1. Introduction to emission control system	
5.2. purpose and importance of emission control system	
5.3. pollution, pollutants and emission	
5.4. pollution and its measurement	
5.5. HSU and measurement	
5.6. Vehicle emission norms and standards	
5.7. Function and working principle of emission control systems used in engine: EVAP, EGR, Secondary air injection, PCV, PDFs, Catalytic converter	
5.8. Fault findings	
<b>Unit 6: Small Engines and Appliances</b>	<b>[5 hrs]</b>
6.1 Land mover	
6.2 Generator	
6.3 Compressor	
<b>Unit 7: Farm and Construction Equipment</b>	<b>[5 hrs]</b>
7.1. Tractor and harvester	
7.2. Earth moving equipment: Dozer, excavator, loader, Grader	
7.3. Road paving equipment: Roller, Asphalt paving machine	
<b>Unit 8: Non-Conventional Energy Vehicles</b>	<b>[10 hrs]</b>
8.1 Battery operated vehicle	
8.2 Gasohol operated	
8.3 Bio diesel operated	
8.4 LPG and CNG operated	
8.5 Solar operated vehicle	
8.6 Hybrid engine	
8.7 Fuel cell vehicles	

**1. Diesel Engines**

**[30 hrs]**

- Demonstrate the working principle of diesel engine
- Dismantling of engine
- Identification of parts and their functions
- Checking and replacement of defective parts
- Measurement of engine components
- Identification and maintenance of lubrication system
- Identification and maintenance of cooling system
- Assembling and testing engine.
- Setting valve timing and fuel Injection pump timing
- Trouble shooting
- Safety precautions

**2. Diesel fuel system**

**[30 hrs]**

- Identification and demonstration of various components of diesel fuel system
- Servicing of various components of diesel fuel system
- Demonstrate the working principle of fuel injection pump
- Dismantling injection pump
- Identification of parts and their function
- Inspection and replacement of defective parts.
- Assembling parts
- Testing injection pump on test bench
- Dismantling injection nozzle
- Assembling and testing nozzle and set the pressure
- Identification of components and function of CRDI system
- Checking and replacing defective parts
- Lay out of CRDI system.
- Circuit diagram of CRDI system
- Continuity, voltage, resistance and short circuit test in CRDI system by using multimeter.
- Fault finding by using diagnostic tool.
- Safety precautions

**3. Turbo charger and supercharger**

**[10 hrs]**

- Dismantling, identification of components and assembling turbocharger

**4. Emission Control System**

**[20 hrs]**

- Testing of exhaust gas emission using gas analyzer of petrol and diesel engine
- Demonstration of EGR system
- Demonstration of PCV system
- Demonstration of secondary air injection system
- Demonstration of EVAP system
- Demonstration of PDF system
- Demonstration of catalytic converter

**References:**

1. William H. Crouse, "Automotive Engines", Tata McGraw Hill Company, New Delhi
2. William H. Crouse, Anglin, "Automotive Mechanics", Tata McGraw Hill Company, New Delhi
3. T.R. Banga, Nathu Singh, "A text book of Automobile Engineering"
4. Frederick C. Nash, KalmanBanitz, "Automotive Technology"
5. P. S. Gill, "A Text book of Automobile Engineering Volume I & II", S. K. Kataria and sons, Ansari Road, Daryagunj, New Delhi, 110002
6. Dr. Kripal Singh, "Automobile Engineering Volume I & II", Standard Publishers Distributors, Naisarak, Post box 1066, Delhi, 110006
7. S.K. Agarwal, "Automotive Pollution", Ashish Publishing House, New Delhi 110026
8. Willard W. Pulkrabek, "Engineering Fundamentals of Internal Combustion Engine", Prentice-Hall of India P. Ltd., New Delhi
9. V.M. Domkundwar, "A Course in International Combustion Engine", DhanpatRai& Company, New Delhi
10. Bosch, "Diesel Fuel Injection", Society of Automotive Engineers (SAE), USA
11. "Repair & Maintenance of Stationary Diesel Engines", Rural Mechanic Course-3, Tool Foundation

**Mark Specification for final examination:**

<b>Unit</b>	<b>Content</b>	<b>Course hours</b>	<b>Marks</b>
1	Diesel Engine and Fuel System	6	12
2	Combustion Chambers of Diesel Engine	5	8
3	Combustion Chambers of Diesel Engine	2	4
4	Super Charging and Turbo Charging System	4	8
5	Emission Control System	8	16
6	Small Engines and Appliances	5	8
7	Farm and Construction Equipment	5	8
8	Non-Conventional Energy Vehicles	10	16
	<b>Total</b>	<b>45</b>	<b>80</b>

*Note: There might be minor deviation on the above specified marks*

# Automotive Electronics I

## EG 3103 AE

**Year: III**  
**Part: I**

**Total: 7 Hrs/week**  
**Lecture: 3 Hrs/week**  
**Tutorial: Hrs/week**  
**Practical: 4 Hrs/week**  
**Lab: Hrs/week**

### *Course description:*

This course is designed to impart knowledge and skills on automobile electronics systems used in automobile engineering.

### *Course objectives:*

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

1. Understand the fundamentals of basic automobile electronic system.
2. Understand the working principle and application of electronics components, sensors, actuators etc.
3. Understand the working principle and application of digital electronics system in automobile vehicles.
4. Diagnose, test the auto electronics system of automobile vehicles.

### *Course content:*

#### **Unit 1: Automotive Fundamentals**

**[4 hrs]**

- 1.1. Use of electronics in Automobile
- 1.2. Evolution of Electronics in the Automobile
- 1.3. The automobile Physical Configuration
  - Engine
  - Drive train (transmission, differential, axle)
  - Suspension
  - Steering
  - Brakes
  - Instrumentation
  - Electrical/electronic
  - Motion control
  - Comfort/convenience
  - Entertainment/communication/navigation

#### **Unit 2: The Basics of Electronic Engine Control**

**[12 hrs]**

- 2.1 Motivation for Electronic Engine Control
  - Exhaust Emissions
  - Fuel Economy
- 2.2 Concept of electronic Engine Control System
- 2.3 Definition of General Terms

- Parameters
- Variables

#### 2.4 Definition of Engine Performance Terms

- Power
- BSFC
- Torque
- Volumetric Efficiency
- Thermal Efficiency
- Calibration

#### 2.5 Engine Mapping

- Effect of Air/Fuel Ratio on Performance
- Effect of Spark Timing on Performance
- Effect of Exhaust Gas Recirculation on Performance

#### 2.6 Control Strategy

#### 2.7 Introduction to Electronic Fuel Injection System

#### 2.8 Electronic Fuel Control System

- Engine Control Sequence
- Closed-Loop Control
- Closed-Loop Operation
- Open Loop Mode
- Analysis of Intake Manifold Pressure
- Measuring Air Mass

#### 2.9 Electronic Ignition control: Distributor less ignition system

### **Unit 3: Sensors, Actuators and ECU**

**[12 hrs]**

#### 3.1 Application of Sensors and Actuators

##### 3.1.1. Types of sensors based on variables measurement

- Air flow sensor
- Mass air flow (MAF) Sensor
- Oxygen Sensor
  - Unheated Oxygen Sensor
  - Heated Oxygen Sensor
- Throttle Position Sensor (TPS)
- Crankshaft Position Sensor (CKP)
- Camshaft Position Sensor
- Coolant temperature Sensor
- Intake air temperature Sensor
- Manifold absolute pressure Sensor (MAP)
- Vehicle speed sensor
- Knock Sensor

##### 3.1.2. Set of Switches

- Air conditioner clutch engaged switch
- Brake on/off
- Wide open throttle
- Closed throttle
- AC Blower Switch

- 3.1.3. Engine Crankshaft Angular Position Sensor
  - Magnetic Reluctance Position Sensor
  - Hall-Effect Position Sensor
  - Optical Crankshaft Position Sensor
  
- 3.1.4. Throttle Angle Sensor
  - Potentiometer
  
- 3.1.5. Temperature Sensors
  - Engine Coolant Temperature Sensor
  - Intake Air Temperature Sensor
  - Engine Oil Temperature Sensor
  
- 3.1.6. Sensor for Feedback Control
  - Oxygen Sensor
  - Knock Sensors
  
- 3.1.7. Automotive Engine Control Actuators
  - Fuel pump
  - Fuel Injectors
    - Piezoelectric Injectors
    - Transistorized Injectors
  - IAC valve
  - Exhaust Gas Recirculation Actuator
  - Purge canister valve
  - Ignition System
  - Oil Control valve (OCV)
  - Cooling Fan
  - Main Relay
  - Fuel Pump Relay
  - MIL, Indicators
  
- 3.1.8 Introduction of Electronic control unit

#### **Unit 4: Digital Engine Control System**

**[6 hrs]**

- 4.1 Digital Engine Control Features
- 4.2 Control Modes for Fuel Control
  - 4.2.1. Engine Crank
  - 4.2.2. Engine Warm-Up
  - 4.2.3. Open-Loop Control
  - 4.2.4. Closed-Loop Control
  
- 4.3 EGR Control
- 4.4 Ignition control
- 4.5 Integrated Engine Control System
  - 4.5.1. Secondary Air Management
  - 4.5.2. Evaporative Emissions Canister Purge
  - 4.5.3. Torque Converter Lock-up Control
  - 4.5.4. Automatic System Adjustment

- 4.6 Improvements in Electronic Engine Control
  - 4.6.1. Integrated Engine Control System
  - 4.6.2. Oxygen Sensor Improvements
  - 4.6.3. Fuel Injection Timing

**Unit 5: Vehicle Motion Control**

**[10 hrs]**

- 5.1. Typical Cruise Control System
  - 5.1.1. Speed Response Curves
  - 5.1.2. Digital Cruise Control
  - 5.1.3. Throttle Actuator
  
- 5.2. Antilock Braking System
  - Hydraulic Modulator
  - Solenoids
  - Electronic Parking Brake (EPB)
  - Electronic Brake force Distribution (EBD)
  
- 5.3. Electronic Suspension System
  
- 5.4. Electronic Steering Control
  - Electrostatic Column Lock
  - Electronic Power steering
  - Electronic Stability Program (ESP)
  
- 5.5. Air Bag system
  - Impact Sensors
  - SRS Control Module
  - Clock Spring Operation
  - Passenger Air Bag Operation
  - Driver Air Bag Operation
  - Curtain Air Bag Operation
  - Seat Belt Pretensioners
  - Seat Belt Operation

**Unit 6: Future Trends Automotive Electronic Systems**

**[1 hr]**

***Practical/Laboratory:***

***[60 hrs]***

**1. EFI/EMS**

**[35 hrs]**

- Parts identification and location
- Circuit layout
- Use of scanner
- Diagnosis code reading using scanner and malfunction light
- Inspect system and components
- Identification of defective parts
- Replace of defective parts and components
- Testing of components and system
- Safety measures



2. **Anti-lock brake systems (ABS), Cruise control system, Electronic steering system and Air bags system** [25 hrs]

- Parts identification and location
- Circuit layout
- Checking system and component
- Identification of defective parts
- Replace of defective parts and components
- Testing of components and system
- Safety measures

**References:**

1. William B. Ribbens, "Understanding Automotive Electronics", Society of Automotive Engineers Inc.
2. Bosch, "Automotive Mechatronics", Konrad Reif
3. Robert Bosch GmbH, "Automotive Electronics", John Wiley & Sons
4. Ronald K. Jurgen, "Automotive Electronics Handbook", McGraw Hill Company Ltd.
5. V.A. W. Hillers, "Hiller's Fundamentals of Automotive Electronics", The Institute of Motor Industry
6. S.K. Agarwal, "Automotive Pollution", Ashish Publishing House, New Delhi 110026
7. Willard W. Pulkrabek, "Engineering Fundamentals of Internal Combustion Engine ", Prentice-Hall of India P. Ltd., New Delhi
8. Bosch, "Automotive Brake Systems", Society of Automotive Engineers (SAE), USA

**Mark Specification for final examination:**

Unit	Content	Course hours	Marks
1	Automotive Fundamentals	4	8
2	The Basics of Electronic Engine Control	12	20
3	Sensors, Actuators and ECU	12	20
4	Digital Engine Control System	6	12
5	Vehicle Motion Control	10	16
6	Future Trends Automotive Electronic Systems	1	4
	<b>Total</b>	<b>45</b>	<b>80</b>

**Note: There might be minor deviation on the above specified marks**

# Occupational Hygiene and Safety

EG 3104 AE

Year: III  
Part: I

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

## *Course Description:*

This course deals about hygiene and safety as the most important thing for every operator, worker, technician and engineer while working in the industry. It explains different safety requirement and measures of control for protection from concerned hazard.

## *Course Objectives:*

After completing this course the students will be able to

1. Differentiate and explain industrial hygiene and safety
2. Induce safety awareness
3. Locate unsafe locations and activities on shop floor and take corrective actions
4. Understand legal requirements regarding industrial hygiene and safety

## *Course contents:*

- Unit 1: Introduction to Industrial Hygiene and Safety** [4 hrs]
- 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: Occupational Safety and Health** [4 hrs]
- 2.1 Legal Provisions by ILO, National Acts, labour laws for safety and health
  - 2.2 Occupational Safety Rights
  - 2.3 Industrial Hazard record system
  - 2.4 Hazard Management system
- Unit 3: Industrial Environment** [4 hrs]
- 3.1 Sanitation in industry
  - 3.2 Ventilation system
  - 3.3 Lighting system
  - 3.4 Heating **Electrical Safety** system
- Unit 4: Electrical Safety** [4 hrs]
- 4.1 Effects of electric current on health
  - 4.2 Electrical accidents

4.3	Electrical safety standards and regulations	
4.4	Prevention of electrical accidents	
4.5	Safety requirements for electric installation	
4.6	Protective equipment for electrical safety	
<b>Unit 5:</b>	<b>Fire Prevention and Control</b>	<b>[3 hrs]</b>
5.1	Fire hazards	
5.2	Accident prevention principle	
5.3	Fire control methods	
<b>Unit 6:</b>	<b>Noise Pollution and its Control</b>	<b>[4 hrs]</b>
6.1	Effect of noise on health	
6.2	Standard requirements for industrial noise levels	
6.3	Noise control principle and methods	
6.4	Personal protective equipment	
<b>Unit 7:</b>	<b>Air Pollution</b>	<b>[3 hrs]</b>
7.1	Classification of pollutants in industry	
7.2	Sources of pollutants	
7.3	Permissible limits	
7.4	Control of the environment	
<b>Unit 8:</b>	<b>Electromagnetic Radiation</b>	<b>[4 hrs]</b>
8.1	Health hazards due to electromagnetic radiation	
8.2	Permissible limits of electromagnetic radiation	
8.3	Electromagnetic radiation protection principle	
8.4	Personal protective equipment	
<b>Unit 9:</b>	<b>Industrial Vibration</b>	<b>[2 hrs]</b>
9.1	Causes of vibration	
9.2	Vibration minimizing techniques	
<b>Unit 10:</b>	<b>Material Handling</b>	<b>[4 hrs]</b>
10.1	Factors affecting selection of means for handling of materials	
10.2	Mechanical material handling	
10.3	Handling of dangerous chemicals	
<b>Unit 11:</b>	<b>Machine Guarding</b>	<b>[4 hrs]</b>
11.1	Legal requirements	
11.2	Assessment of guards	
11.3	Types of guards	
11.4	Design aspect of guards	
<b>Unit 12:</b>	<b>Physical and Chemical Hazards and Safety Measures in Various Operations</b>	<b>[5 hrs]</b>
12.1	Arc welding and gas welding	

- 12.2 Forging
- 12.3 Casting
- 12.4 Machining
- 12.5 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

**Marks Specification for final examination:**

Unit	Content	Course Hours	Marks
1	Introduction to Industrial Hygiene and Safety	4	6
2	Occupational Safety and Health	4	6
3	Industrial Environment	4	8
4	Industrial Environment	4	8
5	Fire Prevention and Control	3	4
6	Noise Pollution and its Control	4	8
7	Air Pollution	3	4
8	Electromagnetic Radiation	4	8
9	Industrial Vibration	2	4
10	Material Handling	4	8
11	Machine Guarding	4	8
12	Physical and Chemical Hazards and Safety Measures in Various Operations	5	8
	<b>Total</b>	<b>45</b>	<b>80</b>

**Note: There might be minor deviation on above specified marks**

# Vehicle Driving Practice

EG 3202 AE

Year: III

Part: I

**Total: 4 Hrs/week**  
**Lecture: Hrs/week**  
**Tutorial: Hrs/week**  
**Practical: 4 Hrs/week**  
**Lab: Hrs/week**

## *Course description:*

This course is designed to help the students in developing the knowledge and skills related to four wheeled vehicle driving. It covers check-up of vehicle, driving with different parameters, following the traffic rules and symbols. The students have to attend on final driving test and viva voce for the final evaluation.

## *Course objectives:*

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

1. Demonstrate the skills required for the vehicle driving.
2. Apply control system while vehicle driving.
3. Perform pre inspection, during and post check-up of vehicle to drive.
4. Know the traffic rules and symbols.

## *Course content:*

### **Following Practical content needs to cover on this course.**

1. Perform pre starting check up of vehicle.
2. Start the engine
3. Perform pre driving check up of the vehicle.
4. Control steering practice in the field.
5. Carry out driving practice from stationary.
6. Perform running practice in first gear on the field.
7. Perform running practice in second gear on the field.
8. Perform full driving practices on the field.
9. Perform full driving practice on the road.
10. Perform straight reverse driving practice.
11. Perform bend reverse driving practice.
12. Perform bent reverse parking practice in various patterns.
13. Read traffic Rules and regulations.
14. Interpret traffic sign and symbols.

## *Evaluation Scheme:*

<b>Examination</b>	<b>Content</b>	<b>Marks</b>
Internal	Attendance and driving performance	60
Final	Driving test and viva voce	40
<b>Total</b>		<b>100</b>

## **Elective Subjects**

### **Elective (one of the following)**

- EG 3105 AE.1    a. Body Shop Repair and Maintenance
- EG 3105 AE.2    b. Motor Cycle Repair & Maintenance
- EG 3105 AE.3    c. Automobile Air Conditioning
- EG 3105 AE.4    d. Automobile Service Management

# Body Shop Repair and Maintenance (Elective)

EG 3105 AE.1

Year: III

Part: I

**Total: 8 Hrs/week**  
**Lecture: 2 Hrs/week**  
**Tutorial: Hrs/week**  
**Practical: 6 Hrs/week**  
**Lab: Hrs/week**

## *Course description:*

This course is designed to provide knowledge and skills on vehicle denting & painting related work.

## *Course objectives:*

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

1. Carry out simple denting & painting work
2. Use sheet metal working tools
3. Be familiar with properties of sheet metals
4. Apply appropriate techniques to repair dents.

## *Course contents:*

### **Unit 1. Introduction to Dents** **[4 Hrs]**

- 1.1 Introduction and purpose
- 1.2 Types of dents
  - Shallow dent
  - Crease
  - Sharp dent
  - Collision dent

### **Unit 2. Familiarizing Dent Repair Tools** **[4 Hrs]**

- 2.1 Dent hammers
- 2.2 Metal hammers
- 2.3 Soft hammers
- 2.4 Push rods
- 2.5 Push profiles
- 2.6 Up hold & down hold tools

### **Unit 3. Selecting Materials and Consumables** **[6 Hrs]**

- 3.1. Sand papers
- 3.2. Soft brushes
- 3.3. Soft cloths
- 3.4. Masking paper
- 3.5. Adhesives
- 3.6. Touch paint

- Unit 4. Performing Paint-less Dent Repair** **[8 Hrs]**
- 4.1. Cleaning and wiping the dent area
  - 4.2. Paper masking
  - 4.3. Use of tool blow (trial & error method)
  - 4.4. Finish & check the repaired dent

- Unit 5. Performing collision Dent Repair** **[8 Hrs]**
- 5.1. Identify the dents (repairable)
  - 5.2. Dismantle or detach the dented part /s
  - 5.3. Perform hot/ cold denting as required
  - 5.4. Use appropriate tools
  - 5.5. Apply trial & error method till the dent is repaired
  - 5.6. Clean the repaired area with suitable grade of sand paper
  - 5.7. Wash and rinse the area
  - 5.8. Apply hot drying method
  - 5.9. Apply touch paint (paint sample bought from the company)
  - 5.10. Polish wipe with soft cloth
  - 5.11. Finish & check

<b>Practical/Laboratory:</b>		<b>[90 Hrs]</b>
1. Study of the case	-	[8 hrs]
2. Actual shape of the dented part (free hand sketch)	-	[8 hrs]
3. Detail drawing & cost calculation	-	[8 hrs]
4. Preparation work (materials, tools etc.)	-	[6 hrs]
5. Denting & painting work	-	[40 hrs]
6. Final Check up & Report writing	-	[20 hrs]

**References:**

1. Dennis W. Parks, "The Complete Guide to Auto Body Repair", Motorbooks International, 2008
2. [http://www.nepdrt\\_whatish.htm](http://www.nepdrt_whatish.htm)
3. Ivan Law, "Measuring and marking Metals, Workshop Practice Series", Argus Books Ltd.
4. James E. Duffy, Robert Scharff, "Auto Body Repair Technology", Cenage Learning,
5. John Pfan Stiehl, "Automotive Paint Handbook: Paint Technology for Auto Enthusiastic and Body Shop Professional", HP Books, The Bakerly Publishing Group
6. John Van Nn Winden, "Blacksmithing, Welding & Soldering, Rural Mechanic Course-2", Tool Foundation
7. Robert Scharft, Deve Caruso, "Complete Automotive Welding Metals and Plastics", Demlar Automotive Series



***Marks Specification for final examination:***

<b>Unit</b>	<b>Content</b>	<b>Course Hours</b>	<b>Marks</b>
1	Introduction to Dents	4	6
2	Familiarizing Dent Repair Tools	4	6
3	Selecting Materials and Consumables	6	8
4	Performing Paint-less Dent Repair	8	10
5	Performing collision Dent Repair	8	10
	<b>Total</b>	<b>30</b>	<b>40</b>

***Note: There might be minor deviation on above specified marks***

# Motorcycle Repair & Maintenance (Elective)

EG 3105 AE.2

Year: III

Part: I

**Total: 8 Hrs/week**

**Lecture: 2 Hrs/week**

**Tutorial: Hrs/week**

**Practical: 6 Hrs/week**

**Lab: Hrs/week**

## *Course description:*

This course deals with frame and control, engine, transmission and electrical systems of motorcycle

## *Course objectives:*

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

- Explain the theory and functioning of motorcycle.
- Identify and list various systems in motorcycle.
- Demonstrate general overhaul and repair of motorcycle and their components.
- Perform repair and maintenance of motorcycle's electrical system
- Perform routine/preventative/periodical maintenance as well as minor and major repair of motorcycle.

## *Course content:*

### **Unit 1: Motorcycle Frame and Control System**

**[6 hrs]**

- 1.1. Introduction, purpose and types of frame
- 1.2. Introduction, purpose and types of wheels and tyres
- 1.3. Introduction, Purpose, Working principle and types of brake
- 1.4. Introduction, purpose and working principle of steering system
- 1.5. Faults and remedies of frame and control system
- 1.6. Safety Measures

### **Unit 2: Motorcycle Engine and Transmission**

**[12 hrs]**

#### **2.1 Engine**

- 2.1.1. Working principle of four stroke cycle and two stroke cycle engine
- 2.1.2. Difference between two stroke and four stroke cycle engine
- 2.1.3. Valve timing mechanism and valve timing diagram
- 2.1.4. Importance and purpose of measurement
- 2.1.5. Purpose, importance and uses of fuel system in motorcycle
- 2.1.6. Components of fuel system
- 2.1.7. Importance, purpose and uses of lubrication system
- 2.1.8. Different parts and components of lubrication system
- 2.1.9. Importance, purpose and types of cooling system

2.1.10. Fault and remedies of engine

## 2.2 Transmission

2.2.1. Introduction, purpose, types and function of transmission system

2.2.2. Working principle of clutch, gear box and drive chain.

2.2.3. Components and parts of clutch, gearbox and drive chain

2.2.4. Fault and remedies of transmission

## Unit 3: Motorcycle Electrical System

[12 hrs]

3.1. Introduction of Battery, purpose of battery, types of battery,

3.2. External battery charging rating, battery charging connection, charging of battery

3.3. Introduction, purpose, principle and types of ignition system (Battery ignition, Capacitor Discharge Ignition(CDI), Magneto Ignition)

3.4. Introduction, function and circuit layout of starting system

3.5. Introduction to lighting system

3.6. Types of lighting system (Head light, side light, tail light, brake light)

3.7. Bulb, fuse, relay, switch, Circuit layout

3.8. Introduction, purpose, function and circuit layout of charging system

3.9. Introduction, purpose and circuit layout of horn

3.10. Purpose, uses and circuit layout of Instrument panel/indicator

3.11. Fault and remedies of electrical system

3.12. Safety measures

## Practical/Laboratory

[90 hrs]

1. Repair/maintain chassis [3 hrs]
2. Repair/maintain suspension system [5 hrs]
3. Repair/maintain brake and control system [8 hrs]
4. Repair/maintain fuel supply system [8 hrs]
5. Repair/maintain ignition system [5 hrs]
6. Repair and maintenance of Engine [15 hrs]
7. Measurement engine parts. [5 hrs]
8. Perform servicing of Motorcycle [15 hrs]
9. Repair / maintain clutch, gear and drive chain [10 hrs]
10. Repair / maintain lubrication system [2 hrs]
11. Perform general wiring [8 hrs]
12. Repair/maintain motorbike lighting and signaling system [3 hrs]
13. Repair/maintain charging and starting system [3 hrs]

## Reference:

1. S. Srinivasan, "Automotive Mechanics", Tata McGraw Hill Publishing Company Limited, New Delhi
2. P. L. Kohli, "Automotive Electrical Equipment", Tata McGraw Hill Publishing Company Limited, New Delhi

*Marks Specification for final examination*

<b>Unit</b>	<b>Content</b>	<b>Course Hours</b>	<b>Marks</b>
1	Motorcycle Frame and Control System	6	10
2	Motorcycle Engine and Transmission	12	15
3	Motorcycle Electrical System	12	15
	<b>Total</b>	<b>30</b>	<b>40</b>

*Note: There might be minor deviation on above specified marks*

# Automobile Air Conditioning (Elective)

EG 3105 AE.3

Year: III

Part: I

Total: 8 Hrs/week

Lecture: 2 Hrs/week

Tutorial: Hrs/week

Practical: 6 Hrs/week

Lab: Hrs/week

## *Course description:*

This course deals with the study of refrigeration principle heating, ventilation, cooling and control system. It also imparts knowledge and skills on main components, and functions of air-conditioning systems used in automobile.

## *Course objectives:*

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

1. Explain the theory and functioning air conditioning System used in automobile vehicles.
2. Identify and list various types of air conditioning system and their operational advantages and disadvantages.
3. Explain working principle of air conditioning system.
4. Service and repair of air conditioning system and components.
5. Perform routine/preventative/periodical maintenance as well as minor and major repair of automobile air conditioning system.

## *Course content:*

**Unit 1. Refrigeration** [6 hrs]

**1.1 Principles of refrigeration** [3 hrs]

1.1.1. Definition

1.1.2. Different Refrigeration Methods

1.1.3. Heat Pump and refrigerator

1.1.4. Units of Refrigeration / Refrigerating effect

1.1.5. Coefficient of performance (COP)

1.6. Rating of refrigeration machines

**1.2. Refrigerants** [3 hrs]

1.2.1. Properties of refrigerants

1.2.2. Different types of refrigerants

1.2.3. Hazards of refrigerants

1.2.4. Application of commonly used refrigerants

<b>Unit 2. Air-Conditioning</b>	<b>[4 hrs]</b>
2.1. Introduction	
2.2. Psychrometric properties	
3.2.1. Dry and moist air	
3.2.2. Dry Bulb Temperature and Wet Bulb Temperature	
3.2.3. Humidity (specific, absolute and relative humidity)	
2.3. Psychrometric process	
3.3.1. Heating	
3.3.2. Cooling	
3.3.3. Humidification	
3.3.4. Dehumidification	
2.4. Human comfort	
2.5. Applications of air-conditioning	
<b>Unit 3: Automotive AC System and Components</b>	<b>[12 hrs]</b>
<b>3.1. AC system</b>	<b>[3 hrs]</b>
• Introduction and basic principle	
• Type of AC system (Manual and automatic)	
• Lay out of air conditioning system.	
<b>3.2. Compressor</b>	<b>[2 hrs]</b>
• Introduction, purpose and types of compressor (Types)	
• Working principle and components of compressor	
• Compressor oil filling process	
• Trouble shooting	
<b>3.3. Magnetic Clutch</b>	<b>[2 hrs]</b>
• Introduction, purpose and working principle of magnetic clutch	
• Components of magnetic clutch	
• Trouble shooting	
<b>3.4. Condenser</b>	<b>[1 hr]</b>
• Introduction, purpose and working principle of condenser	
• Trouble shooting	
<b>3.5. Receiver Drier</b>	<b>[1 hr]</b>
• Introduction, purpose, working principle and components of Receiver drier	
• Trouble shooting	
<b>3.6. Expansion Valve</b>	<b>[1 hr]</b>
• Introduction, purpose and working principle of Expansion Valve	
• Trouble shooting	

<b>3.7. Evaporator</b>	<b>[1 hr]</b>
<ul style="list-style-type: none"> <li>• Introduction, purpose and working principle of Evaporator</li> <li>• Trouble shooting</li> </ul>	
<b>3.8. Refrigeration Pipe Line</b>	<b>[1 hr]</b>
<ul style="list-style-type: none"> <li>• Purpose and types of pipe line</li> <li>• Trouble shooting</li> </ul>	
<b>3.9. Refrigerant Gas and its refilling Process</b>	<b>[1 hr]</b>
<ul style="list-style-type: none"> <li>• Refrigerant refilling equipment and process</li> </ul>	
<b>Unit 4: Air Flow Control Systems</b>	<b>[4 hrs]</b>
<b>4.1 Introduction</b>	<b>[1 hr]</b>
<ul style="list-style-type: none"> <li>• Definition</li> <li>• Lay out of air flow control system.</li> <li>• Types, parts and components air flow control system</li> </ul>	
<b>4.2. Blower Motor</b>	<b>[2 hrs]</b>
<ul style="list-style-type: none"> <li>• Introduction and purpose of Blower Motor</li> <li>• Working principle and components and parts</li> <li>• Circuit of blower motor system</li> <li>• Trouble shooting</li> </ul>	
<b>4.3. Cooling fan</b>	<b>[1 hr]</b>
<ul style="list-style-type: none"> <li>• Introduction and purpose of Cooling Fan</li> <li>• Working principle, Components and parts of Cooling Fan</li> <li>• Trouble shooting</li> </ul>	
<b>Unit 5: Heating Systems</b>	<b>[2 hrs]</b>
5.1. Introduction, purpose, working principle and components of heating system	
5.2. Trouble shooting	
<b>Unit 6: AC Control Panel Unit</b>	<b>[1 hr]</b>
6.1. Introduction to various switches and knobs of ac control panel unit of dash board	
<b>Unit 7: Diagnosis of Automotive AC</b>	<b>[1 hr]</b>
<b><i>Practical/Laboratory:</i></b>	<b><i>[90 hrs]</i></b>
<b>1. Introduction</b>	
<ul style="list-style-type: none"> <li>• Demonstrate and Identify of components and parts of AC system.</li> </ul>	
<b>2. Compressor</b>	
<ul style="list-style-type: none"> <li>• Identify and locate compressor</li> <li>• Dismount compressor</li> </ul>	

- Test pressure, compressor oil, leakages
- Dismantle compressor
- Inspection of defective parts
- Repair and replace defective parts
- Refill oil
- Assemble compressor; testing of pressure
- Mount the unit in the vehicle
- Adjust and check the
- tension of AC Belt

### **3. Magnetic Clutch**

- Identify and locate magnetic clutch
- Dismount magnetic clutch
- Test magnetic clutch
- Inspect short circuit, electric coil, pulley bearing
- Repair and replace defective parts
- Test electro-magnetic movement
- Mount the unit in the vehicle

### **4. Condenser**

- Identify and locate condenser
- Detach condenser
- Test condenser; check leakages, blockages in fins
- Service/replace defective condenser
- Assemble the unit in the ac system

### **5. Receiver Drier**

- Identify and locate of Receiver drier
- Dismount Receiver drier
- Inspect and test switch
- Replace defective parts or drier
- Assemble the unit in the vehicle

### **6. Expansion Valve**

- Identify and locate Expansion Valve
- Dismount Expansion Valve
- Inspect of the valve
- Service and adjust valve
- Replace defective valve
- Assemble the components and parts in the system



## 7. Evaporator

- Identify and locate of Evaporator
- Detach Evaporator; check leakages, blockages on fins
- Service/replace defective Evaporator or fin sensor
- Assemble the unit in the ac system

## 8. Blower Motor

- Identify and locate Blower Motor
- Dismount blower motor unit
- Inspect parts; check switch, resistor, motor, relay, fuse, fan blade, ac filter, ventilation
- Service/repair/replace defective parts
- Assemble the unit in the ac system

### *References:*

1. J. K. Gupta, "Textbook of Refrigeration & Air conditioning", S. Chand group, New Delhi
2. C. P. Arora, "Refrigeration and Air Conditioning", Tata McGraw-Hill Publishing Company Ltd., New Delhi
3. Thomas W. Birch, Martin Duvic, "Automotive Heating and Air Conditioning", Prentice Hall
4. Steven Daly, "Automotive Air Conditioning and Climate Control System", Butterworth-Heinemann
5. Warren M. Farnell, "Automotive Heating, Ventilation and Air Conditioning Systems Package", Prentice Hall

### *Marks Specification for final examination:*

<b>Unit</b>	<b>Content</b>	<b>Course Hours</b>	<b>Marks</b>
1	Refrigeration	6	8
2	Air-Conditioning	4	4
3	Automotive AC System and Components	12	16
4	Air Flow Control Systems	4	4
5	Heating Systems	2	4
6	AC Control Panel Unit	1	2
7	Diagnosis of Automotive AC	1	2
	<b>Total</b>	<b>30</b>	<b>40</b>

*Note: There might be minor deviation on above specified marks*

# Automobile Service Management (Elective)

EG 3105 AE.4

**Year: III**  
**Part: I**

**Total: 8 Hrs/week**  
**Lecture: 2 Hrs/week**  
**Tutorial: Hrs/week**  
**Practical: 6 Hrs/week**  
**Lab: Hrs/week**

## *Course description:*

This course includes the fundamental principle of Automobile Service Management and application in different automobile service sectors. Students will be able to know the basics of automobile workshop environment, workshop design, field service management, service advisor and technician responsibilities, warranty handling, disputes management and set different KPI used in service sector.

## *Course objectives:*

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

1. Learn the basic concept of Automobile Service Station design and its architecture.
2. Installation of basic garage equipment, i.e. Hydraulics and Pneumatic systems tools for automobile service station set up.
3. Know the essential criteria for being Manufacturer, Distributors and Dealerships
4. Know the fundamental duties and responsibilities of Service Advisor and Technicians.
5. Learn effective communication skills.
6. Know the basic warranty procedures and documentations.
7. Basic field service management, preparation of different case studies, writing DIR, QIR and FSR.
8. Fundamentals about basic set up procedure of EV Charging port in service station.
9. Set targets and goals for team members to achieve performance.
10. Measure KPI performance outcome and achievements.
11. Gain how to read the current market, understand customer needs & how to drive new sales.

## *Course contents:*

<b>Unit 1. Fundamentals of Automobile Service Management System</b>	<b>[4 hrs]</b>
1.1 History of Automobile Service System	
1.2 Automobile Service Station	
1.3 Classification of Automobile Service Station	
1.3.1 Close Shed Automobile Service Station	
1.3.2 Open Shed Automobile Service Station	
1.4 Size of Automobile Service Station	
1.5 Design of Automobile Service Station	

## 1.6 Basic Architecture of Modern Service Station

- a) Fuel Filling Zone
- b) Vehicle Entry Gate
- c) Security Supervisor Zone
- d) Service Reception Zone
- e) Customer Care zone
- f) Spare Parts Reception Zone
- g) Spare Parts Storage Zone
- h) Service Manager Zone
- i) Meeting Zone
- j) Training Hall
- k) Billing Zone
- l) Kids Zone
- m) Warranty Manager Zone
- n) Finance Department Zone
- o) Technical Officer Zone
- p) Work Shop Bay
- q) Washing Bay
- r) Body shop Zone
- s) Refreshment Zone
- t) Vehicle Parking Zone
- u) EV Plug in Charging Zone
- v) Vehicle Queuing Zone
- w) Garbage Zone
- x) Lubricant Waste Collection Zone
- y) Emergency Exit Gate

## Unit 2: Basic Garage Equipment used in Automobile Service Sectors

[5 hrs]

### 2.1 Hoist Equipment

- Post Hydraulic Lift
- Scissor Lift
- Post Hydraulic Lift

### 2.2 Service Bays

#### 2.2.1 Pit Bay

#### 2.2.2 Lift Bay

#### 2.2.3 Metallic bay

#### 2.2.4 Pneumatic System for general tools operation

- a) Reciprocating Air Compressor
- b) Screw Air Compressor
- c) PLC Based Repair and Maintenance of Air compressor
  - Checking of Air Receiver/Drier unit
  - Checking of Filter Regulator Lubricator (FRL) Units.
    - Pneumatic Guns and Moisture content
    - Compressor Oil Drainage System

- 2.2.5 Hydraulic System used in Automobile Service operation
  - 2.2.5.1 General introduction about hydraulic system operation
    - a) Hydraulic lifts
    - b) Hydraulic Cylinder
    - c) Hydraulic Pumps
    - d) Hydraulic Lines
    - e) Advantages and Disadvantages of Hydraulic system.

**Unit 3: Automobile Manufacturers, Distributors, Dealerships**

**[3 hrs]**

- 3.1 Global Automobile Manufacturers
  - 3.1.1 History of Japanese Car Manufacturers
  - 3.1.2 History of European Car Manufacturers
  - 3.1.3 History of American Car Manufacturers
  - 3.1.4 History of Asian Car Manufacturers
  
- 3.2 Essential Criteria for being Automobile Manufacturer.
  - 3.2.1 Product
  - 3.2.2 No. of unit production
  - 3.2.3 Business Volume
  - 3.2.4 No. of employee
  - 3.2.5 Unique features
  - 3.2.6 Quality Management System (QMS) System
  - 3.2.7 Market Share
  
- 3.3 Essential Criteria for being Distributors
  - 3.3.1 Product
  - 3.3.2 No. of sales outlet
  - 3.3.3 No. of service outlets
  - 3.3.4 No. of spare parts outlet
  - 3.3.5 No. of Employee
  - 3.3.6 QMS Implementation
  - 3.3.7 Training and HR Management
  - 3.3.8 Market Share
  
- 3.4 Essential Criteria for being Dealerships
  - 3.4.1 Product
  - 3.4.2 No. of sales outlet
  - 3.4.3 No. of service outlets
  - 3.4.4 No. of spare parts outlet
  - 3.4.5 No. of Employee
  - 3.4.6 Quality Management System (QMS) Implementation
  - 3.4.7 Training and HR Management
  - 3.4.8 Market Share

## **Unit 4: Fundamentals of Service Management**

**[3 hrs]**

- 4.1 Fundamental of Service
- 4.2 6 step process of vehicle reception
  - 4.2.1 Service Appointment
  - 4.2.2 Service Reception
  - 4.2.3 Repair order and Order monitoring
  - 4.2.4 Job Execution
  - 4.2.5 Service delivery and explanation
  - 4.2.6 Post Service Follow-up
  
- 4.3 Service Advisor and essential quality of Service Advisor
  - 4.3.1 Integrity
  - 4.3.2 People Skills
  - 4.3.3 Empathy
  - 4.3.4 Ability to Articulate
  - 4.3.5 Mechanical Knowledge
  - 4.3.6 Superior communication skills
  - 4.3.7 Self-control
  - 4.3.8 A good work ethic
  - 4.3.9 Patience
  
- 4.4 Service Technician and essential quality of Service Technician
  - 4.4.1 Technicians
  - 4.4.2 Duties of Service Technicians
    - Fault finding
    - Estimating time and costs for jobs
    - Customer service
    - Repairing and replacing parts
    - Carrying out servicing and maintenance tasks and checks
  
  - 4.4.3 Essential Quality of Service Technicians
    - Product Knowledge
    - Finishing
    - Diagnosis and analysis
    - Repair Techniques
    - Appetite for Knowledge
    - Strong Customer Service Skills
    - Interpersonal Skills
    - Certification

## **Unit 5. Automobile Field Service Management**

**[2 hrs]**

- 5.1 Breakdown Maintenance
- 5.2 Periodic Maintenance
- 5.3 Preventive Maintenance

5.4 Field Service Case Studies Development Method

5.4.1 Field Service Report (FSR)

5.4.2 Dealer Investigation Report (DIR)

5.4.3 Quality Improvement Report (QIR)

5.5 Diagnosis from FSR, DIR, QIR

5.6 Practical Example of Case Studies

**Unit 6. Automobile Warranty Claim System**

**[2 hrs]**

6.1 Introduction to Warranty System

6.2 Introduction to Manufacturing Defects

6.3 Criteria of Warranty Claim based on origin

6.4 Quality Investigation Report (QIR) and Findings

6.5 Database Management Software System (DMS) for warranty claim

6.6 Warranty Handling Method

6.7 Warranty Claim Method

6.8 Warranty Settlement Method

6.9 Physical Destroying of Warranty Parts

6.10 Warranty cases as topic for Research and Development

**Unit 7. Conflict and Dispute Management in Service Sector**

**[2 hrs]**

7.1 Introduction to Conflict

7.2 Introduction to Disputes

7.3 Methods of Disputes Resolution

7.3.1 Non-binding Resolution

7.3.1.1 Negotiation

7.3.1.2 Mediation

7.3.1.3 Conciliation

7.3.1.4 Dispute Boards

7.3.1.5 Expert Determination

7.3.1.6 Adjudication

7.3.2 Binding Resolution

7.3.2.1 Arbitration

7.3.2.2 Litigation

7.4 An Example and Case study of Disputes Management

**Unit 8. Essentials (Electric Vehicle) EV Charging Station**

**[4 hrs]**

8.1 Basic Concept of EV

8.2 Plug-in charging Method

8.3 Charging Station Design

8.3.1 Charging Zone Parking

8.3.2 Charging Station

8.4 Different Types of Chargers and Installation Process

8.4.1 AC Connectors

8.4.1.1 Type 1 AC Connector

8.4.1.2 Type 2 AC Connector

#### 8.4.2 DC Connectors

8.4.2.1 Type 1 Combined Charging System (CCS) Combo Charger

8.4.2.2 Type 2 Combined Charging System (CCS) Combo Charger

8.4.2.3 Chademo Charger

#### 8.4.3 DC-DC Fast Charger

### **Unit 9: Different Key Performance Indicators (KPI) used in Service Management [4 hrs]**

9.1 Introduction to Key Performance Indicators (KPI)

9.2 Different types of service KPIs

- a) Unit in Operation (UIO)
- b) No. of Vehicles
- c) Repair Orders (RO)
- d) No. of Technicians
- e) Spare Parts Sales
- f) Lubricant Sales
- g) Labor Sales
- h) Counter Sales
- i) Dent and Paint Sales
- j) Average Bill per RO
- k) Spare Parts Sales per RO
- l) Labor Sales per RO
- m) Lubricant Sales per RO
- n) Labor Sales per Technician
- o) Parts Sales to Labor Sales Ratio
- p) Same Day Delivery (SDD) Rate
- q) Bay Efficiency
- r) Customer Complain Rate
- s) Customer Satisfaction Index (CSI)
- t) RO per Day
- u) Pre Delivery Inspection (PDI)
- v) Service Interval
- w) Annual Maintenance Contract (AMC)

### **Unit 10: The next generation of Automobile Service and Parts Strategy [1 hr]**

#### ***Practical/Laboratory:* [75 hrs]**

#### **1. Industrial Orientation and visit at different distributors/dealers of Nepal [45 hrs]**

- Overview of different design and layout of service center
- Overview of customer care operation
- Overview of service receiving and execution
- Overview of hydraulics and pneumatic systems
- Overview of technician and service advisor's responsibility.
- Overview of general safety measures taken in service dealerships.

- 2. Industrial visit and Field Service Report and Dealer Investigation Report Preparation [12 hrs]**
- Field Service Report preparation of any breakdown cases that occurred during vehicle in road.
  - Dealer Investigation Report preparation of any cases relating to fault finding and diagnosis.
- 3. Industrial visit and Orientation on Warranty management system [6 hrs]**
- Observation of warranty handling process
  - Observation of warranty claim in DMS system
- 4. Industrial visit and Orientation on EV Charging system [6 hrs]**
- Observation of different types of EV Charging ports
  - Observation of different methods of EV Charging system.
  - Observation of Fast charging DC-DC Charger
- 5. Industrial visit Orientation on different KPI used in service station [6 hrs]**
- Unit in Operation
  - Repair Orders
  - Average Bill per RO
  - Spare parts sales per RO
  - Labor Sales per RO
  - Lubricant Sales per RO
  - Labor Sales per technician
  - Parts sales to labor sales ratio
  - Same Day Delivery Rate
  - Customer satisfaction index
  - Pre delivery inspection
  - Service Interval
  - Annual Maintenance contract.

***References:***

1. Andrew A. Rezen, "A text book of Automobile Service Management, Principles into Practice", Pearson, ISBN: 978-0-13-470985-7
2. Thijs. N. & Staes. P., "European Primer on Customer Satisfaction Management, 5<sup>th</sup> European Quality Conference, French EU Presidency".
3. "Customer Satisfaction Handbook", The Charter Oak Group, LLC.
4. "Essential Skills Manual, Automobile Service Technician", NOC 7321
5. "EV Charging station, Technical Installation Guide", Hydro-Quebec.
6. "Global Automobile Industry, Issue 2: Fall 2004, BERA", Boston Consulting Group, Oct 22, 2013.
7. James Rodger, "Global automobile warranty survey report, Bearing Point, Management and Technology consultancy.



8. M. Afzalus Rahim, "Managing conflict in organizations", QUORUM Books, ISBN: 1-56720-262-4
9. "A Text Book of Automobile Engineering Technician", AET, paper III YR2
10. "Warranty Management, WNS Extending your enterprise", 2014, WNS Global services.
11. Paper- Charging the future: Challenges and opportunities for electric vehicle adoption, Henry Lee, Alex Clark, Havard Kennedy School, BELFER CENTER for science and international affair, August, 2018.
12. Presentation on Disputes Resolution and conflict management, Ontario public school, Boards Association, [www.thefletcherconsultancy.com](http://www.thefletcherconsultancy.com)

***Marks Specification for final examination:***

<b>Unit</b>	<b>Content</b>	<b>Course Hours</b>	<b>Marks</b>
1	Fundamentals of Automobile Service Management System	4	4
2	Basic Garage Equipment used in Automobile Service Sectors	5	6
3	Automobile Manufacturers, Distributors, Dealerships	3	4
4	Fundamentals of Service Management	3	4
5	Automobile Field Service Management	2	4
6	Automobile Warranty Claim System	2	4
7	Conflict and Dispute Management in Service Sector	2	4
8	Essentials (Electric Vehicle) EV Charging Station	4	4
9	Different Key Performance Indicators (KPI) used in Service Management	4	4
10	The next generation of Automobile Service and Parts Strategy	1	2
	<b>Total</b>	<b>30</b>	<b>40</b>

***Note: There might be minor deviation on above specified marks***

## **Sixth Semester Year III Part II**

### **Subjects:**

1. EG 3201 AE Automotive Electronics II
2. EG 3201 MG Entrepreneurship Development
3. EG 3202 AE Automotive Technology IV
4. EG 3203 AE Industrial Attachment

# Entrepreneurship Development

## EG 3201 MG

**Year: III**  
**Semester: II**

**Total: 5 Hrs. /week**  
**Lecture: 3 Hrs./week**  
**Tutorial: Hr./week**  
**Practical: 2 Hrs./week**  
**Lab: Hrs./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 and
5. Manage small business.

### **Course Contents:**

#### **Theory**

#### **Unit 1: Introduction to Business & Entrepreneurship: [9 Hrs.]**

- a. Overview of entrepreneur and entrepreneurship
- b. Wage employment, self-employment and business
- c. Synopsis of types and forms of enterprises
- d. Attitudes, characteristics & skills required to be an entrepreneur
- e. Myths about entrepreneurs
- f. Overview of MSMEs (Micro, Small and Medium Enterprises) in Nepal

#### **Unit 2: Exploring and Developing Entrepreneurial Competencies: [9 Hrs.]**

- a. Assessing individual entrepreneurial inclination
- b. Assessment of decision-making attitudes
- c. Risk taking behavior and risk minimization
- d. Creativity and innovation in business
- e. Enterprise management competencies

#### **Unit 3: Business identification and Selection: [4 Hrs.]**

- a. Sources and method of finding business idea(s)
- b. Selection of viable business ideas
- c. Legal provisions for MSMEs in Nepal

**Unit 4: Business plan Formulation:****[18 Hrs.]**

- a. Needs and importance of business plan
- b. 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
- c. Business operation plan
  - Process of product or service creation
  - Required fix assets
  - Level of capacity utilization
  - Depreciation & amortization
  - Estimation office overhead and utilities
- d. Organizational and human resource plan
  - Legal status of business
  - Management structure
  - Required human resource and cost
  - Roles and responsibility of staff
- e. 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
- f. Business plan appraisal
  - Return on investment
  - Breakeven analysis
  - Risk factors

**Unit 5: Small Business Management:****[5 Hrs.]**

- a. Concept of small business management
- b. Market and marketing mix
- c. Basic account keeping

## **Practical**

**Unit 1: Overview of Business & Entrepreneurship** [2 Hrs.]

1. Collect business information through interaction with successful entrepreneur

**Unit 2: Exploring and Developing Entrepreneurial Competencies** [2 Hrs.]

1. Generate innovative business ideas

**Unit 3: Product or service Identification and Selection** [2 Hrs.]

1. Analyze business ideas using SWOT method

**Unit 4: Business Plan Formulation** [22 Hrs.]

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

**Unit 5: Small Business Management** [2 Hrs.]

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

# Automotive Electronics II

## EG 3201 AE

**Year: III**  
**Part: II**

**Total: 6 Hrs/week**  
**Lecture: 3 Hrs/week**  
**Tutorial: Hrs/week**  
**Practical: Hrs/week**  
**Lab: 3 Hrs/week**

### ***Course description:***

This course is designed to impart knowledge and skills on auto electronics systems used in automobile engineering.

### ***Course objectives:***

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

- Understand the fundamentals of automobile electronics.
- Understand the working principle and application of electronics components, sensors, actuators used in CRDI System, Body Control System and Automatic Transmission system.
- Understand basic about Controller Area Network (CAN) system used in automobile vehicles.
- Basic knowledge of SCANNER operation

### ***Course content:***

#### **Unit 1: Automobile Diesel Fuel Electronics System**

**[6 hrs]**

- 1.1 Introduction to Common Rail Direct Injection System (CRDI)
  - 1.1.1 Fuel Pump Operation (Low Pressure Circuit)
    - 1.1.1.1 Fuel Filter
    - 1.1.1.2 Fuel Pump
    - 1.1.1.3 Pressure Relief valve
  - 1.1.2 High Injection Pump System (High Pressure Circuit)
    - 1.1.2.1 Common Rail
    - 1.1.2.2 Rail Pressure Sensor
    - 1.1.2.3 High Pressure Pump
    - 1.1.2.4 Pressure Relief valve
    - 1.1.2.5 High Pressure Injectors
    - 1.1.2.6 Return Lines

#### **Unit 2: Automobile Transmission Control System**

**[10 hrs]**

- 2.1 Transmission Control Unit (TCU)
  - 2.1.1 Input Parameters
    - 2.1.1.1 Vehicle Speed Sensors (VSS)
    - 2.1.1.2 Wheel Speed Sensors (WSS)
    - 2.1.1.3 Throttle Position Sensors (TPS)
    - 2.1.1.4 Turbine Speed Sensors (TSS)
    - 2.1.1.5 Transmission Fluid Temperature Sensor (TFTS)
    - 2.1.1.6 Kick Down switch
    - 2.1.1.7 Brake Light Switch
    - 2.1.1.8 Traction Control System

- 2.1.1.9 Cruise Control Module
- 2.1.1.10 Input from other Controllers (CAN input)

- 2.1.2 Output Parameters
  - 2.1.2.1 Shift Locks
  - 2.1.2.2 Shift Solenoids
  - 2.1.2.3 Pressure Control Solenoids
  - 2.1.2.4 Torque Converter Clutch Solenoids
  - 2.1.2.5 Output to Electronic Control Unit (ECU)
  - 2.1.2.6 Output to Other Controllers
  - 2.1.2.7 Clutch Wear Indicators and Shift Pressures
  - 2.1.2.8 Malfunction Indicator Lamp (MIL)

### **Unit 3: Body Control Module (BCM)**

**[10 hrs]**

- 3.1 Block Diagram of BCM
- 3.2 Components of BCM
- 3.3 Operation of BCM
  - 3.3.1 Power Window operation
  - 3.3.2 Instrument Cluster
  - 3.3.3 Anti theft System
  - 3.3.4 Immobilizer System
  - 3.3.5 Immobilizer Coding
  - 3.3.6 Push Button start
  - 3.3.7 Rear View Mirror
  - 3.3.8 Global Positioning System (GPS)- Navigation System
  - 3.3.9 Bluetooth Communication System

### **Unit 4: Vehicle Controller Area Network (CAN) System**

**[12 hrs]**

- 4.1 Relation between data transfer rate and bus length
- 4.2 CAN Protocol
- 4.3 Carrier Sense Multiple Access/ Collision Detection (CSMA/CD)
- 4.4 CAN Message Frame Format
  - 4.4.1 Standard Frame
    - 4.4.1.1 Start of Frame (SOF) field
    - 4.4.1.2 Arbitration field
    - 4.4.1.3 Control Field
    - 4.4.1.4 Data Field
    - 4.4.1.5 Cyclic Redundancy Check (CRC) field,
    - 4.4.1.6 Acknowledge (ACK) field
    - 4.4.1.7 End of Frame (EOF) field
  - 4.4.2 Extended Frame
- 4.5 CAN standards
  - 4.6.1 CAN High Speed according to ISO-11898
  - 4.6.2 CAN Low Speed according to ISO-11519
- 4.6 CAN Nodes Allocation
  - 4.7.1 Nd1 – Controls all rear lighting loads

- 4.7.2 Nd2 – Controls electric windows
- 4.7.3 Nd3 – Controls the windscreen wipers.
- 4.7.4 Nd4 – Controls all front lighting loads
- 4.7 CAN Controller
  - 4.9.1 MCU Interface
  - 4.9.2 CAN Protocol Controller
  - 4.9.3 Message Acceptance Filter
  - 4.9.4 Message Memory
- 4.8 CAN Transceiver
  - 4.10.1 Bus Failure Management
  - 4.10.2 Signaling
- 4.9 CAN Bus
- 4.10 Transmission between Nodes

**Unit 5. Automobile Diagnosis System [3 Hrs]**

- 5.1 Automobile On-board diagnostics (OBD) Systems.
- 5.2 Different Scanner Devices used in automobiles: OBD II scan tool, Launch, carman scan, Autel etc.
- 5.3 Worldwide Diagnosis System

**Unit 6. Programming and Control Through Scanner [4 Hrs]**

- Ignition Key Programming
- Injector Replacement and Coding
- Diesel Fuel System Air Bleeding through Scanner
- Simulation of different actuators.

***Practical/ Laboratory: [45 hrs]***

- 1) EFI/EMS Diesel 12 hrs.
  - a. Using common rail injection tester (CIT) for diagnosis of CRDI System
- 2) Automatic Transmission System 12 hrs.
- 3) Diagnosis through Scanner and operation of
  - a. Solenoids
  - b. Transmission Control System
- 4) Body Control Module Programming 12 hrs.
  - a. Fault finding through Scanner in BCM
  - b. Basic CAN Structure overview
- 5) Programming and control through Scanner 9 hrs.
  - a. Ignition Key Programming
  - Injector Replacement and Coding
  - Diesel Fuel System Air Bleeding through Scanner
  - Simulation of different actuators.



**Reference books:**

1. William B. Ribbens, "Understanding Automotive Electronics", Society of Automotive Engineers Inc.
2. Robert Bosch GmbH, "Automotive Electrics Automotive Electronics", John Wiley & Sons
3. Bosch, "Automotive Mechatronics", Konrad Reif
4. Tom Denton, "Automobile Electrical and Electronic systems", Elsevier
5. Ronald K. Jurgen, "Automotive Electronics Handbook", McGraw Hill Company Ltd.
6. Tracy Martin, "How to Diagnose & Repair Automotive Electrical System, Motorbooks Workshop", MBI Publishing Company, USA
7. V.A. W. Hillers, "Hiller's Fundamentals of Automotive Electronics", The Institute of Motor Industry
8. Bosch, "Diesel Fuel Injection", Society of Automotive Engineers (SAE), USA
9. H.M. Sethi, "Automotive Technology", Tata MC Graw-Hill Publishing Company Ltd., New Delhi

**Mark Specification for final examination:**

<b>Unit</b>	<b>Content</b>	<b>Course Hours</b>	<b>Marks</b>
1	Automobile Diesel Fuel Electronics System	6	12
2	Automobile Transmission Control System	10	20
3	Body Control Module (BCM)	10	20
4	Vehicle Controller Area Network (CAN) System	12	20
5	Automobile Diagnosis System	3	4
6	Programming and Control Through Scanner	4	4
	<b>Total</b>	<b>45</b>	<b>80</b>

**Note: There might be minor deviation on the above specified marks**

# Automotive Technology IV

EG 3202 AE

Year: III  
Part: II

Total: 11 Hrs/week  
Lecture: 3 Hrs/week  
Tutorial: Hrs/week  
Practical: 8 Hrs/week  
Lab: Hrs/week

## *Course description:*

This course provides knowledge and skills on repairing and maintenance of vehicle and their diagnosis procedures. It helps to develop driving skill of students and helps to know motor vehicle acts and rules.

## *Course objectives:*

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

- Understand technical condition of vehicles and diagnosis procedure.
- Understand the braking dynamics and cross country ability of vehicle
- Understand vehicle service, repair and maintenance
- Understand defensive driving, read and interpret traffic rules, vehicle regulations and acts

## *Course content:*

### **Unit 1: Diagnosis of Vehicles**

**[24 hrs]**

- 1.1 Diagnosis of Engine Management system (EMS) petrol and diesel
- 1.2 Diagnosis of Transmission System
- 1.3 Diagnosis of brake system
- 1.4 Diagnosis of Steering system
- 1.5 Diagnosis of Suspension system
- 1.6 Diagnosis of Advance Electrical and Electronic System
  - Body Control Module (BCM)
  - Anti-Lock Braking System (ABS)
  - Heating Ventilation and Air Conditioning (HVAC) System
  - Immobilizer System
  - Center Door Locking (CDL)
  - Supplementary Restraint System (SRS)
  - Instrument cluster
  - Electrical Power Assisted Steering (EPAS)

### **Unit 2: Concept of Maintenance, Repairs and Wear in Vehicles**

**[8 hrs]**

- 2.1. Introduction to maintenance
- 2.2. Importance of maintenance
- 2.3. Types of maintenance
- 2.4. Activities of maintenance
- 2.5. Repair and its purpose
- 2.6. Overhaul and running repair

**Unit 3: Braking Dynamics and Cross Country Ability** [2 hrs]

- 3.1 General on braking dynamics
- 3.2 Braking distance
- 3.3 Cross country ability of a motor vehicle
- 3.4 General on cross country ability with examples of 4×4

**Unit 4: Driving** [6 hrs]

- 4.1 Traffic rules and regulation
- 4.2 Traffic signs and symbols
- 4.3 Plain driving
- 4.4 Night driving
- 4.5 Hill driving
- 4.6 City driving
- 4.7 Reverse
- 4.8 Parking

**Unit 5: Motor Vehicles Acts and Rules** [5 hrs]

***Practical/Laboratory:*** [120 hrs]

- 1. Fault finding, repair and maintenance of chassis, frame and control system. [8 hrs]
- 2. Fault finding, repair and maintenance and overhaul of Petrol Engine. [24 hrs]
- 3. Circuit diagram analysis of different types of EMS-Petrol. [4 hrs]
- 4. Fault finding in EMS (Petrol) by using multimeter. [8 hrs]
- 5. Fault finding in EMS (Petrol) by using diagnostic tools. [4 hrs]
- 6. Fault finding, repair and maintenance and overhaul of Diesel Engine [24 hrs]
- 7. Circuit diagram analysis of different types of EMS-Diesel. [8 hrs]
- 8. Fault finding in EMS (Diesel) by using multimeter [8 hrs]
- 9. Fault finding in EMS (Diesel) by using diagnostic tools [4 hrs]
- 10. Fault finding in transmission system by using diagnostic tools [8 hrs]
- 11. Circuit Diagram analysis, Circuit analysis and fault finding using multimeter, diagnostic tools of the following system. [20 hrs]
  - Body Control Module (BCM)
  - Anti-Lock Braking System (ABS)
  - Heating Ventilation and Air Conditioning (HVAC) System
  - Center Door Locking (CD)
  - Supplementary Restraint System (SRS)
  - Instrument cluster
  - Electrical Power Assisted Steering (EPAS)
  - Wiper System
  - Window Winding
  - Revers Parking
  - Radiator Fan
  - Heated Rear window
  - Power Mirror
  - Horn System
  - Infotainment System

**References:**

1. William H. Crouse, "Automotive Engines", Tata McGraw Hill Company, New Delhi
2. William H. Crouse, Anglin, "Automotive Mechanics", Tata McGraw Hill Company, New Delhi
3. Robert Bosch Gmbh, "Automotive Electrical and Electronics", John Wiley & Sons
4. Bosch, "Automotive Mechatronics", Konrad Reif
5. T.R. Banga, Nathu Singh, "A text book of Automobile Engineering",
6. Frederick C. Nash, Kalman Banitz, "Automotive Technology"
7. R.K. Mohanty, "Automobile Engineering Volume I & II", Standard Book House, 1705A Naisarak, Delhi, 110006
8. P. S. Gill, "A Text book of Automobile Engineering Volume I & II", S. K. Kataria and sons, Ansari Road, Daryaganj, New Delhi, 110002
9. Dr. Kripal Singh, "Automobile Engineering Volume I & II", Standard Publishers Distributors, Naisarak, Post box 1066, Delhi, 110006
10. A. S. Rangwala, "Trends in Automobile Engineering", New Age International Publishers
11. Willard W. Pulkrabek, "Engineering Fundamentals of Internal Combustion Engine", Prentice-Hall of India P. Ltd., New Delhi
12. V.M. Domkundwar, "A Course in International Combustion Engine, DhanpatRai& Company, New Delhi
13. H. Gerscher, "Technology for Automotive Trade Volume 1 & 2", GTZ
14. P. L. Kohli, "Automotive Electrical Equipment", Tata McGraw Hill Publishing Company Limited, New Delhi

**Mark Specification for final examination:**

<b>Unit</b>	<b>Content</b>	<b>Course Hour</b>	<b>Marks</b>
1	Diagnosis of Vehicles	24	40
2	Concept of Maintenance, Repairs and Wear in Vehicles	8	16
3	Braking Dynamics and Cross Country Ability	2	4
4	Driving	6	12
5	Motor Vehicles Acts and Rules	5	8
	<b>Total</b>	<b>45</b>	<b>80</b>

**Note: There might be minor deviation on the above specified marks**

## **Industrial Attachment**

**EG 3203 AE**

**Year: III**  
**Part: II**

**Total: 18 Hrs/week**  
**Lecture: Hrs/week**  
**Tutorial: Hrs/week**  
**Practical: 18 Hrs/week**  
**Lab: Hrs/week**

### ***Course description:***

The students will be deputed to various automobile production/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 signed by supervisor of the industry. Industrial attachment should consist of exposure to world of work to learn skills and techniques in operation, diagnosis, maintenance and repair as well as the managerial aspects in automobile sector based on the nature of the organization available locally or at national level.

### ***Course objectives:***

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

- Develop the technical skills learn in the institute with the needs of the employer.
- Increase self-confidence to face the real world of work.
- Develop a space for the future career.
- Identify essential managerial aspects
- Sensitize with modern and new technologies applied in the industry.
- Present the contents in front of a concerned mass of people.

### ***Course contents:***

- A small team of student and suitable industry should be selected at the initial of the semester.
- Students should be given an orientation before releasing and controlled throughout the attachment by a team of supervisor from the institute.
- Students should follow rules and norms, safety aspects and flow process of the industry.
- Each team should prepare a dairy of daily activities.
- Each team should submit a project report including the following.
  - Page of approval from the industry
  - Profile of the industry
  - Contact details
  - Layout of the Plant/industry.
  - List of machines and material handling equipment.
  - Process flow chart within the industry
  - Special technological aspect learnt during the internship/attachment.
  - General problems of the workshop/industry

- Suggestions for improvement of selected aspect of the problems (store management, layout improvement, work study etc).
- List of daily activities performed
- Photographs of major involvement

***Evaluation Scheme:***

<b>Examination</b>	<b>Content</b>	<b>Marks</b>
Internal (300 marks)	Evaluation from Industry <ul style="list-style-type: none"> <li>• Attendance</li> <li>• Job performance</li> <li>• Report</li> </ul>	25 200 25
	Evaluation from institute	50
Final (150 marks)	Group Report and Viva voce on Institute	150
<b>Total</b>		<b>450</b>

## Experts Involved in Curriculum Revision, 2022

S.N.	Name	Position	Organization
1	Dr. Mahesh Chandra Luintel	Professor	IOE, Pulchowk Campus
2	Dr. Surya Prasad Adhikari	Assoc. Professor	IOE, Pulchowk Campus
3	Dr. Krishna Prasad Shrestha	Asst. Professor	SoE, Kathmandu University
4	Dr. Daniel Tuladhar	Asst. Professor	SoE, Kathmandu University
5	Laxman Motra	Lecturer	IOE, Pulchowk Campus
6	Dr. Khem Gyanwali	Lecturer	IOE, Thapathali Campus
7	Raj Kumar Chaulagain	Lecturer	IOE, Thapathali Campus
8	Dharma Maharjan	Lecturer	IOE, Thapathali Campus
9	Subodh Kumar Ghimire	Lecturer	IOE, Thapathali Campus
10	Debendra Bahadur Raut	Lecturer	IOE, Thapathali Campus
11	Laxman Palikhel	Instructor	IOE, Thapathali Campus
12	Bishwaram Parajuli	Instructor	IOE, Thapathali Campus
13	Rajan Sharma	Instructor	Balaju School of Engineering & Technology, Balaju
14	Chandrika Nanda Adhikari	Instructor	Shankarapur Polytechnic, Shakhapur