



# **CURRICULUM**

**For**  
**THREE YEAR'S DIPLOMA**  
**OF**  
**ASSOCIATE ENGINEER**  
**IN**

**Mechanical Technology (Power) with Specialization in**  
**AUTO & FARM MACHINERY**  
**TECHNOLOGY**

**REVISED BY, TEVTA PUNJAB**

**ADOPTED BY, SBTE KARACHI**

**OCTOBER 2020**

**REVISED CURRICULUM OF**  
**Mechanical Technology (Power) with Specialization in**  
**Auto & Farm Machinery Technology**

**SCHEME OF STUDIES**

**1<sup>st</sup> year**

Code		Subject	T	P	C
Gen	111	Islamiat& Pak Studies	1	0	1
ENG	112	English	2	0	2
Math	113	Applied Mathematics-I	3	0	3
Phy	122	Applied Physics	1	3	2
MT	164	Workshop Practice-I			
		a) Machine shop & Safety Practice	1	3	2
		b) Metal shop, Welding Practice & Foundry	1	3	2
AD	133	I.C Engine	2	3	3
AD	143	Automotive Electricity & Electronics	2	3	3
Comp	142	Computer Application	1	3	2
Mech	163	Basic Engineering Drawing & CAD-I	1	6	3
<b>TOTAL</b>			<b>15</b>	<b>24</b>	<b>23</b>

**2<sup>nd</sup> year**

Code		Subject	T	P	C
Gen	211	Islamiat& Pak Studies	1	0	1
CH	213	Applied Chemistry	2	3	3
MATH	212	Applied Mathematics-II	2	0	2
PHY	212	Applied Physics/Applied Mechanics	1	3	2
MGM	232	Industrial Management & Economics	2	0	2
AD	213	Suspension, Steering & Brakes	2	3	3
AD	224	Workshop Practice-II	2	6	4
AD	232	Applied Thermodynamics	1	3	2
AF	223	Farm Machinery-I	2	3	3
AF	232	Crop Husbandry	1	3	2
<b>TOTAL</b>			<b>16</b>	<b>24</b>	<b>24</b>

**3<sup>rd</sup> year**

Code		Subject	T	P	C
Gen	311	Islamiat& Pak Studies	1	0	1
MGM	321	Business Communication	1	0	1
AD	312	Motor Vehicle Inspection	1	3	2
AD	343	Fuel Injection & Carburetion	2	3	3
AD	363	Automotive Transmission	2	3	3
AD	373	Computer Application in CAD & Automation	2	3	3
AF	302	Soils Fertilizers	1	3	2
AF	313	Farm Machinery-II	2	3	3
AF	322	Earth Moving Machinery	1	3	2
AF	334	Workshop Practice-III	2	6	4
<b>TOTAL</b>			<b>15</b>	<b>27</b>	<b>24</b>

## اسلامیات / مطالعہ پاکستان

حصہ اول اسلامیات Gen III ٹی پی سی  
1 0 1

حصہ دوم مطالعہ پاکستان

موضوعات حصہ اول اسلامیات سال اول

کتاب و سنت

قرآن مجید

- 1- تعارف قرآن مجید 2- نزول قرآن 3- کئی و مدنی سورتوں کی خصوصیات 4- وحی کی اقسام 3  
5- پندرہ منتخب آیات مع ترجمہ

- 1- لن تنالوا البر حتی تنفقوا مما تحبون
- 2- واعتصموا بحبل الله جميعا ولا تفرقوا
- 3- ولا یجرمنکم شتان قوم علی ان لا تعدلوا
- 4- ان الله یامرکم ان تؤدوا الامانات الی اهلها
- 5- ان الله یامر بالعدل والاحسان
- 6- ان الصلوة تنهی عن الفحشاء والمنکر
- 7- لقد کان لکم فی رسول الله اسوة حسنة
- 8- ان اکرمکم عند الله اتقاکم
- 9- وما اتاکم الرسول فخذوه وما نهاکم عنه فانتهوا
- 10- واولو بالمعہد
- 11- وعاشروہن بالمعروف
- 12- یمحق الله الربو ویربى الصدقات
- 13- واصبر علی ما اصابک
- 14- وقولوا قولا سديدا
- 15- ان الدین عند الله الاسلام

(ب) سفت

- 1- سفت کی اہمیت
- 1- انما الاعمال بالنیات
- 2- انما بعث لاتمم مکارم الاخلاق
- 3- لایومن احدکم حتی یحب الاخیه ما یحب لنفسه
- 4- المسلم من سلم المسلمون من لسانه ویده
- 5- قل امنت باللہ ثم استقم
- 6- خیرکم خیرکم لاہلہ
- 7- سباب المسلم فسوق وقتالہ کفر
- 8- المؤمن اخو المؤمن
- 9- کل المسلم علی المسلم حرام دمه وماله وعرضه
- 10- آية المنافق ثلاثة اذا حدث کذب واذا اوتمن خان واذا وعد اخلف

(5)

2- دین اسلام

2.1 اسلام کے بنیادی عقائد کی وضاحت اور انسان کی انفرادی و اجتماعی زندگی پر ان کے اثرات

1- توحید

2- رسالت

3- آخرت

4- ملائکہ

5- آسمانی کتب

(5)

2.2 عبادات

1- نماز 2- روزہ 3- حج 4- زکوٰۃ

مندرجہ بالا عبادات کی اہمیت و فضیلت، حکمتیں اور انسان کی انفرادی و معاشرتی زندگی پر اس کے اثرات

#### 4- دین اسلام

عمومی مقصد۔ دین اسلام کے بنیادی عقائد اور عبادات کے بارے میں جان سکے اور بیان کر سکے  
خصوصی مقاصد:

- ☆ لفظ دین اسلام کے لغوی اور اصطلاحی معنی بیان کر سکے۔
- ☆ اسلام کے بنیادی عقائد کی اہمیت بیان کر سکے۔
- ☆ اسلام کے بنیادی عقائد کے انسان کی انفرادی و اجتماعی زندگی پر پڑنے والے اثرات بیان کر سکے
- ☆ عبادت کے لفظی و اصطلاحی معنی بیان کر سکے۔
- ☆ عقیدے اور عبادت کا فرق بیان کر سکے۔
- ☆ عبادات (نماز، روزہ، حج، زکوٰۃ) کے فوری احکامات اور انسانی زندگی پر ان کے اثرات بیان کر سکے
- ☆ اسلامی عقائد و عبادات کے مطابق اپنی زندگی و حال کو ایک اچھا مسلمان بن سکے۔

سال اول (غیر مسلم طلباء کیلئے)  
Gen III

نصاب اخلاقیات  
حصہ اول اخلاقیات

نی 1  
پی 0  
سی 1

کل وقت: 20 گھنٹے

حصہ دوم مطالعہ پاکستان

موضوعات

اخلاقیات کی تعریف اور اہمیت  
اخلاقیات کا معیار (قانون - عقل - الہامی کتب)  
مندرجہ ذیل اخلاق کی وضاحت

دیانت داری

وفاداری

نظم و ضبط

راست گوئی

صبر و استقلال

حوصلہ مندی

وقت کی پابندی

صفائی

اعتماد

باہمی احترام

مصلحت

## نصاب اخلاقیات سال اول

### تدریسی مقاصد

- عمومی مقصد۔ اعلیٰ اخلاق کی وجہ سے ملکی ترقی میں قابل قدر اضافہ کر سکے۔
- خصوصی مقاصد۔ طالب علم اس قابل ہوگا کہ:
  - موضوعات کا مطلب بیان کر سکے۔
  - عملی زندگی سے مثالوں کی نشاندہی کر سکے۔
  - اپنی شخصیت اور معاشرے پر موضوعات کے مثبت اثرات پیدا کرنے کے طریقے بیان کر سکے۔
  - دیانت داری کی اہمیت بیان کر سکے۔
  - وقاداری کی اہمیت بیان کر سکے۔
  - نظم و ضبط کی افادیت بیان کر سکے۔
  - صدق بیان کی ضرورت بیان کر سکے۔
  - حوصلہ مندی کے فوائد بیان کر سکے۔
  - وقت کی پابندی کے فوائد بیان کر سکے۔
  - صفائی اور باہمی اعتماد سے حسن کارکردگی کو بیان کر سکے۔
  - مصلحت کے فوائد بیان کر سکے۔

## مطالعہ پاکستان

### حصہ دوم

تدریسی مقاصد۔ حریت فکر:  
عمومی مقصد۔ طالب علم یہ جان لے کہ اسلام میں اور مسلمان قوم میں آزادی فکر کی کیا اہمیت ہے۔  
خصوصی مقاصد:

- حریت فکر کا معنی و مفہوم بیان کر سکے۔
- آزادی فکر کی اہمیت بیان کر سکے۔
- خصوصاً اسلام میں آزادی اظہار رائے کی اہمیت بیان کر سکے۔
- دینی غلامی کے قومی سطح پر نقصانات بیان کر سکے۔
- جسمانی غلامی کے قومی سطح پر نقصانات بیان کر سکے۔

### نظریہ پاکستان

عمومی مقصد۔ نظریہ پاکستان (دین اسلام) سے پوری طرح واقف ہو جائے  
خصوصی مقاصد:

- نظریہ کی تعریف بیان کر سکے اور اس کی وضاحت کر سکے۔
- نظریہ پاکستان کی تعریف کر سکے اور اس کا مفہوم بیان کر سکے۔
- علامہ اقبال اور قائد اعظم کے فرمودات کی روشنی میں نظریہ پاکستان بیان کر سکے۔

### نظریہ پاکستان کا تاریخی پہلو

عمومی مقصد۔ نظریہ پاکستان کے تاریخی پس منظر سے واقفیت حاصل کر سکے۔  
خصوصی مقاصد۔ محمد بن قاسم کے بارے میں بیان کر سکے۔



کل وقت: 12 گھنٹے

موضوعات

حریت فکر

مسلمان قوم میں آزادی فکر کی تاریخ۔ مسلمانوں میں سیاسی آزادی کی اہمیت اور ضرورت۔ ذہنی و جسمانی غلامی کے نقصانات  
نظریہ پاکستان

قیام پاکستان کی اساس (دین اسلام) قیام پاکستان کی غرض و غایت۔ نظریہ پاکستان کی وضاحت۔ نظریہ پاکستان  
علامہ اقبال اور قائد اعظم کے ارشادات کی روشنی میں  
نظریہ پاکستان کا تاریخی پہلو

محمد بن قاسم کی آمد۔ مجدد الف ثانی اور شاہ ولی اللہ کی تبلیغی خدمات، سید احمد شہید کی تحریک مجاہدین  
تعلیمی تحریکیں

علی گڑھ۔ ندوۃ العلماء۔ دیوبند۔ مدرسۃ الاسلام (سندھ) اسلامیہ کالج (پشاور) انجمن حمایت اسلام (لاہور)

محمد بن قاسم کے ہندوستان پر حملہ کی وجہ بیان کر سکے

محمد بن قاسم کے ہندوستان پر حملہ کے اثرات بیان کر سکے

وہ بیان کر سکے کہ ہندوستان میں ہندو مسلم دو قومی نظریہ کا نکتہ آغاز کیا ہے۔

مجدد الف ثانی کی علمی خدمات بیان کر سکے

شاہ ولی اللہ کی علمی خدمات بیان کر سکے

مجدد الف ثانی اور شاہ ولی اللہ نے جو تبلیغ دین اور مسلمانوں میں سیاسی شعور پیدا کیا اسے بیان کر سکے۔

علمی تحریکیں

عمومی مقصد۔

برصغیر کی علمی تحریکیں سے آگاہی حاصل ہو سکے

خصوصی مقاصد

علی گڑھ۔ دیوبند۔ ندوۃ العلماء۔ مدرسۃ الاسلام۔ اسلامیہ کالج۔ انجمن حمایت اسلام نے تعلیم کے ذریعہ جو سیاسی شعور

مسلمانوں میں پیدا کیا اسے بیان کر سکے۔

آزادی ہند کے سلسلہ میں تحریک مجاہدین کی خدمات بیان کر سکے۔

<b>Total Contact Hours</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Theory</b> <b>64</b>	<b>2</b>	<b>0</b>	<b>2</b>

AIMS.

At the end of the course, the students will be equipped with cognitive skill to enable them to present facts in a systematic and logical manner to meet the language demands of dynamic field of commerce and industry for functional day-to-day use and will inculcate skills of reading, writing and comprehension.

### Detail of Contents:

#### PAPER-A

- |          |  |                 |
|----------|--|-----------------|
| <b>1</b> | <b>prose/text</b>  | <b>16 hours</b> |
|          | 1.1 First eight essays of Intermediate English Book-II   |                 |
| <b>2</b> | <b>close test</b>  | <b>4 hours</b>  |
|          | 2.1 A passage comprising 50-100 words will be selected from the text. Every 11th word or any word for that matter will be omitted. The number of missing word will range between 5-10. The chosen word may or may not be the one used in the text, but it should be an appropriate word. |                 |

#### PAPER-B

- |           |   |                 |
|-----------|---|-----------------|
| <b>3</b>  | <b>Grammar</b>  | <b>26 hours</b> |
|           | 3.1 Sentence Structure.   |                 |
|           | 3.2 Tenses.   |                 |
|           | 3.3 Parts of speech.  |                 |
|           | 3.4 Punctuation.  |                 |
|           | 3.5 Change of Narration.  |                 |
|           | 3.6 One word for several  |                 |
|           | 3.7 Words often confused  |                 |
| <b>4.</b> | <b>Composition</b>  | <b>12 hours</b> |
|           | 4.1 Letters/Messages  |                 |
|           | 4.2 Job application letter  |                 |
|           | 4.3 For character certificate/for grant of scholarship  |                 |
|           | 4.4 Telegrams, Cablegrams and Radiograms, Telexes, Facsimiles   |                 |
|           | 4.5 Essay writing   |                 |
|           | 4.6 Technical Education, Science and Our life, Computers, Environmental Pollution, Duties of a Student. |                 |
| <b>5.</b> | <b>Translation</b>  | <b>6 hours</b>  |
|           | 5.1 Translation from Urdu into English.<br>For Foreign Students: A paragraph or a dialogue.             |                 |

### Recommended Textbooks:

Technical English developed by Mr. Zia Sarwar, Mr. Habib-ur –Rehman, Evaluated by Mr.Zafar Iqbal Khokhar, Mr. Zahid Zahoor, Vol - I, National Book Foundation

**Instructional Objectives:****PAPER-A**

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**Demonstrate better reading, comprehension and vocabulary**

- 1.1 Manipulate, skimming and scanning of the text.
- 1.2 Identify new ideas.
- 1.3 Reproduce facts, characters in own words
- 1.4 Write summary of stories

**Understand facts of the text**

- 2.1 Rewrite words to fill in the blanks recalling the text.
- 2.2 Use own words to fill in the blanks.

**PAPER-B**

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**Apply the rules of grammar in writing and speaking**

- 3.1 Use rules of grammar to construct meaningful sentences containing a subject and a predicate.
- 3.2 State classification of time, i.e present, past and future and use verb tense correctly in different forms to denote relevant time.
- 3.3 Identify function words and content words.
- 3.4 Use marks of punctuation to make sense clear.
- 3.5 Relate what a person says in direct and indirect forms.
- 3.6 Compose his writings.
- 3.7 Distinguish between confusing words.

**Apply the concepts of composition writing to practical situations**

- 4.1 Use concept to construct applications for employment, for character certificate, for grant of scholarship.
- 4.2 Define and write telegrams, cablegrams and radiograms, telexes, facsimiles
- 4.3 Describe steps of a good composition writing.
- 4.4 Describe features of a good composition.
- 4.5 Describe methods of composition writing
- 4.6 Use these concepts to organize facts and describe them systematically in practical situation.

**Applies rules of translation**

- 5.1 Describe confusion.
- 5.2 Describe rules of translation.
- 5.3 Use rules of translation from Urdu to English in simple paragraph and sentences.

<b>Total Contact Hours</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Theory</b> <b>96</b>	<b>3</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** Must have completed a course of Elective Mathematics at Metric level.

**AIMS.**

After completing the course the students will be able to  
 Solve problems of Algebra, Trigonometry, vectors, Mensuration, Matrices and Determinants.  
 Develop skill, mathematical attitudes and logical perception in the use of mathematical instruments as required in the technological fields.  
 Acquire mathematical clarity and insight in the solution of technical problems.

### **Detail of Contents:**

- |   |                |
|---|----------------|
| <b>1. Quadratic equations</b><br>1.1 Standard Form<br>1.2 Solution<br>1.3 Nature of roots<br>1.4 Sum & Product of roots<br>1.5 Formation<br>1.6 Problems  | <b>6 Hours</b> |
| <b>2. Arithmetic progression and series.</b><br>2.1 Sequence<br>2.2 Series<br>2.3 nth term<br>2.4 Sum of the first n terms<br>2.5 Means<br>2.6 Problems   | <b>3 Hours</b> |
| <b>3. Geometric progression and series.</b><br>3.1 nth term<br>3.2 Sum of the first n terms<br>3.3 Means<br>3.4 Infinite Geometric progression<br>3.5 Problems  | <b>3 Hours</b> |
| <b>4. Binomial theorem</b><br>4.1 Factorials<br>4.2 Binomial Expression<br>4.3 Binomial Co-efficient<br>4.4 Statement<br>4.5 The General Term<br>4.6 The Binomial Series<br>4.7 Problems.                         | <b>6 Hours</b> |
| <b>5. Partial fractions</b><br>5.1 Introduction<br>5.2 Linear Distinct Factors Case I<br>5.3 Linear Repeated Factors Case II<br>5.4 Quadratic Distinct Factors Case III<br>5.5 Quadratic Repeated Factors Case IV | <b>6 Hours</b> |

5.6	Problems	
<b>6.</b>	<b>Fundamentals of trigonometry</b>	<b>6 Hours</b>
6.1	Angles	
6.2	Quadrants	
6.3	Measurements of Angles	
6.4	Relation between Sexagesimal & circular system	
6.5	Relation between Length of a Circular Arc & the Radian Measure of its central Angle	
6.6	Problems	
<b>7.</b>	<b>Trigonometric functions and ratios</b>	<b>6 Hours</b>
7.1	Trigonometric functions of any angle	
7.2	Signs of trigonometric Functions	
7.3	Trigonometric Ratios of particular Angles	
7.4	Fundamental Identities	
7.5	Problems	
<b>8.</b>	<b>General identities</b>	<b>6 Hours</b>
8.1	The Fundamental Law	
8.2	Deductions	
8.3	Sum & Difference Formulae	
8.4	Double Angle Identities	
8.5	Half Angle Identities	
8.6	Conversion of sum or difference to products	
8.7	Problems	
<b>9.</b>	<b>Solution of triangles</b>	<b>6 Hours</b>
9.1	The law of Sines	
9.2	The law of Cosines	
9.3	Measurement of Heights & Distances	
9.4	Problems	
<b>10.</b>	<b>Mensuration of solids</b>	<b>30 Hours</b>
10.1	Review of regular plane figures and Simpson's Rule	
10.2	Prisms	
10.3	Cylinders	
10.4	Pyramids	
10.5	Cones	
10.6	Frusta	
10.7	Spheres	
<b>11.</b>	<b>Vectors</b>	<b>9 Hours</b>
11.1	Scalars & Vectors	
11.2	Addition & Subtraction	
11.3	The unit Vectors i, j, k	
11.4	Direction Cosines	
11.5	Scalar or Dot Product	
11.6	Deductions	
11.7	Dot product in terms of orthogonal components	
11.8	Vector or cross Product	
11.9	Deductions	
11.10	Analytic Expression for $a \times b$ .	

**12. Matrices and determinants**

**9 Hours**

- 12.1 Definition of Matrix
- 12.2 Rows & Columns
- 12.3 Order of a Matrix
- 12.4 Algebra of Matrices
- 12.5 Determinants
- 12.6 Properties of Determinants
- 12.7 Solution of Linear Equations
- 12.8 Problems

**Recommended Textbooks:**

Applied Mathematics: Math-123, Developed by Nasir -ud-Din Mahmood, Sana-ullah Khan, Tahir Hameed, Evaluated by Syed Tanvir Haider, Javed Iqbal, Vol - I, National Book Foundation

**Instructional Objectives:****Use different methods for the solution of quadratic equations.**

- 1.1 Define a standard quadratic equation.
- 1.2 Use methods of factorization and method of completing the square for solving the equations.
- 1.3 Derive quadratic formula.
- 1.4 Write expression for the discriminate.
- 1.5 Explain nature of the roots of a quadratic equation.
- 1.6 Calculate sum and product of the roots.
- 1.7 Form a quadratic equation from the given roots.
- 1.8 Solve problems involving quadratic equations.

**Understand apply concept of arithmetic progression and series.**

- 2.1 Define an Arithmetic sequence and a series.
- 2.2 Derive formula for the  $n$ th term of an A.P.
- 2.3 Explain Arithmetic Mean between two given numbers.
- 2.4 Insert  $n$  Arithmetic means between two numbers.
- 2.5 Derive formulas for summation of an Arithmetic series.
- 2.6 Solve problems on Arithmetic Progression and Series..

**Understand geometric progression and series.**

- 3.1 Define a geometric sequence and a series.
- 3.2 Derive formula for  $n$ th term of a G.P.
- 3.3 Explain geometric mean between two numbers.
- 3.4 Insert  $n$  geometric means between two numbers.
- 3.5 Derive a formula for the summation of geometric Series.
- 3.6 Deduce a formula for the summation of an infinite G.P.
- 3.7 Solve problems using these formulas.

**Expand and extract roots of a binomial.**

- 4.1 State binomial theorem for positive integral index.
- 4.2 Explain binomial coefficients:  $(n,0), (n,1), \dots, (n,r), \dots, (n,n)$
- 4.3 Derive expression for the general term.
- 4.4 Calculate the specified terms.
- 4.5 Expand a binomial of a given index.
- 4.6 Extract the specified roots.
- 4.7 Compute the approximate value to a given decimal place.
- 4.8 Solve problems involving binomials.

**Resolve a single fraction into partial fractions using different methods.**

- 5.1 Define a partial fraction, a proper and an improper fraction.
- 5.2 Explain all the four types of partial fractions.
- 5.3 Set up equivalent partial fractions for each type.
- 5.4 Explain the methods for finding constants involved.
- 5.5 Resolve a single fraction into partial fractions.
- 5.6 Solve problems involving all the four types.

**Understand systems of measurement of angles.**

- 6.1 Define angles and the related terms.
- 6.2 Illustrate the generation of an angle.
- 6.3 Explain sexagesimal and circular systems for the measurement of angles.
- 6.4 Derive the relationship between radian and degree.
- 6.5 Convert radians to degrees and vice versa.
- 6.6 Derive a formula for the circular measure of a central angle.
- 6.7 Use this formula for solving problems.

**Apply basic concepts and principles of trigonometric functions.**

- 7.1 Define the basic trigonometric functions/ratios of an angle as ratios of the sides of a right triangle.
- 7.2 Derive fundamental identities.
- 7.3 Find trigonometric ratios of particular angles.
- 7.4 Draw the graph of trigonometric functions.
- 7.5 Solve problems involving trigonometric functions.

**Use trigonometric identities in solving technological problems.**

- 8.1 List fundamental identities.
- 8.2 Prove the fundamental law.
- 8.3 Deduce important results.
- 8.4 Derive sum and difference formulas.
- 8.5 Establish half angle, double angle & triple angle formulas.
- 8.6 Convert sum or difference into product & vice versa.
- 8.7 Solve problems.

**Use concepts, properties and laws of trigonometric functions for solving triangles.**

- 9.1 Define angle of elevation and angle of depression.
- 9.2 Prove the law of sines and the law of cosines.
- 9.3 Explain elements of a triangle.
- 9.4 Solve triangles and the problems involving heights and distances.

**Use principles of mensuration in finding surfaces, volumes and weights of solids.**

- 10.1 Define mensuration of plane and solid figures.
- 10.2 List formulas for perimeters & areas of plane figure.
- 10.3 Define pyramid and cone.
- 10.4 Define frusta of pyramid and cone.
- 10.5 Define a sphere and a shell.
- 10.6 Calculate the total surface and volume of each type of solid.
- 10.7 Compute weight of solids.
- 10.8 Solve problems of these solids.

**Use the concept and principles of vectors in solving technological problems.**

- 11.1 Define vector quantity.
- 11.2 Explain addition and subtraction of vector.
- 11.3 Illustrate unit vectors  $i, j, k$ .
- 11.4 Express a vector in the component form.
- 11.5 Explain magnitude, unit vector, direction cosines of a vector.
- 11.6 Derive analytic expression for dot product and cross product of two vector.
- 11.7 Deduce conditions of perpendicularity and parallelism of two vectors.
- 11.8 Solve problems



**Use the concept of matrices & determinants in solving technological problems.**

- 12.1 Define a matrix and a determinant.
- 12.2 List types of matrices.
- 12.3 Define transpose, adjoint and inverse of a matrix.
- 12.4 State properties of determinants.
- 12.5 Explain basic concepts.
- 12.6 Explain algebra of matrices.
- 12.7 Solve linear equation by matrices.
- 12.8 Explain the solution of a determinant.
- 12.9 Use Crammers Rule for solving linear equations.

<b>Total Contact Hours</b>		<b>T</b>	<b>P</b>	<b>C</b>
<b>Theory</b>	<b>32</b>	<b>1</b>	<b>3</b>	<b>2</b>
<b>Practical</b>	<b>96</b>			

**Pre-requisite:** None.

**AIMS.**

The students will be able to understand the fundamental principles and concept of physics, use these to solve problems in practical situations/technological courses and understand concepts to learn advance physics/technical courses.

### Detail of Contents:

- 1 **Measurements.** **2 Hours.**
  - 1.1 Fundamental units and derived units
  - 1.2 Systems of measurement and S.I. units
  - 1.3 Concept of dimensions, dimensional formula
  - 1.4 Conversion from one system to another
  - 1.5 Significant figures
- 2 **Scalars and vectors.** **4 Hours.**
  - 2.1 Revision of head to tail rule
  - 2.2 Laws of parallelogram, triangle and polygon of forces
  - 2.3 Resolution of a vector
  - 2.4 Addition of vectors by rectangular components
  - 2.5 Multiplication of two vectors, dot product and cross product
- 3 **Motion** **4 Hours.**
  - 3.1 Review of laws and equations of motion
  - 3.2 Law of conservation of momentum
  - 3.3 Angular motion
  - 3.4 Relation between linear and angular motion
  - 3.5 Centripetal acceleration and force
  - 3.6 Equations of angular motion
- 4 **Torque, equilibrium and rotational inertia.** **4 Hours.**
  - 4.1 Torque
  - 4.2 Centre of gravity and centre of mass
  - 4.3 Equilibrium and its conditions
  - 4.4 Torque and angular acceleration
  - 4.5 Rotational inertia
- 5 **Wave motion.** **5 Hours**
  - 5.1 Review Hooke's law of elasticity
  - 5.2 Motion under an elastic restoring force
  - 5.3 Characteristics of simple harmonic motion
  - 5.4 S.H.M. and circular motion
  - 5.5 Simple pendulum

5.6	Wave form of S.H.M.	
5.7	Resonance	
5.8	Transverse vibration of a stretched string	
<b>6</b>	<b>Sound.</b>	<b>5 Hrs</b>
6.1	Longitudinal waves	
6.2	Intensity, loudness, pitch and quality of sound	
6.3	Units of Intensity of level and frequency response of ear	
6.4	Interference of sound waves silence zones, beats	
6.5	Acoustics	
6.6	Doppler effect.	
<b>7</b>	<b>Light.</b>	<b>5 Hours</b>
7.1	Review laws of reflection and refraction	
7.2	Image formation by mirrors and lenses	
7.3	Optical instruments	
7.4	Wave theory of light	
7.5	Interference, diffraction, polarization of light waves	
7.6	Applications of polarization in sunglasses, optical activity and stress analysis	
<b>8</b>	<b>Optical fiber.</b>	<b>2 Hours</b>
8.1	Optical communication and problems	
8.2	Review total internal reflection and critical angle	
8.3	Structure of optical fiber	
8.4	Fiber material and manufacture	
8.5	Optical fiber - uses.	
<b>9</b>	<b>Lasers.</b>	<b>3 Hours</b>
9.1	Corpuscular theory of light	
9.2	Emission and absorption of light	
9.3	Stimulated absorption and emission of light	
9.4	Laser principle	
9.5	Structure and working of lasers	
9.6	Types of lasers with brief description.	
9.7	Applications (basic concepts)	
9.8	Material processing	
9.9	Laser welding	
9.10	Laser assisted machining	
9.11	Micro machining	
9.12	Drilling, scribing and marking	
9.13	Printing	
9.14	Lasers in medicine	

### **Recommended Textbooks:**

Applied Physics by Mr. Khalid Mehmood, Asif Ali, Zafar Iqbal Tarar & Dr. Muhammad Ajmal, Vol-I, Published by National Book Foundation

**Instructional Objectives:****Use concepts of measurement to practical situations and technological problems.**

- 1.1 Write dimensional formulae for physical quantities
- 1.2 Derive units using dimensional equations
- 1.3 Convert a measurement from one system to another
- 1.4 Use concepts of measurement and Significant figures in problem solving.

**Use concepts of scalars and vectors in solving problems involving these concepts.**

- 2.1 Explain laws of parallelogram, triangle and polygon of forces
- 2.2 Describe method of resolution of a vector into components
- 2.3 Describe method of addition of vectors by rectangular components
- 2.4 Differentiate between dot product and cross product of vectors
- 2.5 Use the concepts in solving problems involving addition resolution and multiplication of vectors.

**Use the law of conservation of momentum and concepts of angular motion to practical situations.**

- 3.1 Use law of conservation of momentum to practical/technological problems.
- 3.2 Explain relation between linear and angular motion
- 3.3 Use concepts and equations of angular motion to solve relevant technological problems.

**Use concepts of torque, equilibrium and rotational inertia to practical situation/problems.**

- 4.1 Explain Torque
- 4.2 Distinguish between Centre of gravity and centre of mass
- 4.3 Explain rotational Equilibrium and its conditions
- 4.4 Explain Rotational Inertia giving examples
- 4.5 Use the above concepts in solving technological problems.

**Use concepts of wave motion in solving relevant problems.**

- 5.1 Explain Hooke's Law of Elasticity
- 5.2 Derive formula for Motion under an elastic restoring force
- 5.3 Derive formulae for simple harmonic motion and simple pendulum
- 5.4 Explain wave form with reference to S.H.M. and circular motion
- 5.5 Explain Resonance
- 5.6 Explain Transverse vibration of a stretched string
- 5.7 Use the above concepts and formulae of S.H.M. to solve relevant problems.

**Understand concepts of sound.**

- 6.1 Describe longitudinal wave and its propagation
- 6.2 Explain the concepts: Intensity, loudness, pitch and quality of sound
- 6.3 Explain units of Intensity of level and frequency response of ear
- 6.4 Explain phenomena of silence zones, beats
- 6.5 Explain Acoustics of buildings
- 6.6 Explain Doppler effect giving mathematical expressions.

**Use the concepts of geometrical optics to mirrors and lenses.**

7.1 Explain laws of reflection and refraction

7.2 Use mirror formula to solve problems

7.3 Use the concepts of image formation by mirrors and lenses to describe working of optical instruments, e.g. microscopes, telescopes, camera and sextant.

**Understand wave theory of light**

8.1 Explain wave theory of light

8.2 Explain phenomena of interference, diffraction, polarization of light waves

8.3 Describe uses of polarization given in the course contents.

**Understand the structure, working and uses of optical fiber.**

9.1 Explain the structure of the Optical Fiber

9.2 Explain its principle of working

9.3 Describe use of optical fiber in industry and medicine.

**List of Practicals:**

Draw graphs representing the functions:

$$y=mx \text{ for } m=0, 0.5, 1, 2$$

$$y=x^2$$

$$y=1/x$$

Find the volume of a given solid cylinder using vernier callipers.

Find the area of cross-section of the given wire using micrometer screw gauge.

Prove that force is directly proportional to (a) mass, (b) acceleration, using fletchers' trolley.

Verify law of parallelogram of forces using Grave-sands apparatus.

Verify law of triangle of forces and Lami's theorem

Determine the weight of a given body using

Law of parallelogram of forces

Law of triangle of forces

Lami's theorem

Verify law of polygon of forces using Grave-sands apparatus.

Locate the position and magnitude of resultant of like parallel forces.

Determine the resultant of two unlike parallel forces.

Find the weight of a given body using principle of moments.

Locate the centre of gravity of regular and irregular shaped bodies.

Find Young's Modules of Elasticity of a metallic wire.

Verify Hooke's Law using helical spring.

Study of frequency of stretched string with length.

Study of variation of frequency of stretched string with tension.

Study resonance of air column in resonance tube and find velocity of sound.

Find the frequency of the given tuning fork using resonance tube.

Find velocity of sound in rod by Kundt's tube.

Verify rectilinear propagation of light and study shadow formation.

Study effect of rotation of plane mirror on reflection.

Compare the refractive indices of given glass slabs.

Find focal length of concave mirror by locating centre of curvature.

Find focal length of concave mirror by object and image method

Find focal length of concave mirror with converging lens.

Find refractive index of glass by apparent depth.

Find refractive index of glass by spectrometer.

Find focal length of converging lens by plane mirror.

Find focal length of converging lens by displacement method.

Find focal length of diverging lense using converging lens.

Find focal length of diverging lens using concave mirror.

Find angular magnification of an astronomical telescope.

Find angular magnification of a simple microscope (magnifying glass)

Find angular magnification of a compound microscope.

Study working and structure of camera.

Study working and structure of sextant.

Compare the different scales of temperature and verify the conversion formula.

Determine the specific heat of lead shots.

Find the coefficient of linear expansion of a metallic rod.

Find the heat of fusion of ice.

Find the heat of vaporization.

Determine relative humidity using hygrometer.

Total Contact Hours		T	P	C
Theory	64	2	6	4
Practical	192			

**(PART-A) MACHINE SHOP AND SAFETY PRACTICES & PROCEDURES**

Total Contact Hours		T	P	C
Theory	32	1	3	2
Practical	96			

**Pre-requisite:** None**MACHINE SHOP.**

- AIMS. 1. Know different basic machines like Drill machine, Grinder, Lathe, and Shaper  
 2. Understand methods of producing simple jobs on Lathe and Shaper.

**SAFETY PRACTICES & PROCEDURES**

- AIMS. 1. Describe the importance of safety.  
 State safety rules.  
 Explain safety procedures in work shop.  
 Explain safety procedures in Industries.  
 Identify hazards in shop/industries.  
 State cost of accidents.  
 State the rules in maintaining cleanliness and order lines of working area.

**MACHINE SHOP.****Detail of Contents:**

- |   |                |
|---|----------------|
| <b>1. Lathe construction</b><br>1.1 Parts of lathe<br>1.2 Description of each part<br>1.3 Types of lathe<br>1.4 Description of each type<br>1.5 Size of lathe<br>1.6 Accessories, attachments, work holding devices with uses | <b>2 Hours</b> |
| <b>2. Lathe cutting tools</b><br>2.1 Types of lathe cutting tools<br>2.2 Description of each and their angles   | <b>1 H our</b> |
| <b>3. Cutting speed, feed, and cut</b><br>3.1 Speed and feed<br>3.2 Method of speed and feed calculation  | <b>2 Hours</b> |

3.3	Relationship between speed and feed	
3.4	Depth of cut	
<b>4.</b>	<b>Lathe operation and drilling</b>	<b>4 Hours</b>
4.1	Methods of centering the job	
4.2	Importance of centering job	
4.3	Method of turning a job	
4.4	Shoulder turning/ step turning	
4.5	Taper Turning	
4.6	Principle of taper turning	
4.7	Formulae for taper turning angle	
4.8	Methods of taper turning	
4.9	Definition of knurling	
4.10	Purpose of knurling	
4.11	Knurling Methods	
4.12	Definition of thread	
4.13	Pitch and lead	
4.14	Thread cutting calculation	
4.15	Thread cutting calculation based on system	
4.16	Thread cutting operation	
4.17	Definition of facing	
4.18	Facing operation	
4.19	Method of drilling on lathe machine	
4.20	Methods of boring, reaming and types of reamers	
<b>5.</b>	<b>Drill press/drilling.</b>	<b>2 Hours</b>
5.1	Types of drill machines	
5.2	Description of each type	
5.3	Parts of a drill machine	
5.4	Drilling operation	
5.5	Parts of a drill	
5.6	Explanation of each parts	
<b>6.</b>	<b>Tool grinder.</b>	<b>1 Hour</b>
6.1	Parts of grinder	
6.2	Grinding operation	
<b>7.</b>	<b>Shaper work.</b>	<b>2 Hours</b>
7.1	Parts of a shaper	
7.2	Forward/backward stroke of a shaper	
7.3	Shaper stroke adjustment	
7.4	Types of shaper tools	
7.5	Explanation of each part	
7.6	Adjustment of shaper speed and feed	
7.7	Different clamping devices for job and tool	



## **II. SAFETY PRACTICES & PROCEDURES.**

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### **Detail of Contents:**

- |   |                |
|---|----------------|
| <b>1. Introduction and importance of safety.</b>          | <b>2 Hours</b> |
| 1.1 Introduction  |                |
| 1.2 Importance institute shops                            |                |
| 1.3 Importance in Industry                                |                |
| 1.4 Accident cost   |                |
| <b>2. Accidents in chemical industry</b>                  | <b>1 Hour</b>  |
| 2.1 Accidents in petroleum industry                       |                |
| 2.2 Accidents in paint shop/industry                      |                |
| 2.3 Explosive vapors and gases                            |                |
| 2.4 Accident in fertilizers and others chemical industry. |                |
| <b>3. Accidents in mechanical industry.</b>               | <b>2 Hours</b> |
| 3.1 Material handling and transportation.                 |                |
| 3.2 Accidents due to hand tools.                          |                |
| 3.3 Accidents in machines shop.                           |                |
| 3.4 Accidents in Metal work shop.                         |                |
| 3.5 Accidents in wood working shop.                       |                |
| 3.6 Accident in Foundry, welding, and forging shop.       |                |
| 3.7 Preventive measures                                   |                |
| <b>4. Accidents in flow production industry.</b>          | <b>2 Hours</b> |
| 4.1 Accidents in Textile mills.                           |                |
| 4.2 Accidents in paper mills.                             |                |
| 4.3 Accidents in Food industry.                           |                |
| <b>5. Accidents in other industries.</b>                  | <b>2 Hours</b> |
| 5.1 Accidents in mines.                                   |                |
| 5.2 Accidents in leather industries.                      |                |
| 5.3 Accidents in power plant.                             |                |
| 5.4 Accidents in printing industry.                       |                |
| <b>6. Environmental effect on accidents.</b>              | <b>1 Hour</b>  |
| 6.1 Industrial ventilation.                               |                |
| 6.2 Exhaust systems.                                      |                |
| 6.3 Industrial noise.                                     |                |
| 6.4 Illumination for safety and comfort.                  |                |
| 6.5 Industrial hygiene and plant sanitation.              |                |
| <b>7. Personnel protective equipments.</b>                | <b>1 Hour</b>  |
| 7.1 For face and hand protection.                         |                |
| 7.2 For body protection.                                  |                |
| 7.3 For chemical gases protection.                        |                |
| <b>8. Safety on plant.</b>                                | <b>1 Hour</b>  |
| 8.1 Plant lay out for safety.                             |                |
| 8.2 House keeping for safety.                             |                |

8.3	Lay out for safety.	
<b>9.</b>	<b>Fire accidents.</b>	<b>2 Hours</b>
9.1	Fire hazard.	
9.2	Causes.	
9.3	Fire fighting equipments.	
9.4	Plant lay out for fire safety.	
<b>10.</b>	<b>Analyzing causes of accidents.</b>	<b>2 Hours</b>
10.1	Accident prevention fundamentals.	
10.2	Plan inspections.	
10.3	Safety inventory.	
10.4	Accidents investigation.	
10.5	Records and reports.	
<b>11.</b>	<b>First aid.</b>	<b>1 Hour</b>
11.1	Importance.	
11.2	Procedure.	
11.3	Extended medical services.	
<b>12.</b>	<b>Promoting safety.</b>	<b>1 Hour</b>
12.1	Employees training.	
12.2	Displays.	
12.3	Guidance.	
<b>13.</b>	<b>Safety laws.</b>	<b>1 Hour</b>
13.1	Pakistan factory act (laws concerning to safety).	
13.2	Workman compensation act.	
13.3	Industrial insurance.	

**(PART-A) MACHINE SHOP AND SAFETY PRACTICES & PROCEDURES****Instructional Objectives:**

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

**MACHINE SHOP****Know function of lathe parts.**

- 1.1 List the parts of lathe
- 1.2 Describe each part
- 1.3 List types of lathe
- 1.4 Describe each type
- 1.5 Describe size of lathe
- 1.6 Describe accessories, attachments, work holding devices with uses

**Understand lathe cutting tools.**

- 2.1 List types of lathe cutting tools
- 2.2 Explain each type of lathe cutting tool and their angles
- 2.3 Describe cutting tools angles

**Know cutting speed, feed, and cut.**

- 3.1 Define speed and feed
- 3.2 Describe method of speed and feed calculation
- 3.3 Describe relationship between speed and feed
- 3.4 Describe depth of cut

**Understand lathe operation and drilling.**

- 4.1 List methods of centering the job
- 4.2 Explain importance of centering job
- 4.3 Explain method of turning a job
- 4.4 Explain shoulder turning/ step turning
- 4.5 Explain taper turning
- 4.6 State principle of taper turning
- 4.7 The use of formulae for taper turning angle
- 4.8 Explain methods of taper turning
- 4.9 Define knurling
- 4.10 Describe purpose of knurling
- 4.11 Describe method knurling
- 4.12 Define thread
- 4.13 Describe pitch and lead
- 4.14 Calculate the pitch and TPI of threads
- 4.15 Explain thread cutting calculation based on system
- 4.16 Explain thread cutting operation
- 4.17 Define facing
- 4.18 Describe facing operation
- 4.19 Describe method of drilling on lathe machine
- 4.20 Describe methods of boring, reaming and types of reamers

**Understand drill machines.**

- 5.1 List types of drill machines
- 5.2 Describe each type
- 5.3 List parts of a drill machine
- 5.4 Explain drilling operation
- 5.5 List parts of a drill
- 5.6 Explain each part

**Understand tool grinder.**

- 6.1 List parts of grinder
- 6.2 Explain grinding operation

**Understand shaper machine.**

- 7.1 List parts of a shaper
- 7.2 Explain forward/backward stroke of a shaper
- 7.3 Explain shaper stroke adjustment
- 7.4 List types of shaper tools
- 7.5 Explain each type
- 7.6 Explain adjustment of shaper speed and feed
- 7.7 List different clamping devices for job and tool

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**SAFETY PRACTICES & PROCEDURES.****Know importance of safety practices and its necessity in the industry.**

- 1.1 Describe safety
- 1.2 Describe the importance of safety practices in Institute work shop and industry
- 1.3 Define accident cost
- 1.4 Describe the factors related to accident cost

**Know causes and preventions of accident in chemical based industry.**

- 2.1 Describe the type of accidents in petroleum fertilizer, paint and chemical based industry
- 2.2 State the methods of prevention, for chemical based industry
- 2.3 Describe effects of chemical explosive, gases and vapors
- 2.4 List preventive measures for chemical explosive gases and vapors

**Know causes and prevention of accidents in mechanical industry**

- 3.1 List the possible accidents in material handling and transportation
- 3.2 Describe the method of prevention of accident in Mechanical handling and transportation
- 3.3 State the types of possible accident in Machine Shop, Metal Work, Wood Working Shop, Foundry, Welding and Forging Shop
- 3.4 List methods of preventing accident in Mechanical industry

**Know causes and methods of prevention of accident in flow production industry.**

- 4.1 State the types of accident in flow production industry
- 4.2 List the accident in textile mills, paper and board mills and food industry
- 4.3 Describe the methods of prevention of accidents in flow production industry

**Know causes and method of prevention of accident in different industries.**

- 5.1 State the types of accidents in leather industry, printing works, mines and power plants
- 5.2 Describe the method of prevention of accidents in leather industry, printing works,

**Understand the environmental effect on accidents.**

- 6.1 State environmental effects on human beings and surroundings
- 6.2 Explain importance and purpose of industrial ventilation
- 6.3 Describe exhaust system in industry
- 6.4 Explain the effect of noise on accidents
- 6.5 Explain the effect of illumination on safety and comfort
- 6.6 Explain the plant hygiene for safety and comfort
- 6.7 Explain the effect of plant sanitation for prevention of accidents

**Know the principle method and importance of personal protective device.**

- 7.1 Define protective devices
- 7.2 List personal protective devices
- 7.3 State Importance of personal protective devices
- 7.4 Describe protective devices for protecting hands and faces
- 7.5 Describe protective devices for protecting human body
- 7.6 Describe protective devices for protection from chemical gases

**Know the basic concept of safety on plant.**

- 8.1 State the safety aspect for plant layout
- 8.2 Describe the house keeping procedure for safety on a plant
- 9.3 State the procedure to lay out machines and equipment considering safety aspect

**Understand the causes and prevention of fire accidents.**

- 9.1 Define fire hazard
- 9.2 List the causes of accidents due to fire
- 9.3 Describe fire fighting equipment
- 9.4 Explain the procedure effective for lay out of plant for the purpose of safety

**Understand the procedure of analyzing the causes of accidents.**

- 10.1 Identify the general causes of accident
- 10.2 Explain the step by step procedure to analyze the accident
- 10.3 Record accident inventory.
- 10.4 Prepare accident reports
- 10.5 Describe plan inspections
- 10.6 Use the accident data for analyzing the causes of accidents

**Know the method of providing first aid.**

- 11.1 State the importance of safety
- 11.2 Explain the methods of providing first aid
- 11.3 Identify the step by step procedure of providing medical services

**Know the methods and procedures for promoting**

- safety.** 12.1 List methods of promoting safety concepts
- 12.2 Describe method to promote safety concept by display
- 12.3 State the importance of guidance for safety promotion

**Understand laws regarding safety.**

- 13.1 Explain clauses of Pakistan factory act related to safety.
- 13.2 Explain workman compensation act.
- 13.3 Explain industrial Insurance

## **(PART-B) METAL SHOP, WELDING PRACTICE AND FOUNDRY**

Total Contact Hours		T	P	C
Theory	32	1	3	2
Practical	96			

**Pre-requisite:** None.

**AIMS.**

Explain the shop setting of Metal work, wood work, welding and foundry.

State shop rules and regulations of individual shops

Explain the use of tools involved in these shops.

Identify the main parts of each tool and machine of all these shops.

Exercise proper care and maintenance of each tool and machine of Metal work, welding and Foundry.

Prepare jobs/projects in all the aforesaid shops.

### **Detail of Contents:**

- 1. Metal work tools and machines. 14 Hours**
  - 1.1 Hand Tools
  - 1.2 Measuring tools
  - 1.3 Layout tools.
  - 1.4 Cutting tools
  - 1.5 Chisels
  - 1.6 Files
  - 1.7 Hacksaw
  - 1.8 Drill
  - 1.9 Miscellaneous tools
  - 1.10 Drilling Machine.
  - 1.11 Power Hacksaw
  - 1.12 Bending Machine
  - 1.13 Rolling Machine
  - 1.14 Shearing machine.
- 2. Welding, hand tools and machines. 6 Hours**
  - 2.1 Gas welding Tools.
  - 2.2 Welding processes.
  - 2.3 Welding tests and equipment
  - 2.4 Welding materials and electrodes
- 3. Hand forging operations. 6 Hours**
  - 3.1 Drawing
  - 3.2 Swaging
  - 3.3 Up-setting
  - 3.4 Punching
  - 3.5 Cutting.
  - 3.6 Forge welding
- 4. Foundry shop tools and machines 6 Hours**

- 4.1 Hand Moulding Tools.
- 4.2 Moulding boxes.
- 4.3 Pit furnace.
- 4.4 Core baking furnace.
- 4.5 Grinding and brushing machines.

### **Recommended Textbooks:**

Chapman Vol-I - Workshop Technology

**(PART-B) METAL SHOP, WELDING PRACTICE AND FOUNDRY**

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**Instructional Objectives:**

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

**Understand kinds of tools and machines**

- 1.1 Describe Hand Tools like:
  - Measuring tools
  - Layout tools.
  - Cutting tools
  - Chisels
  - Files
  - Hacksaw
  - Drill
  - Miscellaneous tools
- 1.2 Explain Drilling Machine.
- 1.3 Explain Power Hacksaw
- 1.4 Explain Bending Machine
- 1.5 Explain Rolling Machine
- 1.6 Explain Shearing machine.

**Understand welding shop tools and machines.**

- 2.1 Describe hand lay out tools
- 2.2 Describe Gas welding Tools.
- 2.3 Describe Welding processes Gas, Electric, TIG, MIG.
- 2.4 State welding principles
- 2.5 Explain Welding tests and equipment
- 2.6 State Welding materials and electrodes

**Understand forging operations.**

- 3.1 Explain Drawing, Swaging Upsetting, Punching  
Cutting and Forge Welding
- 3.2 Describe the forging tools
- 3.3 State Up-setting
- 3.4 Describe Punching
- 3.5 State Cutting.
- 3.6 Explain Forge welding

**Know kinds of foundry shop tools and machines.**

- 4.1 Describe Hand Moulding Tools.,
- 4.2 Describe Moulding boxes, moulding sands and  
moulding methods.
- 4.3 Describe Pit furnace and types of cores.
- 4.4 Describe Core baking furnace.
- 4.5 Describe grinding and brushing machines.



**List of Practicals:****Machine shop**

Practice of facing  
Practice of plain turning  
Practice of Drilling & Boring  
Practice of Threading (External)  
Practice of Taper Turning

**Metal shop**

Practice of hacksaw cutting  
Practice of filing  
Practice of drilling on flat piece  
Practice of threading on flat piece

**Welding**

Practice of making Butt Joint  
Practice of making Lap Joint  
Practice of making Tee Joint

**Forging**

Practice of Drawing  
Practice of Swaging

Total Contact Hours		T	P	C
Theory	64	2	3	3
Practical	96			

**Pre-requisite:** None

**AIMS.**

- Understand the working principles of petrol and diesel engines.
- Understand the construction and working of engine systems.
- Understand the systems based upon pressure and volume
- Recognize the importance of proper relationship between different parts and components.
- Identify main parts of petrol and diesel engine
- Know different types of IC engines
- Compare between petrol and diesel engine

### Detail of Contents:

## **ENGINE HISTORY/CONSTRUCTION AND FUNDAMENTALS.**

1. **History and development of automobile .** **2 Hours**
  - 1.1 History of Automobile.
  - 1.2 History of an engine.
  
2. **Main components of vehicle.** **2 Hours**
  - 2.1 Different Types of Automobiles.
  - 2.2 Main components of Vehicle and draw the Lay-out of their position.
  - 2.3 Engine, Frame, and chassis.
  - 2.4 Types of engines (IC Engine & EC engine).
  
3. **Construction and working of IC engine parts .** **14 Hours**
  - 3.1 Function, types, materials, construction and working of following engine parts.
    - a. Piston , Piston rings, Piston pin, piston pin locks.
    - b. Connecting rod.
    - c. Crankshaft.
    - d. Vibration Damper
    - e. Fly Wheel
    - f. Cylinder Block, Cylinder, Cylinder Liner and its characteristics.
    - g. Camshaft.
    - h. Engine Valve

- i. Rocker arm
- j. Cylinder Head.
- k. Combustion chamber.
- l. Gaskets.
- m. Timing Gears
- n. Timing belt.

#### **4. IC engine fundamentals and operations.**

**6 Hours**

##### **4.1 Terminology of IC Engine.**

- a. Bore & Stroke.
- b. TDC & BDC.
- c. Clearance Volume.
- d. Swept /Displacement Volume.
- e. Cylinder total Volume.

4-Stroke Petrol Engine.

2-Stroke Petrol Engine.

4-Stroke Diesel Engine.

2-Stroke Diesel Engine.

##### **4.3 Engine Compression ratio and its formula.**

##### **4.4 Capacity of engine in Cubic Centimeter(CC) and Calculate the Swept Volume of the engine cylinder.**

##### **4.5 Compare 4-stroke cycle engine with 2-stroke cycle engine.**

##### **4.6 Compare Petrol engine with diesel engine.**

#### **5. Construction, types, and working of valve train mechanism.**

**4 Hours**

##### **5.1 Function ,construction and working of the components of valve train mechanism.**

( Inlet / Exhaust valve, Valve seat, Valve Guide, Valve return spring, Valve retainer, Push rod, Valve lifter and its types, Camshaft and camshaft timing gear, Rocker arm assembly, Lay-out of Valve train assembly).

##### **5.2 Crankshaft timing gear and cam shaft timing gear.**

##### **5.3 Engine Valve timing diagram.**

##### **5.4 Valve overlapping.**

##### **5.5 Procedure of setting of engine valve timing.**

##### **5.6 Valve clearance and its adjustment.**

##### **5.7 Types of valve arrangements.**

##### **5.8 Variable valve timing intelligent system (VVT-i).**

#### **6. Classifications of engines.**

**6 Hours**

##### **6.1 Classifications /types of engines w.r.t.**

Fuel

Strokes.

Ignition.

Cylinder arrangements.

No of Cylinders.

- Valve arrangements.
- Camshaft arrangements.
- Cooling systems.
- Lubrication systems.
- Engine capacity.
- Combustion chambers.
- 6.2 Working principle of Wankle engine.
- 6.3 Introduction and lay-out of main components of Gas Turbine.
- 6.4 Introduction and lay-out of main components of Hybrid Vehicle.

- 7. Engine bearings. 2 Hours**
- 7.1 Purpose of bearings.
  - 7.2 Types of bearings and their use in vehicles.
  - 7.3 Purpose of lubrication of bearings.

## **ENGINE SYSTEMS.**

- 8. Engine intake system. 2 Hours**
- 8.1 Function, and features of intake system.
  - 8.2 Function of air cleaner.
  - 8.3 Parts of intake system.

- 9. Engine exhaust system. 2 Hours**
- 9.1 purpose of exhaust system.
  - 9.2 parts of engine exhaust system.

- 10. Purpose, types, construction of engine Cooling system. 6 Hours**
- 10.1 Purpose of engine Cooling System.
  - 10.2 Types of Engine Cooling System.
  - 10.3 Construction and Working of each component of Engine Cooling system.  
i.e.(Radiator, Radiator Pressure Cap, Radiator expansion tank,  
Hose pipe, Water pump, Water Jackets, Thermostat Valve,  
Fan Shroud, Automatic Electric Fan, Fluid Coupling fan, Fan belt) .
  - 10.4 Purpose and Characteristics of Anti-Freeze Coolant  
(Ethylene glycol).
  - 10.5 Causes and remedies of Engine Cooling System Faults.

- 11. Purpose, types , construction & working of an engine lubricating system. 6 Hours**
- 11.1 Purpose of Engine Lubricating System.
  - 11.2 Types of Engine Lubricating System(Forced Feed & Splash System).

- 11.3 Construction and Working of each component of Engine Lubricating system. i.e. (Oil Sump, Oil strainer, Oil Pump and its types, Oil pressure relief valve, Oil Filter, Oil Gallery, Oil pressure gauge and its circuit, cylinder oil passages oil return line).
- 11.4 Function of engine Oil.
- 11.5 Engine Oil Viscosity and viscosity index i.e. SAE-30.
- 11.6 Schedule for changing of engine oil.
- 11.7 Causes and remedies of Engine Lubricating System Faults.

**12. Construction and working of petrol engine fuel system. 4 Hours**

- 12.1 Purpose of Engine Fuel System.
- 12.2 Main Components and function of fuel system.
- 12.3 Main components of carburetor.
- 12.4 Basic Working Principle of Carburetor.
- 12.5 Procedure and steps involved for disassemble and assemble Motorcycle engine Carburetor
- 12.6 Steps for the adjustment of carburetor float level.

**13. Working of petrol engine ignition system. 4 Hours**

- 13.1 Purpose of Engine ignition System.
- 13.2 Main Components of ignition system.
- 13.3 Purpose, construction and working of following components of ignition system. i.e. (Battery, Ignition Switch, Ballast resistor, Ignition coil, Distributor, CB Points, dwell angle, Condenser, High tension leads, Spark plugs and its types, firing orders).
- 13.4 Causes and remedies of Engine Ignition System Faults.

**14. 4-stroke motorcycle engine 4 Hours**

- 14.1 Main components of motorcycle.
- 14.2 Main components of motorcycle engine.
- 14.3 Working principle of motorcycle engine.
- 14.4 Construction and working of each component and systems of motorcycle engine.
- 14.5 Procedure and steps involved to disassemble and Assemble motorcycle engine.

**Recommended Textbooks:**

- Auto fundamentals by Martin W. Stockal
- Modern Automotive Mechanics by James E. Duffy.
- Automotive Technology A System Approach by Jack Erjavec

**Instructional Objectives:**

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

**ENGINE HISTORY/CONSTRUCTION  
AND FUNDAMENTALS.**

**Know the history and development of automobile .**

- 1.1 Describe the History of Automobile.
- 1.2 Describe the History of an engine.

**Understand identification of the main components of vehicle.**

- 2.1 Describe the different Types of Automobiles.
- 2.2 Enlist the main components of Vehicle and draw the Lay-out of their position.
- 2.3 Define engine, Frame, and chassis.
- 2.4 Describe types of engines (IC Engine & EC engine).

**Understand the construction and working of IC engine parts .**

- 3.1 Describe the function, types, materials, construction and working of following engine parts.
  - Piston , Piston rings, Piston pin, piston pin locks.
  - Connecting rod.
  - Crankshaft.
  - Vibration Damper
  - Fly Wheel
  - Cylinder Block, Cylinder, Cylinder Liner and its characteristics.
  - Camshaft.
  - Engine Valve
  - Rocker arm
  - Cylinder Head.
  - Combustion chamber.
  - Gaskets.
  - Timing Gears
  - Timing belt.

**Understand the ic engine fundamentals and operations.**

4.1 Define the following terminology of IC Engine.

Bore & Stroke.

TDC & BDC.

Clearance Volume.

Swept /Displacement Volume.

Cylinder total Volume.

4.2 Explain the working Principle of

4-Stroke Petrol Engine.

2-Stroke Petrol Engine.

4-Stroke Diesel Engine.

2-Stroke Diesel Engine.

4.3 Describe the Engine Compression ratio and its formula.

4.4 Describe the Capacity of engine in Cubic Centimeter(CC) and Calculate the Swept Volume of the engine cylinder.

4.5 Compare 4-stroke cycle engine with 2-stroke cycle engine.

4.6 Compare petrol engine with diesel engine.

**Understand the construction, types, and working of valve train mechanism.**

5.1 Describe the function ,construction and working of the components of valve train mechanism.

( Inlet / Exhaust valve, Valve seat, Valve Guide, Valve return spring, Valve retainer, Push rod, Valve lifter and its types, Camshaft and camshaft timing gear, Rocker arm assembly, Lay-out of Valve train assembly).

5.2 Describe ratio between crankshaft timing gear and cam shaft timing gear.

5.3 Explain Engine Valve timing diagram.

5.4 Describe Valve overlapping.

5.5 Describe the procedure of setting of engine valve timing.

5.6 Describe valve clearance and its adjustment.

5.7 Enlist different types of valve arrangements.

5.8 Describe variable valve timing intelligent system (VVT-i).

**Understand the classifications of engines.**

- 6.1 Describe the Classifications/types of engines w.r.t.
  - Fuel
  - Strokes.
  - Ignition.
  - Cylinder arrangements.
  - No of Cylinders.
  - Valve arrangements.
  - Camshaft arrangements.
  - Cooling systems.
  - Lubrication systems.
  - Engine capacity.
  - Combustion chambers.
- 6.2 Describe working principal of Wankle engine.
- 6.3 Brief Introduction and lay-out of main components of Gas Turbine.
- 6.4 Brief Introduction and lay-out of main components of Hybrid Vehicle.

**Understand the engine bearings.**

- 7.1 State the purpose of bearings.
- 7.2 Enlist the types of bearing and their use in vehicles.
- 7.3 State the purpose of lubrication of Bearing .

## **ENGINE SYSTEMS.**

**Understand the working of an engine intake system.**

- 8.1 State the function, and features of intake system.
- 8.2 State the function of Air Cleaner.
- 8.3 Enlist the parts of intake system.
- 8.4 Explain the working of each part of inlet system.

**Understand the working of engine exhaust system.**

- 9.1 State the purpose of exhaust system.
- 9.2 Enlist the parts of engine exhaust system.
- 9.3 Explain the working of each part of exhaust system.

**Understand the purpose, types & construction of engine cooling system .**

- 10.1 State the Purpose of engine Cooling System.
- 10.2 Describe the types of Engine Cooling System.
- 10.3 Describe the Construction and Working of each component of Engine Cooling system. i.e. (Radiator, Radiator Pressure Cap, Radiator expansion tank, Hose pipe, Water pump, Water Jackets, Thermostat valve, fan Shroud, Automatic Electric Fan, Fluid Coupling fan, Fan belt) .
- 10.4 Describe the Purpose and Characteristics of Anti-Freeze Coolant (Ethylene glycol).



**Understand the purpose, types , construction & working of an engine lubricating system.**

- 11.1 State the Purpose of Engine Lubricating System.
- 11.2 Describe the types of Engine Lubricating System(Forced Feed & Splash System).
- 11.3 Describe the Construction and Working of each component of engine lubricating system. i.e. (oil Sump, oil strainer, Oil Pump and its types, oil pressure relief valve, Oil Filter, oil gallery, Oil pressure gauge and its circuit, cylinder oil passages oil return line).
- 11.4 Describe the function of engine oil.
- 11.5 Describe the engine oil Viscosity and viscosity index i.e. SAE-30.
- 11.6 Describe the Schedule for changing of engine oil.
- 11.7 Describe causes and remedies of engine lubricating system faults.

**Understand the purpose, types , construction and working of petrol engine fuel system.**

- 12.1 State the Purpose of Engine Fuel System.
- 12.2 Enlist and explain the Main Components of fuel system.
- 12.3 Enlist the main components of carburetor.
- 12.4 Describe the Basic Working Principle of Carburetor.
- 12.5 Describe in detail the procedure and steps involved for disassembling and assembling 4stroke Motorcycle engine Carburetor
- 12.6 Describe the steps for the adjustment of carburetor float level.

**Understand the purpose, construction and working of petrol engine ignition system**

- 13.1 State the Purpose of Engine ignition System.
- 13.2 Enlist the Main Components of ignition system.
- 13.3 Describe the purpose, construction and working of following components of ignition system. i.e. (Battery, Ignition Switch, Ballast resistor, Ignition coil, distributor, CB Points, dwell angle, Condenser, High tension leads, Spark plugs and its types, firing orders).
- 13.4 Describe Causes and remedies of Engine Ignition System Faults.

**Understand the construction and working of 4-stroke motorcycle engine**

- 14.1 Enlist the main components of motorcycle.
- 14.2 Enlist the main components of motorcycle Engine.
- 14.3 Explain the working principle of motorcycle Engine.
- 14.4 Describe the construction and working of each component and systems of Motorcycle engine.
- 14.5 Describe in detail the procedure and steps involved to disassemble and assemble the motorcycle engine.

**List of Practicals:**

Identify the main components of vehicle and sketch them.  
Identify the main components of engine and sketch them.  
Identify the main components of Piston and sketch them.  
Measure the size of piston, piston pin, crankshaft main journal by using Vernier caliper and Micrometer.  
Identify the parts of crankshaft & camshaft, and sketch them.  
Disassemble & Assemble the cam shaft and crankshaft on engine block.  
Measure the Swept Volume of given engine cylinder .  
Disassemble and inspect the valves face and valve seat.  
Perform the engine valve lapping and re-assemble it.  
Check and adjust the engine valve clearance.  
Practice to change the engine Oil.  
Identify the location of different bearings in engine.  
Identify the engine cylinder liners.  
Identify the intake and exhaust system parts and their location.  
Identify the main components of engine cooling system and sketch them.  
Identify the main components of engine lubricating system and sketch them.  
Identify the main components of engine ignition system and sketch them.  
Identify the different types of IC engines.  
Carry out the Complete overhauling of a 4-stroke Motorcycle engine.  
Visit at Modern Automotive workshop to familiar with the working environment of Auto workshop.

<b>Total Contact Hours</b>		<b>T</b>	<b>P</b>	<b>C</b>
<b>Theory</b>	<b>64</b>	<b>2</b>	<b>3</b>	<b>3</b>
<b>Practical</b>	<b>96</b>			

**Pre-requisite:** Applied Physics  
AIMS.

Know the basic principles of electricity and electronics  
Recognize the different electrical units of an automobile  
Repair and maintain the electrical and electronics units fitted on an automobile  
Service, repair and maintain all types of batteries  
Trace and rectify faults in electrical system of an automobile  
Understand wiring diagrams of various makes of automobiles  
Understand electronics devices, transistors, rectifiers, amplifiers, S.C.R; S.C.O; sensors and microprocessors.  
know the purpose of modern type accessories

### **Detail of Contents:**

#### **BASIC ELECTRICITY**

1. **Principle of basic electricity.** **4 Hours**
  - 1.1 Atom and its particles (electron, neutrons & protons).
  - 1.2 EMF , Voltage drop ,current and resistance
  - 1.3 AC&DC
  - 1.4 Volt, Ampere, Ohm ,Ohms law, Capacitance.
  - 1.5 Series and Parallel circuits and their characteristics.
  - 1.6 Problems of series and parallel circuits using OHM's Law
  - 1.7 Use of AVO meter .
  - 1.8 Value of resistance with the help of Color code.
  - 1.9 Electrical, electronic symbols used in vehicle electrical circuits.
  
2. **Magnet, magnetism, conductor, insulator, semi conductor and their materials.** **4 Hours**
  - 2.1 Magnet, magnetism and permanent magnet.
  - 2.2 Electromagnet.
  - 2.3 Flux, inductance, mutual-induction conductance and magnetic force.
  - 2.4 Conductor, insulator and semiconductor.
  - 2.5 Doping.
  - 2.6 Differentiate between p-type & n-type materials.
  - 2.7 Working of diode & transistor.
  
3. **Storage battery its working and testing.** **4 Hours**
  - 3.1 Battery and its types.
  - 3.2 Construction of dry charged battery.
  - 3.3 Construction of lead acid battery.

- 3.4 Chemical activities in lead acid battery.
  - 3.5 Battery rating .
  - 3.6 Effects of temperature on battery .
  - 3.7 Service procedure of lead acid battery.
  - 3.8 Procedure of preparation of electrolyte.
  - 3.9 Methods of storage of batteries.
- 4. Troubleshooting of batteries. 4 Hours**
- 4.1 Factors effecting battery life.
  - 4.2 Discharging, sulphation, internal short circuiting.
  - 4.3 Battery failures.
  - 4.4 Overcharging, causes of loss of water, discoloring of Electrolyte and specific gravity variation.
  - 4.5 Charging system of battery in vehicle.
  - 4.6 Battery charging methods .(series & parallel).
  - 4.7 Problems of battery
    - Plucked off.
    - Deterioration of plates.
    - Cracking of container.
    - Corrosion of battery terminals and clamps.
- 5. Charging system AC & DC . 5 Hours**
- 5.1 Charging system
  - 5.2 Generator (dc & ac)
  - 5.3 Components of dc generator
  - 5.4 Construction & working of dc generator
  - 5.5 Charging circuit of dc generator
  - 5.6 Construction and working of alternator
  - 5.7 Charging circuit of alternator.
  - 5.8 Half-wave and full-wave rectifier.
  - 5.9 DC and AC Generator
  - 5.10 Construction & working principle of Cut out Relay.
  - 5.11 Voltage and current Regulator.
  - 5.12 Trouble shooting of DC, & AC Generator
  - 5.13 Trouble shooting of current and Voltage Regulator.
- 6. CB Point and Magneto ignition system. 5 Hours**
- 6.1 Purpose, function of ignition system.
  - 6.2 Types of ignition system.
  - 6.3 Components of c.b point's type ignition system.
  - 6.4 C.B point ignition system.
  - 6.5 Dwell angle, cam angle and ignition timing.
  - 6.6 Advance mechanism and its types.
  - 6.7 Construction , types, heat ranges of spark plug.

- 6.8 Magneto ignition system.
- 6.9 Trouble shooting of ignition system.

**7. Electronic ignition system.**

**6 Hours**

- 7.1 Electronic ignition system .
- 7.2 Advantages of electronic ignition system.
- 7.3 Types of Electronic ignition system
- 7.4 Construction and working of
  - a. Pick -up Coil type.
  - b. Hall Effect ignition system.
  - c. Optical type
  - d. High energy ignition system (HEI)
  - e. Distributer less ignition system (DIS)
  - f. Coil on plug (Cop) ignition system
  - g. CDI system
  - h. Intelligent dual sequential ignition system.

**8. Starting system.**

**4 Hours**

- 8.1 Starting system.
- 8.2 Construction and working of starting system.
- 8.3 Function of each part of starting motor.
- 8.4 Types of starting motor.
- 8.5 Construction and working of each types of starting motors.
- 8.6 Starting motor drive mechanisms.
  - a. Bendix drive
  - b. Lucas Drive
  - c. Gear reduction Drive
- 8.7 Construction and working of Solenoid switch
- 8.8 Starting circuit diagram.
- 8.9 Faults of Starting system.

**9. Lighting system and its troubleshooting.**

**4 Hours**

- 9.1 Function of the head light, tail light, brake light, fog light, backup light and vehicle interior lights.
- 9.2 Parts of head light
- 9.3 Draw the head light circuit.
- 9.4 Aiming of headlight.
- 9.5 Automatic head light aiming.
- 9.6 Auto light control system.
- 9.7 Draw the directional signal circuit.
- 9.8 Faults of directional signal circuit.
- 9.9 Electrical wiring diagram of a car/vehicle using Symbol & color code.
- 9.10 Electrical Wiring diagram of Car/Vehicle.

- |            |   |                |
|------------|---|----------------|
| <b>10.</b> | <b>Construction &amp; working of horn, windshield wiper &amp; washer.</b>   | <b>4 Hours</b> |
| 10.1       | Horn circuit.   |                |
| 10.2       | Working and service of horn circuit.  |                |
| 10.3       | Method of fault finding and adjustment of horn .  |                |
| 10.4       | Working of wind shield wiper system.  |                |
| 10.5       | Wind shield wiper system.   |                |
| 10.6       | Working of wiper motor.   |                |
| 10.7       | Faults of wiper system.   |                |
| 10.8       | Circuit of wind shield wiper system.  |                |
| 10.9       | Wiper with rain drop sensor system.   |                |
| 10.10      | Rear screen wiper.  |                |
| <br>       |   |                |
| <b>11.</b> | <b>Working of instrument panel gauges, meters, &amp; warning lights.</b>  | <b>3 Hours</b> |
| 11.1       | Circuit and describe the Working of fuel gauge.   |                |
| 11.2       | Circuit and describe the Working of Engine temperature gauge.   |                |
| 11.3       | Circuit and describe the Working of Engine Cooling system Electric Fan.   |                |
| 11.4       | Circuit and describe the Working of Engine oil pressure Light .and Gauge.   |                |
| 11.5       | Different warning lights.<br>Low oil pressure light.<br>charging system light.<br>Engine Malfunction Light (MIL)<br>Gear Selected indicator Light |                |
| 11.6       | Purpose of following dash board meters.<br>Digital Speedo meter.<br>Odometer<br>Tachometer.   |                |

## **BASIC ELECTRONICS**

- |           |   |                |
|-----------|---|----------------|
| <b>12</b> | <b>Transistor, thermistors, thyristors and their applications.</b>          | <b>4 Hours</b> |
| 12.1      | Transistor.   |                |
| 12.2      | Working of PNP-Transistor and NPN-Transistor.                               |                |
| 12.3      | Oscillator and their uses.  |                |
| 12.4      | Working and use of Silicon Control rectifier (SCR).                         |                |
| 12.5      | DIAC & TRIC.  |                |
| <br>      |   |                |
| <b>13</b> | <b>Logic gates/ integrated circuit.</b>                                     | <b>3 Hours</b> |
| 13.1      | Electronic Logic Gates.(AND, OR, NOT,NAND,NOR)                              |                |
| 13.2      | Printed circuit and integrated circuit (IC).                                |                |
| <br>      |   |                |
| <b>14</b> | <b>Purpose and application of different types of sensors in automotive.</b> | <b>3 Hours</b> |
| 14.1      | Sensor and its importance in automotive                                     |                |

- 14.2 Types of sensors.
- 14.3 Purpose of different sensors .
  - Voltage generating sensors
    - Zirconium dioxide sensors
    - Piezoelectric sensors
    - Magnetic sensors.
  - Reference voltage sensor
    - Potentiometers.
    - Switches.
    - Thermistors

## **15 Microcomputers.**

**3 Hours**

- 15.1 Micro Computers.
- 15.2 Components of Micro computer.
  - a. Microprocessor
  - b. Memory
  - c. Programmable Read Only Memory (PROM)
  - d. Keep alive memory
  - e. Electronically Erasable PROMES (EEPROMS)
  - f. Input Device.
  - g. Output Device.
- 15.3 Explain operation of a Microcomputer

## **16 Automotive accessories .**

**4 Hours**

- 16.1 State the vehicle following accessories.
  - a. Vehicle immobilizer system.
  - b. Vehicle navigation system.
  - c. Vehicle communication system.
  - d. Vehicle tracking system.
  - e. Power window system.
  - f. Night vision mode.
  - g. Climate control system.
  - h. Key less entry system
  - i. Cigarette lighter.
  - j. Central locking door system.
  - k. Power side mirror.
  - l. Vehicle rear camera.
  - m. Child door lock system.
  - n. Rear screen defogger.
  - o. Glass embedded point antenna
  - p. Door suction system.
  - q. Supplementary restrain system (SRS).
    - Heated rear window system.
  - r. Auto light control system (Head lights turn on automatically according to the level of darkness)

### **Recommended Textbooks:**

Automotive Electrical and Electronic systems by Frank C. Derato

Automotive Electricity & Electronics by Barry Hollembeak

Automotive Electricity, Electronics & Computer Controls

by Barry Hollembeak



**Instructional Objectives:**

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

**BASIC ELECTRICITY****Understand the principle of basic electricity.**

- 1.1 Describe atom and its particles (electron, neutrons & protons).
- 1.2 Describe EMF, Voltage drop, current and resistance
- 1.3 Describe AC & DC
- 1.4 Describe Volt, Ampere, Ohm, Ohm's law, Capacitance.
- 1.5 Explain Series and Parallel circuits and their characteristics.
- 1.6 Solve problems of series and parallel circuits using OHM's Law
- 1.7 Describe the use of AVO meter.
- 1.8 Describe the value of resistance with the help of Color code.
- 1.9 Enlist all electrical, electronic symbols used in vehicle electrical circuits.

**Understand magnet, magnetism, conductor, insulator, semi conductor and their materials.**

- 2.1 Define magnet, magnetism and permanent magnet.
- 2.2 Define electromagnet.
- 2.3 Define flux, inductance, mutual-induction conductance and magnetic force.
- 2.4 Explain conductor, insulator and semiconductor.
- 2.5 Define doping.
- 2.6 Differentiate between p-type & n-type materials.
- 2.7 Describe the construction and working of diode & transistor.

**Understand the storage battery its working and testing.**

- 3.1 Define battery and its types.
- 3.2 Describe the construction of dry charged battery.
- 3.3 Describe the construction of Lead Acid Battery.
- 3.4 Describe the chemical activities in Lead Acid Battery.
- 3.5 Describe the battery rating.
- 3.6 State the effects of temperature on battery.
- 3.7 Discuss the service procedure of Lead acid battery.
- 3.8 Describe the procedure of preparation of electrolyte.
- 3.9 State the methods of storage of batteries.

**Understand the troubleshooting of batteries**

- 4.1 Describe the Factors effecting battery life.
- 4.2 Define self discharging, sulphation, internal short circuiting.
- 4.3 Discuss causes of battery failures.

- 4.4 Discuss the overcharging, causes of loss of water, discoloring of Electrolyte, plates and specific gravity variation.
- 4.5 Describe the charging system of battery in vehicle.
- 4.6 State the battery charging methods .(series & parallel).
- 4.7 Identify the following problems of a battery
  - Plucked off.
  - Deterioration of plates.
  - Cracking of container.
  - Corrosion of battery terminal and clamps.

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#### **Understand charging system AC & DC .**

- 5.1 State the purpose of charging system
- 5.2 Define Generator (DC & AC)
- 5.3 Enlist the components of DC generator
- 5.4 Describe the construction & working of DC generator
- 5.5 Draw charging circuit of DC generator
- 5.6 Explain the construction and working of Alternator
- 5.7 Draw charging circuit of Alternator.
- 5.8 Describe half-wave and full-wave rectifier.
- 5.9 Differentiate DC and AC Generator
- 5.10 State the construction & working principle of Cut out Relay.
- 5.11 State the working principle and construction of Voltage and current Regulator.
- 5.12 Trouble shooting of DC, & AC Generator
- 5.13 Trouble shooting of current and Voltage Regulator.

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#### **Understand CB Point and Magneto ignition system.**

- 6.1 Explain the purpose, function of ignition system.
- 6.2 Enlist the types of ignition system.
- 6.3 Enlist the components of C.B point's type ignition system.
- 6.4 Describe the construction and working of C.B point ignition system.
- 6.5 Describe dwell angle, cam angle and ignition timing.
- 6.6 Describe the advance mechanism and its types.
- 6.7 Describe the construction , types, heat ranges of spark plug.
- 6.8 Explain the construction & working of magneto ignition system.
- 6.9 Discuss the trouble shooting of ignition system.

#### **Understand the electronic ignition system.**

- 7.1 Define electronic ignition system .
- 7.2 State the advantages of electronic ignition system.
- 7.3 Enlist the types of electronic ignition system
- 7.4 Describe the construction and working of
  - Pick -up Coil type.
  - Hall Effect ignition system.
  - Optical type



High energy ignition system (HEI)  
Distributor less ignition system (DIS)  
Coil on plug (Cop) ignition system  
Capacitor discharge ignition (CDI) system  
Intelligent dual sequential ignition system.

**Understand the starting system.**

- 8.1 Define starting system.
- 8.2 Explain the construction and working of starting system.
- 8.3 Enlist and define the function of each part of Starting motor.
- 8.4 Enlist the types of starting motor.
- 8.5 Describe the construction and working of each types of starting motors.
- 8.6 Describe the starting Motor drive mechanisms.
  - Bendix drive
  - Lucas Drive
  - Gear reduction Drive
- 8.7 Explain the construction and working of Solenoid switch
- 8.8 Draw the starting circuit diagram.
- 8.9 Identify the faults of Starting system.

**Understand Lighting system and its trouble shooting.**

- 9.1 State the function of the head light, tail light, brake light, fog light, backup light and vehicle interior lights.
- 9.2 Enlist the parts of Head Light
- 9.3 Describe & draw the Head light circuit.
- 9.4 Explain aiming of headlight.
- 9.5 Describe automatic head light aiming.
- 9.6 Describe auto light control system.
- 9.7 Describe & draw the directional signal circuit.
- 9.8 Identify the faults of directional signal circuit.
- 9.9 Draw the electrical wiring diagram of a car/vehicle using symbol & color code.
- 9.10 Read the Electrical Wiring diagram of Car/Vehicle.

**Understand construction & working of horn, windshield wiper & washer.**

- 10.1 Describe Horn circuit.
- 10.2 Explain construction, working and service of horn circuit.
- 10.3 Explain the method of fault finding and adjustment of horn .
- 10.4 Describe the construction and working of wind shield wiper system.
- 10.5 Define wind shield wiper system.
- 10.6 Describe the working of wiper motor.
- 10.7 Identify the faults of wiper system.
- 10.8 Draw the circuit of wind shield wiper system.

- 10.9 Define wiper with rain drop sensor system.
- 10.10 Define rear screen wiper.

**Understand the construction & working of instrument panel gauges, meters, & warning lights.**

- 11.1 Draw the Circuit and describe the Working of fuel gauge.
- 11.2 Draw the Circuit and describe the Working of Engine temperature gauge.
- 11.3 Draw the Circuit and describe the Working of Engine Cooling system Electric Fan.
- 11.4 Draw the Circuit and describe the Working of Engine oil pressure Light .and Gauge.
- 11.5 State purpose of different warning lights.
  - Low oil pressure light.
  - charging system light.
  - Engine Malfunction Light (MIL)
  - Gear Selected indicator Light
- 11.6 State the Purpose of following dash board meters.
  - Digital Speedo meter.
  - Odometer
  - Tachometer.

## **BASIC ELECTRONICS**

**Understand transistor, thermistors, thyristors and their applications.**

- 12.1 Define transistor.
- 12.2 Describe the construction & working of PNP-Transistor and NPN-Transistor.
- 12.3 Define Oscillator and their uses.
- 12.4 Explain the working and use of Silicon Control rectifier (SCR).
- 12.5 Define DIAC & TRIC.

**Understand logic gates/ integrated circuit.**

- 13.1 Describe the purpose, application, and working of following electronic Logic Gates.(AND, OR, NOT,NAND,NOR)
- 13.2 Describe printed circuit and integrated circuit (IC).

**14 Understand the purpose and application of different types of sensors in automotive.**

- 14.1 Define a sensor and its importance in automotive
- 14.2 Enlist types of sensors.
- 14.3 State the Purpose of different sensors .
  - Voltage generating sensors a.
  - Zirconium dioxide sensors

Piezoelectric sensors

Magnetic sensors.

Reference voltage sensor

Potentiometers.

Switches.

Thermistors

**Understand microcomputers.**

- 15.1 Define Micro Computers.
- 15.2 State the function of following components of Micro computer.
  - a. Microprocessor
  - b. Memory
  - c. Programmable Read Only Memory (PROM)
  - d. Keep alive memory
  - e. Electronically Erasable PROMES (EEPROMS)
  - f. Input Device.
  - g. Output Device.
- 15.3 Describe briefly operation of a Microcomputer.

**16 Understand Automotive Accessories .**

- 16.1 State the vehicle following accessories.
  - Vehicle immobilizer system.
  - Vehicle navigation system.
  - Vehicle communication system.
  - Vehicle tracking system.
  - Power window system.
  - Night vision mode.
  - Climate control system.
  - Key less entry system
  - Cigarette lighter.
  - Central locking door system.
  - Power side mirror.
  - Vehicle rear camera.
  - Child door lock system.
  - Rear screen defogger.
  - Glass embedded point antenna
  - Door suction system.
  - Supplementary restrain system (SRS).
  - Heated rear window system.
  - Auto light control system (Head lights turn on automatically according to the level of darkness)

**List of Practicals:**

- Identify the electrical units of a vehicle.
- Make electromagnet(Solenoid).
- Verify OHM'S Law.
- Make series and parallel circuits on bench board and verify the properties of both circuits.
- Disassemble unserviceable Lead acid Battery and identify its parts.
- Measure voltage of a battery .
- Measure Current of a Circuit.
- Prepare electrolyte for Lead Acid Battery.
- Check the Specific gravity of electrolyte of a battery.
- Charge the batteries in series and parallel using Battery Charger.
- Service the Lead acid Battery.
- Identify the Units of C.B.Point Ignition System and trace the circuit.
- Identify the problems of ignition system.
- Inspect, clean and adjust CB Point gap.
- 15. Check the ignition coil (i) Resistance (ii) Ground Test
- Check the Pick-up coil (i) Resistance (ii) Ground Test
- Identify the Problems of Charging System.
- Check Starting Motor Solenoid Switch (i) Pull-in (ii) Hold-in Windings.
- Check Starting Motor Field winding (i) Open circuit (ii) Short Circuit.
- Check the Armature winding (i) Open circuit (ii) Short Circuit.
- Disassemble and assemble of DC Generator .
- Disassemble Alternator and check the Stator winding
  - Open circuit (ii) Short Circuit (iii) Ground circuit)
- Check the Alternator rotor winding
  - Open circuit (ii) Short Circuit (iii) Ground circuit)
- Adjust the Head Light aiming.
- Make the Horn Circuit on a Bench board.
- Make the Head Light Circuit on a Bench board.
- Identify the Sensors , Actuators and Microcomputer on Vehicle
- Visit at modern automotive workshop to familiar how modern electronic diagnostic equipments are being using to find out the faults of vehicle electrical

systems.

Prepare a project (circuit / system) relevant to the subject

(this activity may be performed in a group of students).

Identify the parts of following accessories of an automotive Vehicle. (vehicle immobilizer system, Vehicle navigation system, Vehicle communication system, Vehicle tracking system, Power window system, Night vision mode, Climate control system, Key less entry system, Cigarette lighter, Central locking door system, Power side mirror, Vehicle rear camera, Child door lock system, Rear screen defogger, Glass embedded point antenna, Door suction system, Supplementary restrain system (SRS), Heated rear window system. Auto light control system (head light turn on automatically according to the level of darkness).



Total Contact Hours		T	P	C
Theory	32	1	3	2
Practical	96			

**Pre-requisite:** None

**AIMS:** This subject will enable the student to be familiar with the fundamental concepts of Computer Science. He will also learn MS-Windows, MS-Office, and Internet to elementary level.

### **Detail of Contents:**

- 1. Electronic data processing (E.D.P.)** **6 Hours**
  - 1.1 Basic Terms of Computer Science Data & its types, Information, Hardware, Software
  - 1.2 Computer & its types
  - 1.3 Block diagram of a computer system
  - 1.4 BIT, Byte, RAM & ROM
  - 1.5 Input & Output devices
  - 1.6 Secondary storage devices
  - 1.7 Types of Software
  - 1.8 Programming Languages
  - 1.9 Applications of computer in different fields
  - 1.10 Application in Engineering, Education & Business
  
- 2. MS-windows** **2 Hours**
  - 2.1 Introduction to Windows
  - 2.2 Loading & Shut down process
  - 2.3 Introduction to Desktop items (Creation of Icons, Shortcut, Folder & modify Taskbar)
  - 2.4 Desktop properties
  - 2.5 Use of Control Panel
  - 2.6 Searching a document
  
- 3. MS-office (MS-word)** **8 Hours**
  - 3.1 Introduction to MS-Office
  - 3.2 Introduction to MS-Word & its Screen
  - 3.3 Create a new document
  - 3.4 Editing & formatting the text
  - 3.5 Saving & Opening a document
  - 3.6 Page setup (Set the Margins & Paper)
  - 3.7 Spell Check & Grammar
  - 3.8 Paragraph Alignment
  - 3.9 Inserting Page numbers, Symbols, Text box & Picture in the document
  - 3.10 Use the different Format menu drop down commands  
(Drop Cap, Change Case, Bullet & Numbering and Border & Shading)

- 3.11 Insert the Table and it's Editing
- 3.12 Printing the document
- 3.13 Saving a document file as PDF format

**4. MS-office (MS-excel) 9 Hours**

- 4.1 Introduction to MS-Excel & its Screen
- 4.2 Entering data & apply formulas in worksheet
- 4.3 Editing & Formatting the Cells, Row & Colum
- 4.4 Insert Graphs in sheet
- 4.5 Page setup, Print Preview & Printing
- 4.6 Types & Categories of Charts

**5. MS. Office (MS-power point) 4 Hours**

- 5.1 Introduction to MS-Power point
- 5.2 Creating a, presentation
- 5.3 Editing & formatting a text box
- 5.4 Adding pictures & colors to a slide
- 5.5 Making slide shows
- 5.6 Slide Transition

**6. Internet & e-mail 3Hours**

- 6.1 Introduction to Internet & browser window
- 6.2 Searching, Saving and Print a page from internet
- 6.3 Creating, Reading & Sending E-Mail
- 6.4 Explain some advance features over the internet and search engines

**Recommended Textbooks:**

Bible Microsoft Office 2007 by John Walkenbach  
Bible Microsoft Excel 2007 by John Walkenbach  
Bible Microsoft PowerPoint 2007 by John Walkenbach

**Instructional Objectives:****Understand electronic data processing (E.D.P)**

- 1.1. Describe Basic Terms of Computer Science, Data & its Types, Information, Hardware, Software
- 1.2. Explain Computer & its types
- 1.3. Explain Block diagram of a computer system
- 1.4. State the terms such as BIT, Byte, RAM & ROM
- 1.5. Identify Input & Output devices
- 1.6. Describe Secondary Storage devices
- 1.7. Explain Types of Software
- 1.8. Introduction to Programming Language
- 1.9. Explain Applications of computer in different fields
- 1.10. Application in Engineering, Education & Business

**Understand ms-windows**

- 2.1 Explain Introduction to Windows
- 2.2 Describe Loading & Shut down process
- 2.3 Explain Introduction to Desktop items(Creation of Icons, Shortcut, Folder & modify Taskbar)
- 2.4 Explain Desktop properties
- 2.5 Describe Use' of Control Panel (add/remove program, time & date, mouse and create user account)
- 2.6 Explain the method of searching a document

**Understand ms-office (MS-word)**

- 3.1 Explain Introduction to MS-Office
- 3.2 Describe -Introduction to MS-Word & its Screen
- 3.3 Describe create a new document
- 3.4 Explain Editing & formatting the text
- 3.5 Describe saving & Opening a document
- 3.6 Explain Page setup, (Set the Margins & Paper)
- 3.7 Describe Spell Check & Grammar
- 3.8 Explain Paragraph Alignment
- 3.9 Explain Inserting Page numbers, Symbols, Text box & Picture in the document
- 3.10 Describe Use the different Format menu drop down commands(Drop Cap, Change Case, Bullet & Numbering and Border & Shading)
- 3.11 Explain Insert the Table and its Editing and modifying
- 3.12 Describe printing the document
- 3.13 Describe the method of file saving as a PDF Format

**Understand ms-office (MS-excel)**

- 4.1 Explain Introduction to MS-Excel & its Screen
- 4.2 Describe Entering data & apply formulas in worksheet

- 4.3 Describe Editing & Formatting the, Cells, Row & Column
- 4.4 Explain Insert Graphs in sheet
- 4.5 Describe Page setup, Print preview & Printing
- 4.6 Explain in details formulas for sum, subtract, multiply, divide, average
- 4.7 Explain in details the types of charts e.g pie chart, bar chart

#### **Understand ms-office (MS-power point)**

- 5.1 Describe Introduction to MS-Power point
- 5.2 Explain creating a presentation
- 5.3 Describe Editing & formatting a text box
- 5.4 Explain Adding pictures & colors to a slide
- 5.5 Describe Making slide shows
- 5.6 Explain Slide Transitions

#### **Understand internet & e-mail**

- 6.1 Explain Introduction to Internet and browser window
- 6.2 Explain Searching, Saving and Print a page from internet
- 6.3 Describe Creating, Reading & Sending E-Mail and attachments
- 6.4 Explain some advance features over the internet and how to search topics on different search engines

**List of Practical:**

- Identify key board, mouse, CPU, disk drives, disks, monitor, and printer and**  
**3Hrs**
- 2. MS WINDOWS XP** **12 Hrs**
- 2.1 Practice of loading and shutdown of operating system
  - 2.2 Creating items (icons, shortcut, folders etc) and modifying taskbar
  - 2.3 Changing of wallpaper, screensaver, and resolution
  - 2.4 Practice of control panel items (add/remove, time and date, mouse, and create user account)
- 3. MS OFFICE (MS-WORD)** **27 Hrs**
- 3.1 Identifying the MS Word Screen and its menu
  - 3.2 Practice of create a new document, saving and re-opening it from the location and spell check & grammar
  - 3.3 Practice of Page Formatting (Borders, Character Spacing, Paragraph, Bullets& Numberings and Fonts)
  - 3.4 Practice of different tool bars like standard, format& drawing tool bars
  - 3.5 Practice of Insert pictures, clipart, and shapes
  - 3.6 Practice of header and footer
  - 3.7 Practice of insert table and also format of table
  - 3.8 Practice of page setup, set the page margins, and printing documents
- 4. MS OFFICE (MS-EXCEL)** **27 Hrs**
- 4.1 Identifying the MS EXCEL Screen and its menu
  - 4.2 Practice of create a new sheet, saving and re-opening it from the location and spell check
  - 4.3 Practice of insert and delete of row and columns (format of cell)
  - 4.4 Practice of entering data and formulas in worksheet (Add, Subtract, Multiplying, and Divide & Average)
  - 4.5 Repeating practical serial number 04
  - 4.6 Practice of insert chart and its types
  - 4.7 Practice of page setup, set the page margins, and printing
- 5. MS OFFICE (MS-POWER POINT)** **15 Hrs**
- 5.1 Identifying the MS POWER POINT Screen and its menu
  - 5.2 Practice of create a new presentation and save
  - 5.3 Practice of open saves presentations
  - 5.4 Practice of inset picture and videos
- 6. INTERNET & E-MAIL** **12 Hrs**
- 6.1 Identifying internet explorer
  - 6.2 Practice of searching data from any search engine
  - 6.3 Practice of create an E-Mail account and how to send and receive E-mails, download attachments

Total Contact Hours		T	P	C
Theory	32	1	6	3
Practical	192			

**Pre-requisite:** None.

**AIMS.**

At the end of this course the students will be able to understand the Fundamentals of Engineering Drawing used in the various fields of industry especially in the Mechanical Technology. The students will be familiarizing with the use of conventional drawing equipments as well as the modern techniques used for this subject. Also the will be familiarize with AutoCAD and will achieve ability to

### Detail of Contents:

#### **PART-A Manual Drawing 70%**

1. **Application of Technical Drawing** **2Hours**
  - 1.1 Importance of Technical Drawing
  - 1.2 Language of engineering terminology
  - 1.3 Uses of Technical Drawing
  - 1.4 Type of Drawing
  - 1.5 Application of Technical drawing.
2. **Drafting Equipments, Construction Uses, and Care** **1Hour**
  - 2.1. Introduction and importance of drafting equipments
  - 2.2. List of drawing equipments
  - 2.3. Construction, uses and care of all equipment
  - 2.4. Drafting board, Table and machine
  - 2.5. Tee, Triangles and protractors
  - 2.6. Instruments Box and its accessories
  - 2.7. Drawing Pencil, their grading, sharpening and using techniques
  - 2.8. Scale and its types.
3. **Types of Lines** **1Hour**
  - 3.1. Basic lines
  - 3.2. Importance of lines
  - 3.3. Common Types of lines
  - 3.4. Uses and correct line weight age
  - 3.5. Use of pencil for different lines
  - 3.6. Application of lines
  - 3.7. Objectives in drafting
4. **Lettering** **2Hours**
  - 4.1. Importance of a good lettering

- 4.2. General Proportion of lettering
- 4.3. Composition of letters
- 4.4. Guide lines
- 4.5. Classification of lettering
- 4.6. Style of letters
- 4.7. Lettering devices
  
- 5. Drafting Geometry 2Hours**
  - 5.1. Introduction to geometry, plane and solid type
  - 5.2. Definition of terms
  - 5.3. Different conventional shapes, surfaces and objects
  - 5.4. Basic geometrical construction
  
- 6. Sketching and shape description 1Hours**
  - 6.1. Introduction to sketching techniques
  - 6.2. Techniques of sketching straight lines in different directions
  - 6.3. Sketching circles and arcs
  - 6.4. Sketching Ellipse
  - 6.5. Sketching of pictorial views
  - 6.6. Proportions in sketching
  
- 7. Engineering Curves 1Hours**
  - 7.1. Introduction to the curve
  - 7.2. Application of engineering curves
  - 7.3. Cone and conic section
  - 7.4. Spiral and Involute
  - 7.5. Cycloid, Epicycloids, Hypocycloid
  
- 8. Introduction to multi-view drawings 4 Hours**
  - 8.1. Introduction to the plane and its types
  - 8.2. Dihedral and Trihedral angles
  - 8.3. Projection of point, lines, plane and solids
  - 8.4. Definition and concept of multi-view drawings
  - 8.5. Perceptual views of plan of projections
  - 8.6. Orthographic projections
  - 8.7. 1<sup>st</sup> angle and 3<sup>rd</sup> angle projection
  - 8.8. Principal views and its arrangements
  - 8.9. Multi-view drawings and missing lines
  
- 9. Introduction to Pictorial drawing 4Hours**
  - 9.1. Uses of pictorial /3D
  - 9.2. Three types of pictorial views
  - 9.3. Isometric sketching of rectangular block with Arcs and circles
  - 9.4. Oblique sketching of rectangular block
  - 9.5. One point perspective sketching of rectangular block
  - 9.6. Two points perspective sketching of rectangular block
  - 9.7. Preparation of pictorial drawings of simple objects

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|---|---------------|
| <b>10. Basic Dimensioning</b>                   | <b>2Hours</b> |
| 10.1. Definition of dimensioning                |               |
| 10.2. Types of dimensioning                     |               |
| 10.3. Elements of dimensioning                  |               |
| 10.4. System of measurements                    |               |
| 10.5. Dimensioning of multi view drawing        |               |
| 10.6. Dimensioning pictorial views              |               |
| 10.7. Dimensioning rules and practices          |               |
| 10.8. Note & specification.                     |               |
| <br>  |               |
| <b>11. Introduction to multi-view drawings</b>  | <b>2Hours</b> |
| 11.1. Introduction to the surface development   |               |
| 11.2. Role of development in Packaging Industry |               |
| 11.3. Methods to develop the surfaces           |               |
| 11.4. Geometrical solids and development.       |               |

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**PART- B          Auto CAD Mechanical 2010          30%**

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| <b>12. Introduction of AutoCAD Mechanical 2010</b> | <b>2Hours</b> |
| 12.1. User Interface                               |               |
| 12.2. Template                                     |               |
| 12.3. Layers and Object                            |               |
| 12.4. Mechanical Structure                         |               |
| <br>   |               |
| <b>13. Drawing and Edit</b>                        | <b>3Hours</b> |
| 13.1. Object Snap                                  |               |
| 13.2. Drawing Command                              |               |
| 13.3. Edit Command                                 |               |
| 13.4. Object Command                               |               |
| <br>   |               |
| <b>14. Layers</b>                                  | <b>1Hour</b>  |
| 14.1. Layers                                       |               |
| <br>   |               |
| <b>15. Dimension and Symbols</b>                   | <b>2Hours</b> |
| 15.1. Create Dimension                             |               |
| 15.2. Edit Dimension                               |               |
| 15.3. Create Symbols                               |               |
| <br>   |               |
| <b>16. Drawing Layout</b>                          | <b>2Hours</b> |
| 16.1. Make Layout                                  |               |
| 16.2. Create Drawing Frame                         |               |
| 16.3. Create Contents and Template                 |               |



### **Recommended Textbooks:**

Mechanical Drawing (12<sup>th</sup> Addition) by French. Svensen, Helsel and Urbanick  
Drafting Fundamentals by scot. Foy, Schwendan

Engineering Drawing and Design 2<sup>nd</sup> addition by Cecil Jenson / Jay Helsel  
Engineering Drawing by colinsimmous, Dennis Maguire

Technical Drawing by Frederik E. Alva. Henry Cecil

Text Book of machine Drawing by R.K. Dhawan

Engineer Drawing by M.B. Shah (B.C.Rana)

Autodesk Official Training Courseware(AOTC) Volume1

Autodesk Official Training Courseware(AOTC) Volume2

**Instructional Objectives:****Know the application of Technical Drawing**

- 1.1 Describe the technical drawing and its importance
- 1.2 Describe the role of Inventor, Engineer, Designer, Technician, Craftsman etc.
- 1.3 Describe the uses of drawing in manufacturing and construction fields
- 1.4 Describe the free hand and instrumental drawing
  - 1.4.1 Explain the types of instrumental drawing
  - 1.4.2 Describe Multi-view, Pictorial and Schematic drawing

Recognize the different application of technical drawing

**Know and use the common Drafting equipment and accessories**

- 2.1 Explain the introduction and importance of drafting equipments
- 2.2 Identify the different instruments used in drafting
- 2.3 Describe the construction, uses and care of all equipments
- 2.4 Describe the Drafting Board, Table and Drafting machine
- 2.5 Explain the Tee, Triangles and Protractor
- 2.6 Describe the Compasses Divider, Lengthening Bar, Attachments etc.
- 2.7 Describe the use of pencils, their Grading and sharpening techniques
- 2.8 Explain the scale and its different types

**Understand the Types of lines, correct weight age and their application in technical Drawings.**

- 3.1. Describe the point, line and types of straight lines
- 3.2. Describe the importance of lines
- 3.3. Describe the common types of lines
- 3.4. Identify the each line Characteristics
- 3.5. Describe Horizontal, Vertical and inclined lines with proper grade pencil
- 3.6. Describe each line with his correct weight
- 3.7. Describe the objectives in drafting, Accuracy, Speed, Legibility and Neatness

**Applies the good lettering on a drawing**

- 4.1. Know the importance of good lettering in Engineering drawing
- 4.2. Know the general proportion of lettering such as normal, condensed and extended lettering
- 4.3. Describe and Identify the composition of letters
  - 4.3.1. Perform the best spacing between letters and words
  - 4.3.2. State the size and stroke of a letter
- 4.4. Describe the Guide lines
- 4.5. Describe the Gothic, Roman and free hand lettering
  - 4.5.1. Print single stroke, Double stroke lettering, Light face, Bold face lettering, Upper case, Lower case lettering
- 4.6. Print vertical and Inclined style of Gothic lettering
  - 4.6.1 State the proper pencil for lettering with holding techniques

- 4.6.2 Describe the general rules for lettering
- 4.7. Describe and use of different lettering devices such as lettering guide and lettering instrument

**Apply drawing skill with the aid of drawing instruments in geometrical construction**

- 5.1 Define the concept of common terms used in Geometrical construction
- 5.2 Explain different geometrical shapes, surfaces of objects
- 5.3 Bisecting a line, angles
- 5.4 Describe basic geometrical constructions
  - 5.4.1 Define Triangles, Quadrilateral, Polygons
  - 5.4.2 Name and draw the parts of circle

**Understand sketching of circles, arcs and view of objects**

- 6.1 Describe sketching material
- 6.2 State Sketching Technique of Horizontal, Vertical and inclined lines
- 6.3 Describe circular arc using circular line method
- 6.4 Draw a circular arc using square method
- 6.5 Draw an ellipse using rectangular method
- 6.6 Described the sketching of pictorial views
- 6.7 Proportions in sketching of views
- 6.8 Enlargement and Reduction

**Know and draw the different Engineering Curves used in various mechanism**

- 7.1 Describe the different engineering curves
- 7.2 Describe the application of different Engineering curves
- 7.3 Define cone and conic sections
  - 7.3.1 Describe the Ellipse, Parabola & Hyperbola by different methods
- 7.4 Define the Archimedean Spiral and involutes
  - 7.4.1 Define the Involute curves of square, Triangle, Circle and Hexagon
- 7.5 Describe the Cycloid curves
  - 7.5.1 Define Cycloid, Epicycloids and Hypocycloid curves

**Understand the multi-view projections of specific object**

- 8.1 Describe the plane and its types
- 8.2 Define Dihedral and Trihedral angles
- 8.3 Explain the projection of point, lines, plane and solids in different shapes
- 8.4 Define the concept of multi-view drawings
- 8.5 Knows Plane of projections
- 8.6 Know the orthographic method of projection
- 8.7 Explain the 1<sup>st</sup> and 3<sup>rd</sup> angle projections
- 8.8 State six principal views
- 8.9 Practice of multi-view projections and missing lines

**Apply the use, types and methods of pictorial**

- views** 9.1 Describe the importance of pictorial views
- 9.2 State three types of pictorial drawings
- 9.3 Describe isometric view of rectangular blocks, arcs, circles
- 9.4 Describe oblique sketching of a rectangular blocks
- 9.5 Describe one point perspective view of rectangular block

- 9.6 Describe two point perspective view of a rectangular block
- 9.7 Prepare/draw pictorial drawings of simple objects

**Apply good dimensioning on multi-view and pictorial drawings**

- 10.1 Define dimensioning
- 10.2 Identify the types of dimensioning
- 10.3 Enlist the elements of dimensioning
- 10.4 Identify the system of measurements
- 10.5 Indicate complete dimension on multi-view drawings
- 10.6 Indicate complete dimension on pictorial drawings
- 10.7 Follow the general rules of dimensioning
- 10.8 Indicate notes and specification on multi-view drawings

**Know the surface development and their procedure to develop and its role in packing industry**

- 11.1 Define the surface development
- 11.2 Explain the role of development in Packaging Industry
- 11.3 Describe the methods to draw the development
  - 11.3.1 Parallel line or Rectangle method
  - 11.3.2 Radial line or Triangle method
  - 11.3.3 Triangulation method
- 11.4 Define and draw the different Geometrical solids and their development

**Introduction of AutoCAD Mechanical 2010**

- 12.1 User Interface
- 12.2 Understand Template
- 12.3 Understand Layers and Object
- 12.4 Understand Mechanical Structure

**Drawing and Edit**

- 13.1 Understand the Object Snap
- 13.2 State the Drawing Command
- 13.3 Understand the Edit Command
- 13.4 Describe the Object Command

**Layers**

- 14.1. Describe the creation and modifying Layers

**Dimension and Symbols**

- 15.1 Understand create Dimension
- 15.2 Understand create editing Dimension
- 15.3 Understand create Symbols

**Drawing Layout**

- 16.1 Understand creation of Layout
- 16.2 Understand creation of Drawing Frame
- 16.3 Understand creation of Contents and Template

**List of Practical:****PART-A**

Practice of single stroke capital vertical lettering on graph and drawing sheet

Practice of single stroke capital inclined lettering on graph and drawing sheet

Practice of single stroke capital vertical & inclined lettering

Double stroke lettering

Use of Tee-square and set squares for drawing horizontal, vertical and inclined lines

Use of compass, circles, half circles, radius

Use of Tee-square and compass for drawing of lines, centers, curves, and crossing of lines

Draw round corners, figure inside and outside circle

Construction of angles and triangles

Construction of quadrilaterals and circles elements

Construction of parallel-lines, perpendicular, bisects line, angles and equal division of lines

Construction of inscribe and circumscribe figures (square, triangle and hexagon)

Construction of pentagon by different methods

Construction of Hexagon, Octagon, by general and different methods

Construction of Tangents of circles (Inside & Outside)

Construction of Ellipse by four different methods

Construction of parabola curve by four different methods

Construction of hyperbola curve

Construction of Archimedean Spiral curve

20. Construction of involutes curve of square rectangle hexagon and circle

Construction of cycloid, epicycloids, and hypocycloid

Different types of drawing lines

Orthographic projection 1 and 3<sup>rd</sup> angle wooden block-1

Orthographic projection 1 and 3<sup>rd</sup> angle wooden block-2

Orthographic projection 1 and 3<sup>rd</sup> angle wooden block-3

Orthographic projection 1 and 3<sup>rd</sup> angle wooden block-4

Orthographic projection 1 and 3<sup>rd</sup> angle wooden block-5.

Orthographic projection and Isometric Drawing-I

Orthographic projection and Isometric Drawing-II

Orthographic projection and Oblique Drawing-I

Orthographic projection and Oblique Drawing-II

Construction of perspective drawings. (One point)

Construction of perspective drawings. (Two point)

Construction of multi view drawing of Gland

Construction of multi view drawing of Simple Bearing

Construction of multi view drawing of Open Bearing

Missing lines and portions on given views-I

Missing lines and portions on given views-II

Development of prism-I

Development of prism-II

Development of cylinder

Development of cone

Development of pyramid-I

Development of pyramid-II

## **PART-B**

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Starting AutoCAD Mechanical 2010

Title Bar, Tool Bar, Menu Bar, Browser, Status Bar, Command Line

Zoom, Pan, Orbit

Object Snap, Grid, Orthogonal

Layer and Object Property

Construction Line and Center Line

Save AutoCAD Mechanical 2010

Line and Poly line Command

Circle, Arc and Ellipse Command

Rectangular and Polygon Command

Dimension and Hatching

Text Command

Copy, Mirror Command

Offset Command

Move, Rotate and Scale Command

Trim and Extend Command

Join and Break Command

Fillet and Chamfer Command

Explode Command

Exercise of Basic Drawings

Exercise of Mechanical Drawings.

# اسلامیات/مطالعہ پاکستان

نصاب (سال دوم)

حصہ اول	اسلامیات	Gen 211	ٹی	پی	سی
			1	0	1

حصہ دوم مطالعہ پاکستان

موضوعات

کل وقت: 20 گھنٹے

- 1- سورہ المومنوں ایک تا گیارہ آیات مع ترجمہ
- 2- دس منتخب احادیث مع ترجمہ و تشریح
  - خیر کم من تعلم القرآن و علمہ
  - لا ایمان لمن لا امانة له و لا دین لمن عہدہ
  - ایاکم و الظن ان الظن اکذب الحدیث
  - من احدث فی امرنا هذا ما لیس منه فہورد
  - من حمل علینا السلاح فلیس منا
  - انا و کافل الیتیم فی الجنة ہکذا
  - لا یومن احد کم حتی اكون احب الیہ من والدہ و ولدہ و الناس اجمعین
  - من بنی للہ مسجد ابنی اللہ لہ بیتاً فی الجنة
  - لا ضرر ولا ضرار فی الاسلام
  - کلکم راع و کلکم مسئول عن رعیتہ
- 3- سیرت طیبہ
  - مکی زندگی، ولادت، بعثت، ہجرت
  - مدنی زندگی، مواخات، یثاق مدینہ، فتح مکہ (اسباب و نتائج)
  - خطبہ حجۃ الوداع
- 4- حضور ﷺ بحیثیت:
  - معلم کامل - سربراہ خاندان
- 5- اسلامی معاشرہ
  - نظام تعلیم اور اس کے مقاصد - عدل و انصاف - امر بالمعروف و نہی عن المنکر
  - جہاد، کسب حلال، مسجد (اہمیت و فضیلت)
- 6- اسلامی ریاست - ریاست کی تعریف - اسلامی ریاست کی خصوصیات - اسلامی حکومت کے فرائض - اسلامی طرز حکومت -

تدریسی مقاصد

## منتخب آیات قرآنی

قرآن مجید

عمومی مقصد۔ طالب علم پہچان سکے کہ آیات قرآنی کی روشنی میں مومن کے اوصاف کیا ہیں۔

خصوصی مقاصد

- قرآنی آیات کا ترجمہ بیان کر سکے۔
- قرآنی آیات کی تشریح کر سکے۔
- قرآنی آیات کی روشنی میں ایک مومن کے اوصاف بیان کر سکے۔
- قرآنی آیات میں بیان کردہ مومن کے اوصاف اپنے اندر پیدا کر سکے۔
- احادیث نبویہ
- عمومی مقصد۔ احادیث کی روشنی میں اسلام کی اخلاقی اقدار (انفرادی و اجتماعی) سے آگاہ ہو سکے۔

خصوصی مقاصد

- احادیث کا ترجمہ بیان کر سکے
- احادیث کی تشریح کر سکے
- احادیث کی روشنی میں اسلام کی اخلاقی اقدار کی وضاحت کر سکے۔
- ان احادیث میں دی گئی تعلیمات کے مطابق اپنی زندگی گزار سکے۔

سیرت طیبہ

عمومی مقصد۔ حضور ﷺ کی سیرت طیبہ کے بارے میں جان سکے۔

خصوصی مقاصد

- حضور ﷺ کی ابتدائی زندگی اختصار کے ساتھ بیان کر سکے۔
- حضور ﷺ کی ہجرت کا واقعہ بیان کر سکے۔
- حضور ﷺ کی مدنی زندگی اختصار سے بیان کر سکے۔
- حضور ﷺ کی بطور معلم خصوصیات بیان کر سکے۔
- حضور ﷺ کی بطور سربراہ خاندان خصوصیات بیان کر سکے۔



## اسلامی معاشرہ

عمومی مقصد اسلامی معاشرہ کی خصوصیات سے آگاہی حاصل کر سکے۔

## خصوصی مقاصد

- اسلامی معاشرہ کا معنی و مفہوم بیان کر سکے۔
- اسلامی معاشرہ کی امتیازی خصوصیات بیان کر سکے۔
- اسلامی معاشرہ میں عدل و احسان کی اہمیت بیان کر سکے۔
- تبلیغ کے لغوی معنی بیان کر سکے۔
- تبلیغ کے لفظی و اصطلاحی معنی بیان کر سکے۔
- جہاد کی اہمیت بیان کر سکے۔
- جہاد اور قتال میں فرق بیان کر سکے۔
- جہاد کی مختلف اقسام بیان کر سکے۔
- لفظ مسجد کی تعریف کر سکے۔
- مسجد کی سابقہ حیثیت کو بحال کرنے کے بارے میں اقدامات کو جان سکے۔

## اسلامی ریاست

عمومی مقاصد ، اسلامی ریاست کی خصوصیات بیان کر سکے۔

## خصوصی مقاصد

- ریاست کی تعریف بیان کر سکے۔
- اسلامی ریاست میں طرز حکومت سے آگاہی حاصل کر سکے۔
- اسلامی ریاست کی خصوصیات بیان کر سکے۔
- اسلامی ریاست کے اغراض و مقاصد بیان کر سکے۔
- اسلامی ریاست کے قیام کے لئے جدوجہد کر سکے۔

نصاب اخلاقیات ( غیر مسلم طلباء کیلئے )

ٹی پی سی

1 0 1

کل وقت 20 گھنٹے

سال دوم

موضوعات

معاشرتی اقدار ( بلحاظ ہمسایہ، اقوام، قومی سطح، شہری سطح، صنعتی اداروں کی سطح، ضروریات، ورثہ

- حقوق و فرائض

- قوت برداشت

- قوت ارادی

- لگن و جذبہ

- وسیع النظری

- بے غرضی

- انسان دوستی

- حفاظتی شعور

- پاس آزاری

- کامل آگاہی

- تغیرات کو قبول کرنا

- خود شناسی

## نصاب اخلاقیات

سال دوم

### تدریسی مقاصد

عمومی مقاصد طالب علم

- اخلاقیات کی اہمیت و ضرورت سے آگاہ ہو سکے اور بیان کر سکے۔
- خصوصی مقاصد طالب علم اس قابل ہو۔
- موضوعات کا مطلب بیان کر سکے۔
- عملی زندگی سے مثالوں کی نشاندہی کر سکے۔
- اپنی شخصیت اور معاشرے پر موضوعات کے مطابق مثبت اثرات پیدا کرنے کے طریقے بیان کر سکے۔
- اعلیٰ اخلاقی اقدار میں سے:
- قوت برداشت، قوت ارادی، لگن جذبہ، وسیع النظری، بے غرضی، انسان دوستی، حفاظتی شعور، پاس آزادی،
- کامل آگاہی اور خود شناسی کی اہمیت بیان کر سکے۔
- اخلاقیات سے متصف ہو کر قومی خدمت بہتر طور پر انجام دے سکے۔

کل وقت 12 گھنٹے

سال دوم

حصہ دوم

موضوعات

- دو قومی نظریہ
- تحریک پاکستان
- انڈین کانگریس
- مسلم لیگ
- تقسیم بنگال
- یثاق لکھنؤ
- تحریک خلافت
- سندھی تحریک
- تجاویز دہلی
- نہرو رپورٹ
- قائد اعظم کے چودہ نکات
- خطبہ الہ آباد
- انتخابات 1938 اور انتقال اقتدار
- قرارداد پاکستان

حصہ دوم

مطالعہ پاکستان

تدریسی مقاصد

تحریک پاکستان

عمومی مقصد قیام پاکستان کے اسباب و محرکات کو بیان کر سکے۔

خصوصی مقاصد

- قومیت کے مفہوم کو بیان کر سکے۔
- دو قومی نظریہ کی تعریف و توضیح کر سکے۔
- دو قومی نظریہ کی اہمیت بیان کر سکے۔
- ہندوستانی مسلمانوں کی محرومیوں کو بیان کر سکے۔
- قومی تشخص کو بحال رکھنے کے لئے مسلمانان ہند کی مساعی بیان کر سکے۔
- آزادی ہند اور قیام پاکستان کے لیے علامہ اقبال اور قائد اعظم کی مساعی بیان کر سکے۔
- قیام پاکستان سے مستقبل میں اسلامی مملکت کے قیام کے لئے مسلم عوام کی کوششوں کو بیان کر سکے۔
- مسلم لیگ کی قیام پاکستان کے لئے جدوجہد بیان کر سکے۔

Total Contact Hours		T	P	C
Theory	64	2	3	3
Practical	96			

## AIMS.

After studying this course a student will be able to:

Understand significance and role of chemistry in the development of modern technology.

Become acquainted with the basic principles of chemistry as applied in the study of relevant technology.

Know scientific methods for production, properties and use of materials of industrial & technological significance.

Gain skill for the efficient conduct of practical in a chemistry lab.

## Detail of Contents:

- |  |                |
|--|----------------|
| <b>1. Introduction.</b><br>1.1 Scope and significance of the subject.<br>1.2 Orientation with reference to this technology.<br>1.3 Terms used & units of measurements in the study of chemistry.                     | <b>4 Hours</b> |
| <b>2. Fundamental concepts of chemistry.</b><br>2.1 Symbols, Valency, Radicals, formulas.<br>2.2 Chemical Reactions & their types.<br>2.3 Balancing of equations by ionic method.                                    | <b>4 Hours</b> |
| <b>3. Atomic structure.</b><br>3.1 Sub-atomic particles.<br>3.2 Architecture of atoms of elements, Atomic No. and Atomic weight.<br>3.3 Periodic classification of elements, periodic law.                           | <b>4 Hours</b> |
| <b>4. Chemical bond.</b><br>4.1 Nature of Chemical Bond.<br>4.2 Electrovalent bond with examples.<br>4.3 Covalent Bond (Polar and Non-polar) sigma & Pi Bonds. with examples.<br>4.4 Co-ordinate Bond with examples. | <b>4 Hours</b> |

- 5. Gases and liquids. 4 Hours**
- 5.1 The liquid and gaseous state.
  - 5.2 The Liquids and their general properties (Density, viscosity, surface tension capillary action etc).
  - 5.3 Gases and their general properties.
  - 5.4 Gas laws (Boyle's law, Charle's law & Graham's law of diffusion).
  - 5.5 Problems involving gas laws.
- 6. Water. 4 Hours**
- 6.1 Chemical nature and properties.
  - 6.2 Impurities.
  - 6.3 Hardness of water (types, causes & removal)
  - 6.4 Scales of measuring hardness (Degrees Clark, French, PPM, Mg-per liter).
  - 6.5 Boiler feed water, scales and treatment.
- 7. Acids, bases and salts. 4 Hours**
- 7.1 Definitions with examples.
  - 7.2 Properties, their strength, Basicity & Acidity.
  - 7.3 Salts and their classification with examples.
  - 7.4 pH-value and scale.
- 8. Oxidation & reduction. 4 Hours**
- 8.1 The process, definition & scope with examples.
  - 8.2 Oxidizing and Reducing agents.
  - 8.3 Oxides and their classification.
- 9. Nuclear chemistry. 4 Hours**
- 9.1 Introduction.
  - 9.2 Radioactivity (alpha, beta & gamma rays).
  - 9.3 Half life process.
  - 9.4 Nuclear reaction & transformation of elements.
  - 9.5 Isotopes and their uses.
- 10. Alloys. 4 Hours**
- 10.1 Introduction with need.
  - 10.2 Preparation and properties.
  - 10.3 Some important alloys and their composition.
  - 10.4 Uses.
- 11. Fuels. 4 Hours**
- 11.1 Introduction with their significance.
  - 11.2 Solid fuels.
  - 11.3 Liquid Fuels.
  - 11.4 Gaseous Fuels.

- 12. Corrosion.** **4 Hours**  
12.1 Introduction, causes and types.  
12.2 Rusting of iron.  
12.3 Corrosion control.
- 13. Metallurgy.** **4 Hours**  
13.1 General processes/operation of metallurgy.  
13.2 Chemistry of Iron, copper and Aluminum with their Ores.  
13.3 Ores, extraction and metallurgy of iron.  
13.4 Cast iron, Wrought iron and steel.
- 14. Thermo-chemistry.** **4 Hours**  
14.1 Introduction with its significance in modern technology.  
14.2 Thermo-chemical units and reactions.  
14.3 Heat of reaction and heat of combustion.  
14.4 Hess's Law.  
14.5 The process of combustion.  
14.6 Calorific value.  
14.7 Numerical problems pertaining to combustion.
- 15. Lubricants.** **4 Hours**  
15.1 Introduction.  
15.2 Classification.  
15.3 Properties of lubricants.  
15.4 Selection of lubricants.
- 16. Pollution.** **4 Hours**  
16.1 The problem and its dangers  
16.2 Causes of pollution.  
16.3 Air pollution and its control.

**BOOKS RECOMMENDED:**

Text Book of Intermediate Chemistry (I&II)  
Ilmi Applied science by Sh. Ata Mohammad.  
Applied chemistry for engineers by Eric S. Gyngell.  
Engineering Chemistry by M.A. Usmani.



**Instructional Objectives:****Understand the scope, significance and role of the subject.**

- 1.1 Define chemistry and its terms.
- 1.2 Define the units of measurements in the study of chemistry.
- 1.3 Explain the importance of chemistry in various fields of specialization.
- 1.4 Explain the role of chemistry in the concerned technology.

**Understand language of chemistry and chemical reactions.**

- 2.1 Define symbol, valency, radical, formula with examples of each.
- 2.2 Write chemical formula of common compounds.
- 2.3 Define chemical reaction and equation.
- 2.4 Describe types of chemical reactions with examples.
- 2.5 Explain the ionic method of balancing the equation.

**Understand the structure of atoms.**

- 3.1 Define atom.
- 3.2 Describe the fundamental sub atomic particles
- 3.3 Distinguish between atomic no. and mass no; and between isotopes and isobars.
- 3.4 Explain the arrangements of electrons in different shells and sub energy levels.
- 3.5 Explain the grouping and placing of elements in the periodic table.
- 3.6 State the periodic law of elements.

**Understand the nature of chemical bonds.**

- 4.1 Define chemical bond.
- 4.2 Describe the nature of chemical bond.
- 4.3 Differentiate between electrovalent and covalent bonding.
- 4.4 Explain the formation of polar and non polar sigma and pi-bond with examples.
- 4.5 Describe the nature of coordinate bond with examples.

**Gases and liquids.**

- 5.1 Understand the gaseous and liquid states of matter. 5.1.1 Describe the liquid and gaseous states of matter.
  - 5.1.2 Describe the general properties of liquid.
  - 5.1.3 Describe the general properties of gases.
- 5.2 Understand gas equation.
  - 5.2.1 State Boyle's law, Charle's law, Graham's law of diffusion, Dalton's law of partial pressure.
  - 5.2.2 State the mathematical form of these laws.
  - 5.2.3 Derive gas equation.
  - 5.2.4 Solve problems using gas law and gas equation.

**Understand the chemical nature of water.**

- 6.1 Describe the chemical nature of water with its formula.
- 6.2 Describe the general impurities present in water.

- 6.3 Explain the causes and methods to remove hardness of water.
- 6.4 Express hardness in different units like mg/liter. p.p.m, degrees Clark and degrees French.
- 6.5 Describe the formation and nature of scales in boiler feed water.
- 6.6 Explain the method for the treatment of scales.
- 6.7 Explain the sewage treatment and desalination of sea water.

**Understand the nature of acids, bases and salts.**

- 7.1 Define acids, bases and salts with examples.
- 7.2 Describe general properties of acids and bases.
- 7.3 Differentiate between acidity and basicity and use the related terms.
- 7.4 Define salts, give their classification with examples.
- 7.5 Explain p-H value of solution and pH scale.

**Understand the process of oxidation and reduction.**

- 8.1 Define oxidation.
- 8.2 Explain the oxidation process with examples.
- 8.3 Define reduction.
- 8.4 Explain reduction process with examples.
- 8.5 Define oxidizing and reducing agents with examples.
- 8.6 Define oxides.
- 8.7 Classify the oxides with examples.

**Understand the fundamentals of nuclear chemistry.**

- 9.1 Define nuclear chemistry and radio activity.
- 9.2 Differentiate between Alpha , Beta and Gamma particles.
- 9.3 Explain half life process.
- 9.4 Explain nuclear reactions resulting in transformation of elements with examples.
- 9.5 State the uses of isotopes.

**Understand the nature of alloys used in the relevant technology.**

- 10.1 Define alloy.
- 10.2 Describe different methods for the preparation of alloys.
- 10.3 State important properties of alloys.
- 10.4 Explain composition, properties and uses of different alloys.

**Understand the nature and uses of solid, liquid and gaseous fuels.**

- 11.1 Define fuel and give their significance in technological advancements.
- 11.2 Distinguish among solid, liquid and gaseous fuels.
- 11.3 Explain calorific value.
- 11.4 Describe coal with its utilization.
- 11.5 Describe petroleum and its utilization.
- 11.6 Describe various gaseous fuels.
- 11.7 Enlist nuclear and special fuels.

**Understand the process of corrosion.**

- 12.1 Define corrosion.
- 12.2 Describe different types of corrosion.

- 12.3 State the causes of corrosion.
- 12.4 Explain the process of rusting of iron.
- 12.5 Describe methods to prevent/control corrosion.

**Understand the process involved in the extraction of metals like iron, copper and aluminum.**

- 13.1 Define metallurgy
- 13.2 Explain concentration, roasting, calcination and reduction.
- 13.3 Describe physical & chemical properties of iron, copper and aluminum.
- 13.4 Enlist relevant ores of iron, copper and aluminium with their formulae.
- 13.5 Explain the method of extraction and metallurgy in a blast furnace of relevant ores of iron.
- 13.4 Outline important properties of cast iron, wrought iron and steel.

**Understand thermo chemistry.**

- 14.1 Define Thermo chemistry and state Thermo chemical units.
- 14.2 Explain heat of formation, combustion and neutralization.
- 14.3 Explain Hess's law.
- 14.4 Explain the process of combustion.
- 14.5 Solve numerical problems relating to quantities of air & other gases in combustion.

**Understand the chemistry of lubricants.**

- 15.1 Define a lubricant
- 15.2 Explain the uses of lubricants.
- 15.3 Describe classification of lubricants with examples.
- 15.3 State the properties of oils, greases and solid lubricants.
- 15.4 Explain the method of selecting lubricant for particular purpose/job.

**Understand the nature of pollution.**

- 16.1 Define pollution (air, water, soil).
- 16.2 State the causes of environmental pollution.
- 16.3 Enlist air pollutant gases.
- 16.4 Explain the methods used to control air pollution.

**List of Practicals:**

- To introduce the common apparatus, glassware and chemical reagents used in the chemistry lab.
- To purify a chemical substance by crystallization.
- To separate a mixture of sand and salt.
- To find the melting point of substance.
- To find the pH of a solution with pH paper.
- To separate a mixture of inks by chromatography.
- To determine the co-efficient of viscosity of benzene with the help of Ostwald viscometer.
- To find the surface tension of a liquid with a stalagmometer.
- To perform electrolysis of water to produce Hydrogen and Oxygen.
- To determine the chemical equivalent of copper by electrolysis of Cu SO.
- To get introduction with the scheme of analysis of salts for basic radicals.
- To analyse 1st group radicals ( $\text{Ag}^+$  -  $\text{Pb}^{++}$  -  $\text{Hg}^+$ ).
- To make practice for detection 1st group radicals.
- To get introduction with the scheme of II group radicals.
- To detect and confirm II-A radicals ( $\text{Hg}^{++}$ ,  $\text{Pb}^{++++}$ ,  $\text{Cu}^+$ ,  $\text{Cd}^{++}$ ,  $\text{Bi}^{+++}$ ).
- To detect and confirm II-B radicals  $\text{Sn}^{++}$ ,  $\text{Sb}^{+++}$ ,  $\text{As}^{+++}$ ).
- To get introduction with the scheme of III group radicals ( $\text{Fe}^{+++}$  -  $\text{Al}^{+++}$ ,  $\text{Cr}^{+++}$ )
- To detect and confirm  $\text{Fe}^{+++}$ ,  $\text{Al}^{+++}$  and  $\text{Cr}^{+++}$ .
- To get introduction with the scheme of IV group radicals.
- To detect and confirm  $\text{An}^{++}$  and  $\text{Mn}^{++}$  radicals of IV group.
- To detect and confirm  $\text{Co}^{++}$  and  $\text{Ni}^{++}$  radicals of IV group.
- To get introduction with the Acid Radical Scheme.
- To detect dilute acid group.
- To detect and confirm  $\text{CO}_3^{2-}$  and  $\text{HCO}_3^-$  radicals.
- To get introduction with the methods/apparatus of conducting volumetric estimations.
- To prepare standard solution of a substance.
- To find the strength of a given alkali solution.
- To estimate  $\text{HCO}_3^-$  contents in water.
- To find out the %age composition of a mixture solution of  $\text{KNO}_3$  and  $\text{KOH}$  volumetrically.
- To find the amount of chloride ions ( $\text{Cl}^-$ ) in water volumetrically.

<b>Total Contact Hours</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Theory</b> <b>64</b>	<b>2</b>	<b>0</b>	<b>2</b>

**Pre-requisite:** Must have completed Mathematics I.

**AIMS.**

After completing the course the students will be able to:

Solve problems of Calculus and Analytic Geometry.

Develop mathematical skill, attitudes and logical perception in the use of mathematical instruments.

Apply principles of Differential Calculus to work out rate measures, velocity, acceleration, maxima & minima values

Use Principles of Integral Calculus to compute areas and volumes.

Acquire proficiency in solving technological problems with mathematical clarity and insight.

### **Detail of Contents:**

- |   |                       |
|---|-----------------------|
| <p><b>1. Functions &amp; limits.</b></p> <p>1.1 Constant &amp; Variable Quantities</p> <p>1.2 Functions &amp; their classification</p> <p>1.3 The concept of Limit</p> <p>1.4 Limit of a Function</p> <p>1.5 Fundamental Theorems on Limit</p> <p>1.6 Some important Limits</p> <p>1.7 Problems</p>   | <p><b>4 Hours</b></p> |
| <p><b>2. Differentiation</b></p> <p>2.1 Increments</p> <p>2.2 Differential Coefficient or Derivative</p> <p>2.3 Differentiation ab-initio or by first Principle</p> <p>2.4 Geometrical Interpretation of Differential Coefficient</p> <p>2.5 Differential Coefficient of <math>X^n</math>, <math>(ax + b)^n</math></p> <p>2.6 Three important rules</p> <p>2.7 Problems</p> | <p><b>4 Hours</b></p> |
| <p><b>3. Differentiation of algebraic functions</b></p> <p>3.1 Explicit Functions</p> <p>3.2 Implicit Functions</p> <p>3.3 Parametric forms</p> <p>3.4 Problems</p>   | <p><b>4 Hours</b></p> |
| <p><b>4. Differentiation of trigonometric functions</b></p> <p>4.1 Differential Coefficient of Sin x, Cos x, Tan x from first principle.</p> <p>4.2 Differential Coefficient of Cosec x, Sec x, Cot x</p>   | <p><b>4 Hours</b></p> |

4.3	Differentiation of inverse Trigonometric functions.	
4.4	Problems.	
<b>5.</b>	<b>Differentiation of logarithmic &amp; exponential functions</b>	<b>4 Hours</b>
5.1	Differentiation of $\ln x$	
5.2	Differentiation of $\text{Log } a^x$	
5.3	Differentiation of $a^x$	
5.4	Differentiation of $e^x$	
5.5	Problems	
<b>6.</b>	<b>Rate of change of variable.</b>	<b>4 Hours</b>
6.1	Increasing and decreasing functions	
6.2	Maxima and Minima values	
6.3	Criteria for maximum & minimum values	
6.4	Methods of finding maxima & minima	
6.5	Problems	
<b>7.</b>	<b>Integration</b>	<b>8 Hours</b>
7.1	Concept	
7.2	Fundamental Formulas	
7.3	Important Rules	
7.4	Problems	
<b>8.</b>	<b>Methods of integration</b>	<b>6 Hours</b>
8.1	Integration by substitution	
8.2	Integration by parts	
8.3	Problems	
<b>9.</b>	<b>Definite integrals</b>	<b>6 Hours</b>
9.1	Properties	
9.2	Application to area	
9.3	Problems	
<b>10.</b>	<b>Plane analytic geometry &amp; straight line</b>	<b>6 Hours</b>
10.1	Coordinate System	
10.2	Distance Formula	
10.3	The Ratio Formulas	
10.4	Inclination and slope of a line	
10.5	The slope Formula	
10.6	Problems	
<b>11.</b>	<b>Equations of the straight line</b>	<b>6 Hours</b>
11.1	Some important Forms	
11.2	General Form	
11.3	Angle Formula	
11.4	Parallelism & Perpendicularity	
11.5	Problems	

**12. The equations of the circle****8 Hours**

- 12.1 Standard form of Equation
- 12.2 Central form of Equation
- 12.3 General form of Equation
- 12.4 Radius & Coordinates of the centre
- 12.5 Problems

**REFERENCE BOOKS**

Applied Mathematics: Math-123, Developed by Nasir -ud-Din Mahmood, Sana-ullah Khan, Tahir Hameed, Evaluated by Syed Tanvir Haider, Javed Iqbal, Vol - I, National Book Foundation

**Instructional Objectives:**

**Use the concept of functions and their limits in solving simple problems.**

- 1.1 Define a function.
- 1.2 List all types of functions.
- 1.3 Explain the concept of limit and limit of a function.
- 1.4 Explain fundamental theorems on limits.
- 1.5 Derive some important limits.
- 1.6 Solve simple problems on limits.

**Understand the concept of differential coefficient.**

- 2.1 Derive mathematical expression for a differential coefficient.
- 2.2 Explain geometrical interpretation of differential coefficient.
- 2.3 Differentiate a constant, a constant associated with a variable and the sum of finite number of functions.
- 2.4 Solve related problems.

**Use rules of differentiation to solve problems of algebraic functions.**

- 3.1 Differentiate ab-initio  $x^n$  and  $(ax+b)^n$ .
- 3.2 Derive product, quotient and chain rules.
- 3.3 Find derivatives of implicit functions & explicit functions
- 3.4 Differentiate parametric forms, functions w.r.t another function and by rationalization.
- 3.5 Solve problems using these formulas.

**Use rules of differentiation to solve problems involving trigonometric functions.**

- 4.1 Differentiate from first principle  $\sin x$ ,  $\cos x$ ,  $\tan x$ .
- 4.2 Derive formulas for derivation of  $\sec x$ ,  $\operatorname{cosec} x$ ,  $\cot x$ .
- 4.3 Find differential coefficients of inverse trigonometric functions.

**Use rules of differentiation to logarithmic and exponential functions.**

- 5.1 Derive formulas for differential coefficient of logarithmic and exponential functions.
- 5.2 Solve problems using these formulas.

**Understand rate of change of one variable with respect to another.**

- 6.1 Write expression for velocity, acceleration and slope of a line.
- 6.2 Define an increasing and a decreasing function, maxima and minima values, point of inflexion.
- 6.3 Explain criteria for maxima and minima values of a function.
- 6.4 Solve problems involving rate of change of variables.



**Apply concept of integration in solving technological problems.**

- 7.1 Explain the concept of integration.
- 7.2 Write basic theorems of integration.
- 7.3 List some important rules of integration.
- 7.4 Derive fundamental formulas of integration.
- 7.5 Solve problems based on these formulas/rules.

**Understand different methods of integration.**

- 8.1 List standard formulas.
- 8.2 Integrate a function by substitution method.
- 8.3 Find integrals by the method of integration by parts.
- 8.4 Solve problems using these methods.

**Understand the methods of solving definite integrals.**

- 9.1 Define definite integral.
- 9.2 List properties of definite integrals using definite integrals.
- 9.3 Find areas under the curves.
- 9.4 Solve problems of definite integrals.

**Understand the concept of plane analytic geometry.**

- 10.1 Explain the rectangular coordinate system.
- 10.2 Locate points in different quadrants.
- 10.3 Derive distance formula.
- 10.4 Prove section formulas.
- 10.5 Derive Slope formula.
- 10.6 Solve problem using the above formulas.

**Use equations of straight line in solving problems.**

- 11.1 Define a straight line.
- 11.2 State general form of equation of a straight line.
- 11.3 Derive slope intercept and intercept forms of equations of a straight line.
- 11.4 Derive expression for angle between two straight lines.
- 11.5 Derive conditions of perpendicularity and parallelism of two straight lines.
- 11.6 Solve problems involving these equations/formulas.

**Solve technological problems using equation of circle.**

- 12.1 Define a circle.
- 12.2 Describe standard, central and general forms of the equation of a circle.
- 12.3 Convert general form to the central form of equation of a circle.
- 12.4 Deduce formulas for the radius and the coordinates of the center of a circle from the general form.
- 12.5 Derive equation of the circle passing through three given points.
- 12.6 Solve problems involving these equations.

Total Contact Hours		T	P	C
Theory	32	1	3	2
Practical	96			

**Pre-requisite:**

AIMS.

Apply the concepts of Applied Physics to understand Mechanics  
 Apply laws and principles of Mechanics in solving technological problems  
 Use the knowledge of App. Mechanics in learning advance technical courses.  
 Demonstrate efficient skill of practical work in Mechanics Lab.

**Detail of Contents:**

1. **Measurements** **2 Hours**
  - 1.1 Review: Dimensional formula of Equations of Motion
  - 1.2 Review: Systems of measurement, S.I. Units, conversion
  - 1.3 Significant Figures
  - 1.4 Degree of accuracy
  
2. **Equilibrium of con-current forces** **3 Hours**
  - 2.1 Concurrent forces
  - 2.2 Addition and Resolution of Vectors
  - 2.3 Toggle Joint, Hanging Chains
  - 2.4 Roof Trusses, Cranes.
  - 2.5 Framed structures
  
3. **Moments and couples:** **2 Hours**
  - 3.1 Principle of Moments - Review
  - 3.2 Levers
  - 3.3 Safety valve
  - 3.4 Steel yard
  - 3.5 Parallel forces, couple
  - 3.6 Torque
  
4. **Equilibrium of non concurrent forces:** **3 Hours**
  - 4.1 Non-concurrent forces
  - 4.2 Free body diagram
  - 4.3 Varignon's theorem
  - 4.4 Conditions of total Equilibibrium.
  - 4.5 Ladders
  
5. **Moment of inertia:** **3 Hours**
  - 5.1 Review: Rotational Inertia
  - 5.2 Moment of Inertia, Theorems

5.3	Moment of Inertia of symmetrical bodies	
5.4	M.I. of Fly wheel with applications	
5.5	Energy stored by Fly wheel	
<b>6.</b>	<b>Friction:</b>	<b>2 Hours</b>
6.1	Review: Laws of friction	
6.2	Motion of body along an inclined plane (up & down)	
6.3	Rolling friction & Ball Bearings	
6.4	Fluid Friction, Stokes' Law	
<b>7.</b>	<b>Work, energy and power</b>	<b>3 Hours</b>
7.1	Work-Energy relationship	
7.2	Work done by variable force.	
7.3	Power	
7.4	I.H.P, B.H.P and Efficiency	
7.5	Dynamometer.	
<b>8.</b>	<b>Transmission of power:</b>	<b>3 Hours</b>
8.1	Belts, Ropes.	
8.2	Chains.	
8.3	Gears.	
8.4	Clutches, functions and types with application	
<b>9.</b>	<b>Machines:</b>	<b>3 Hours</b>
9.1	Efficiency of machines	
9.2	Inclined plane - Review	
9.3	Reversibility of machines	
9.4	Single purchase crab	
9.5	Double purchase crab.	
9.6	Worm and worm wheel.	
9.7	Differential Screw Jack.	
9.8	Differential Pulley, Wheel and Axle	
<b>10.</b>	<b>Vibratory motion:</b>	<b>2 Hours</b>
10.1	S.H.M. - Review	
10.2	Pendulums	
10.3	Speed Governors.	
10.4	Helical spring.	
10.5	Cams	
10.6	Quick return motion	
<b>11.</b>	<b>Elasticity:</b>	<b>3 Hours</b>
11.1	Three Modulii of Elasticity	
11.2	Loaded Beams, Types of Beam & Loads	
11.3	Bending Stress	
11.4	S.F & B.M diagram	

**12. Simple mechanism:**

**1 Hour**

- 12.1 Introduction
- 12.2 Kinematic link or Element
- 12.3 Kinematic pair and types.
- 12.4 Kinematic chains and types.

**13. Velocity in mechanism:**

**2 Hours**

- 13.1 Introduction.
- 13.2 Instantaneous centre.
- 13.3 Instantaneous velocity.
- 13.4 Velocity of a link by instantaneous centre method.
- 13.5 Relative velocity of two bodies in the straight line
- 13.6 Velocity of a link by relative velocity method.

**Recommended Textbooks:**

Applied Physics by Mr. Khalid Mehmood, Asif Ali, Zafar Tarar, Vol-I, Published by National Book Foundation

**Instructional Objectives:****Use the concepts of measurement in practical situations/problems**

- 1.1 Explain Dimensional formula
- 1.2 Explain systems of measurement
- 1.3 Use concept of significant figures and degree of accuracy to solve problems

**Use the concept of addition and resolution of vectors to problems on equilibrium involving concurrent forces**

- 2.1 Describe concurrent forces
- 2.2 Explain resolution of vectors
- 2.3 Use the analytical method of addition of vectors for solving problems.
- 2.4 Use the graphical method of addition of vectors for solving problems.
- 2.5 Solve problems on forces with emphasis on roof trusses, cranes simple frames and framed structures.

**Use the principle of moments and concept of couple to solve problems.**

- 3.1 Describe the principle of moments.
- 3.2 Use the principle of moments to solve problems on compound levers, safety valve, steel-yard.
- 3.3 Describe couple and torque.
- 3.4 Use the concept to solve problems on torque.

**Use the laws of total equilibrium of forces to solve problems involving forces in equilibrium.**

- 4.1 Distinguish between concurrent and non-concurrent forces.
- 4.2 Prepare a free body diagram of an object or a structure.
- 4.3 Explain Varignon's theorem.
- 4.4 Explain the second condition of equilibrium.
- 4.5 Use laws of total equilibrium to solve problems on forces involving framed structure and ladders.

**Use concepts of moment of inertia to practical situations and problems.**

- 5.1 Explain moment of inertia.
- 5.2 Explain the theorems of Parallel and perpendicular Axis.
- 5.3 Describe the M.I. of regular bodies
- 5.4 Explain M.I. of Fly wheel
- 5.5 Explain Energy stored by Fly Wheel
- 5.6 Use these concepts to solve simple problems.

**Understand the concepts and laws of solid and fluid friction.**

- 6.1 Define Coefficient of friction between a body placed on an inclined plane and the surface.
- 6.2 Explain motion of a body placed on an inclined plane
- 6.3 Calculate the force needed to move a body up and down an inclined plane.
- 6.4 Explain rolling friction and use of ball bearings.
- 6.5 Describe fluid friction and Stoke's law.

**Understand work, energy and power.**

- 7.1 Derive work-energy relationship
- 7.2 Use formulae for work done by a variable force to solve problems.
- 7.3 Explain Power, I.H.P, B.H.P and efficiency.
- 7.4 Describe dynamometers.
- 7.5 Use the concepts to solve problems on power and work-energy

**Understand transmission of power through ropes and belts.**

- 8.1 Describe the need for transmission of power.
- 8.2 Describe methods of transmission of power.
- 8.3 Describe transmission of power through ropes and belts.
- 8.4 Write formula for power transmitted through ropes and belts.
- 8.5 Describe transmission of power through friction gears and write formula.
- 8.6 Describe transmission of power through chains and toothed wheels/gears.
- 8.7 Use the formulae to solve/problems on transmission of power.
- 8.8 Describe types and function of clutches with applications

**Use the concepts of machines to practical situations.**

- 9.1 Explain theoretical, actual mechanical advantage and efficiency of simple machines.
- 9.2 Use the concept to calculate efficiency of an inclined plane.
- 9.3 Describe reversibility of machines.
- 9.4 Calculate the efficiency of:
  - Single purchase crab.
  - Double purchase crab.
  - Worm and worm wheel.
  - Differential screw jack, Diff. Pulley, Wheel and Axle.
- 9.5 Use the formulae to solve the problems involving efficiency, M.A of the above machines.

**Use the concepts of vibratory motion to practical situations.**

- 10.1 Define vibratory motion giving examples.
- 10.2 Describe circular motion and its projection on diameter of the circular path.
- 10.3 Relate rotatory motion to simple vibratory motion.
- 10.4 State examples of conversion of rotatory motion to vibratory motion and vice versa.
- 10.5 Describe speed governors, cams quick return motion.
- 10.6 Derive formulae for position, velocity and acceleration of a body executing S.H.M.
- 10.7 Use the concept of S.H.M to helical springs.
- 10.8 Use the concept S.H.M to solve problems on pendulum.

**Understand bending moments and shearing forces.**

- 11.1 Define three types of stresses and moduli of elasticity.
- 11.2 Describe types of beams and loads.
- 11.3 Explain shearing force and bending moment.
- 11.4 Use these concepts to calculate S.F and B.M in a given practical situation for point loads, uniformly distributed loads.
- 11.5 Prepare S.F and B.M diagram for loaded cantilever and simply supported beams.
- 11.6 Describe torsion and tensional stresses giving formula

**Understand simple mechanisms.**

- 12.1 Define simple mechanisms.
- 12.2 Define kinematics.
- 12.3 Explain kinematic link or element.
- 12.4 Explain kinematic chains.
- 12.5 Distinguish between types of kinematic chains.

**Understand the method of finding velocity in mechanisms.**

- 13.1 Explains relative velocity.
- 13.2 Explain instantaneous center.
- 13.3 Explain instantaneous velocity.
- 13.4 Explain the method of finding velocity of a link by:
  - Relative velocity method.
  - Instantaneous center method.

**List of Practicals:**

Find the weight of the given body using Law of Polygon of forces.  
Find unknown forces in a given set of concurrent forces in equilibrium using Grave-sands apparatus  
Set a jib crane and analyses forces in its members  
Set a Derrick Crane and analyses forces in its members  
Study forces shared by each member of a Toggle Joint  
Set a Roof Truss and find forces in its members  
Verify Principle of Moments in a compound lever  
Calibrate a steelyard  
Find the Reactions at the ends of a loaded beam  
Use Reaction of Beams apparatus to study resultant of Parallel forces  
Find the Moment of Inertia of a Flywheel  
Find the angle of reaction for a wooden block placed on an inclined plane  
Find the B.H.P. of a motor  
Study the transmission of Power through friction gears  
Study the transmission of power through belts  
Study the transmission of Power through toothed wheels  
Study the function of clutches  
Find M.A. and Efficiency of worm and worm wheel  
Find M.A. and efficiency of differential wheel and axle  
Find the efficiency of a screw  
Find the efficiency of a differential pulley  
Study conversion of rotatory motion to S.H.M. using S.H.M. Model/Apparatus  
Study conversion of rotatory motion to vibratory motion of the piston in a cylinder  
Study the reciprocating motion  
Study the working of cams  
Study the quick return motion  
Compare the Elastic constants of the given wires  
Verify Hooke's Law using Helical Spring  
Find the coefficient of Rigidity of a wire using Maxwell's needle  
Find the coefficient of Rigidity of a round bar using torsion apparatus  
Find the coefficient of Rigidity of a rectangular bar using Deflection of Beam Apparatus  
Determine S.F. and B.M. in a loaded canti-lever (Point Loads)  
Determine S.F. and B.M. in a simply supported Beam (Point Loads)  
Determine S.F. and B.M. in a simply supported Beam (Point loads and uniformly distributed load)  
Determine S.F. and B.M. in a simply supported Beam (Point loads and uniformly distributed)  
Study working and function of link mechanism of different types .



<b>Total Contact Hours</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Theory            64</b>	<b>2</b>	<b>0</b>	<b>2</b>

AIMS.

The student will be able to:-

Develop the management skill.

Understand principles of management & Economics.

Develop psychological approach to solve the labour problems in the industrial set-up.

## **Detail of Contents:**

### **PART I**

- |  |                |
|--|----------------|
| <b>1. Industrial psychology.</b><br>1.1 Brief history.<br>1.2 Definition.<br>1.3 Nature and scope.   | <b>3 Hours</b> |
| <b>2. Motivation</b><br>2.1 Definition.<br>2.2 Types (Financial and non financial motives).<br>2.3 Conflict of motives.  | <b>3 Hours</b> |
| <b>3. Industrial accidents</b><br>3.1 Psychological causes.<br>3.2 Objective causes.<br>3.3 Prevention   | <b>3 Hours</b> |
| <b>4. Work appraisal</b><br>4.1 Importance<br>4.2 Techniques   | <b>3 Hours</b> |
| <b>5. Industrial management</b><br>5.1 Introduction<br>5.2 Functions of Management.<br>5.3 Subdivision of Management<br>5.4 Objectives of Industrial management. | <b>3 Hours</b> |
| <b>6. Planning</b><br>6.1 The concept.<br>6.2 Importance of planning<br>6.3 Steps in planning.   | <b>3 Hours</b> |

6.3	Principals of planning.	
<b>7.</b>	<b>Plant location and layout</b>	<b>3 Hours</b>
7.1	Plant location.	
7.2	Selection of plant location.	
7.3	Types of factory building.	
7.4	Plant layout.	
7.5	Factors affecting it.	
7.6	Process and product layout.	
7.7	Plant location and layout of a factory.	
<b>8.</b>	<b>Personnel selection.</b>	<b>3 Hours</b>
8.1	Recruitment of employees.	
8.2	Training.	
8.3	Effects of training on production and product cost.	
<b>9.</b>	<b>Wage payment plans.</b>	<b>2 Hours</b>
9.1	Importance	
9.2	Principles	
9.3	Important plans	
9.4	Effects on production cost.	
<b>10.</b>	<b>Types of production.</b>	<b>2 Hours</b>
10.1	Job, batch, flow and mass production.	
10.2	Types of production and cost consecrations.	
<b>11.</b>	<b>Working conditions.</b>	<b>3 Hours</b>
11.1	Importance.	
11.2	Consideration.	
11.3	Effects on efficiency and per unit cost.	
<b>12.</b>	<b>Time and motion study.</b>	<b>3 Hours</b>
12.1	The concept	
12.2	Importance of work study for management.	
12.3	Sequence of motion study.	
12.4	Principles of motion study.	
12.5	Steps to time study.	
12.6	Determination of operations time.	
<b>13.</b>	<b>Quality control.</b>	<b>3 Hours</b>
13.1	The concept.	
13.2	Advantages of quality control.	
13.3	Methods.	

- 14. Role of foreman in management. 2 Hours**  
14.1 Foreman's abilities.  
14.2 Duties.  
14.3 Functions.
- 15. Foreman's knowledge of cost economics. 3 Hours**  
15.1 Concept of cost Economics.  
15.2 Elements of cost.  
15.3 Cost accounting methods.
- 16. Productivity. 3 Hours**  
16.1 The concept.  
16.2 Importance  
16.3 Factors affecting productivity.

## **PART-II**

- 17. Economics 2 Hours**  
17.1 Definition: Adam Smith, Alfred Marshall, Professor Robins  
17.2 Nature and scope  
17.3. Importance for foreman and technicians.  
17.4 Basic concepts in economics (utility, marginal, Income, Wealth, saving, Investment).
- 18. Demand and supply. 2 Hours**  
18.1 Definition  
18.2 Law of Demand  
18.3 Definition of Supply.  
18.4 Law of Supply.
- 19. Factors of production. 2 Hours**  
19.1 Land  
19.2 Labour  
19.3 Capital  
19.4 Organization
- 20. Business organization 3 Hours**  
20.1 Sole proprietorship.  
20.2 Partnership  
20.3 Joint Stock Company.
- 21. Scale of production. 2 Hours**  
21.1 Meaning and its determination.  
21.2 Large scale production.  
21.3 Small scale production.

- 22. Laws of return. 2 Hours**  
22.1 Law of increasing return.  
22.2 Law of constant return.  
22.3 Law of diminishing return.
- 23. Economics systems 2 Hours**  
23.1 Free economic system.  
23.2 Centrally controlled economy.  
23.3 Mixed economic system.
- 24. Money 2 Hours**  
24.1 Barter system and its inconveniences.  
24.2 Definition of money and its functions.
- 25. BANK 2 Hours**  
25.1 Definition  
25.2 Functions of a commercial bank.  
25.3 Central bank and its functions.
- 26. Cheque 2 Hours**  
26.1 Definition  
26.2 Characteristics and kinds of cheques.  
26.3 Dishonour of cheque.
- 27. Financial institution 2 Hours**  
27.1 IMF  
27.2 IDBP  
27.3 PIDC

**BOOKS RECOMMENDED:**

Business Organization by Nisar-ud-Din Aziz Publisher, Lahore.

An Introduction to Modern Economics By S.M. Akthar, Publishes United Ltd. Lahore.

Nizamat-e-Sanaat Aur Insani Rawabat by Ghulam Hussain (Ilmi Kitab Khana,

The process of Management by Andrew R. Megill Willian M New Man.

Factory and Production Management by K.G.Lockyer.

**Instructional Objectives:**

**Know industrial psychology.**

- 1.1 Describe brief history of Industrial Psychology.
- 1.2 Define Industrial Psychology.
- 1.3 Describe nature and scope of industrial psychology.

**Understand motivation.**

- 2.1 Define motivation.
- 2.2 Describe financial and non financial motives.
- 2.3 Explain conflict of motives.

**Understand the causes of industrial accidents.**

- 3.1 Explain psychological causes of industrial accidents.
- 3.2 Explain objective causes of industrial accidents.
- 3.3 Explain preventive measures of industrial accidents.

**Understand work appraisal.**

- 4.1 Explain importance of work appraisal.
- 4.2 Explain work appraisal techniques.

**Understand industrial management.**

- 5.1 Explain management.
- 5.2 Describe functions of management.
- 5.3 Enlist subdivision of management.
- 5.4 Explain objectives of industrial management.

**Understand planning.**

- 6.1 Define planning.
- 6.2 Describe the importance of planning.
- 6.3 Identify the steps in planning.
- 6.4 Enlist principles of planning.

**Understand the methods of plant location and layout.**

- 7.1 Explain plant location.
- 7.2 Explain criteria for selection of plant location.
- 7.3 Describe types of buildings.
- 7.1 Explain plant layout.
- 7.2 Explain factors affecting layout.
- 7.3 Describe process and product layout.
- 7.4 Prepare layout of an ideal Printing press.

**Understand the effects of training.**

- 8.1 Describe the recruitment procedure of employees in an industrial concern.
- 8.2 Explain training.
- 8.3 Identify the kinds of training.
- 8.4 State the effects of training on production and product cost.

**Understand wage payment plans.**

- 9.1 Explain importance of wage payment plans.
- 9.2 State the principles of wage payment plan.
- 9.3 Describe briefly standard time plan, straight piece rate, differential piece rates.
- 9.4 State the effects of incentive plans on total cost and labour cost.

**Understand types of production along with their impacts on cost.**

- 10.1 Describe types of production.
- 10.2 State the effects of production types on cost.

**Understand working condition along with effects on efficiency.**

- 11.1 Explain importance of working condition.
- 11.2 Describe consideration i.e. Air-conditioning Ventilation, Lighting and Noise.
- 11.3 State the effects of good working condition on efficiency and per unit cost.

**Understand about time and motion study.**

- 12.1 Explain the concept of time & motion..
- 12.2 Describe the importance of work study.
- 12.3 Explain the sequence of motion study.
- 12.4 Identify the principles of motion study.
- 12.5 Describe the steps of time study.
- 12.6 Explain the determination of operations time.

**Understand the effects of quality control.**

- 13.1 Explain quality control.
- 13.2 Identify the advantages of quality control.
- 13.3 Describe methods of quality control.

**Understand the role of foreman in an industrial undertaking.**

- 14.1 Explain abilities of Foreman.
- 14.2 Enlist duties of Foreman.
- 14.3 Describe functions of Foreman as middle management.

**Understand the term cost accounting.**

- 15.1 Explain concept of cost accounting.
- 15.2 Explain elements of cost.
- 15.3 State the principles of cost accounting.

**Understand the term productivity.**

- 16.1 Determine the term productivity.
- 16.2 Describe importance of productivity.
- 16.3 State the factors affecting productivity.

**Understand the importance of economics.**

- 17.1 State definition of economics given by Adam Smith, Alfred Marshall and Professor Robins.
- 17.2 Explain nature and scope of economics.
- 17.3 Describe importance of study economics for technicians.
- 17.4 Define basic terms, utility, income, wealth, saving, investment and value.
- 17.5 Explain the basic terms with examples.

**Understand law of demand and law of supply.**

- 18.1 Define demand
- 18.2 Explain law of demand with the help of schedule and diagram.
- 18.3 State assumptions and limitation of law of demand.
- 18.4 Define supply
- 18.5 Explain law of supply with the help of schedule and diagram
- 18.6 State assumptions and limitation of law of supply.

**Understand four factors of production.**

- 19.1 Define the four factors of production
- 19.2 Explain labour and its features.
- 19.3 Describe capital and its peculiarities.

**Understand forms of organization.**

- 20.1 Describe sole proprietorship, its merits and demerits.
- 20.2 Explain partnership, its advantages and disadvantages.
- 20.3 Describe joint stock company, its merits and demerits.
- 20.4 Distinguish between public limited company and private limited company.

**Understand scale of production.**

- 21.1 Explain scale of production and its determination.
- 21.2 Describe large scale production and its merits.
- 21.3 Explain small scale of production, its advantages and disadvantages.

**Understand laws of return.**

- 22.1 Explain law of increasing return
- 22.2 Explain law of constant return
- 22.3 Explain law of diminishing return

**Understand different economic systems.**

- 23.1 Describe free economic system and its characteristics.
- 23.2 Explain centrally planned economic system, its merits and demerits.

- 23.3 State mixed economic system and its features.

### **Understand money**

- 24.1 Explain barter system and its inconveniences.
- 24.2 Define money.
- 24.3 Explain the factors of money.

### **Understand bank and its functions.**

- 25.1 Define bank.
- 25.2 Describe commercial bank and its functions.
- 25.3 State central bank and its functions.

### **Understand cheque and dishonor of cheque.**

- 26.1 Define cheque.
- 26.2 Enlist the characteristics of cheque.
- 26.3 Identify the kinds of cheque.
- 26.4 Describe the causes of dishonor of a cheque.

### **Understand financial institutions.**

- 27.1 Explain IMF and its objectives.
- 27.2 Explain organisational setup and objectives of IDBP.
- 27.3 Explain organisational setup and objectives PIDC.



Total Contact Hours		T	P	C
Theory	64	2	3	3
Practical	96			

**Pre-requisite:** Workshop Practice-I

**AIMS.**

Measure and correct front end alignment and use of wheel alignment gauges.  
 Overhaul, service, repair and maintain the automotive springs, suspension, shock absorbers and steering system.  
 Diagnose steering and suspension troubles and their remedies.  
 Understand the various types of automotive brakes.  
 Diagnose the troubles of brake system and techniques of rectification.  
 Develop skill in static and dynamic balancing of wheels.  
 Know the Electronically controlled brake assist systems.

### **Detail of Contents:**

## **SUSPENSION**

1. **Function, importance , construction, types, working ,  
fault diagnosing, leveling and servicing of vehicle suspension system.** **16 Hours**
  - 1.1 Suspension system.
  - 1.2 Elements of suspension system.
  - 1.3 Types of suspension systems.
  - 1.4 Independent and Non-independent Suspension system.
  - 1.5 Components of suspension system.
    - a. Control arm
    - b. Steering knuckle.
    - c. Ball Joint.
    - d. Springs (coil and leaf)
    - e. Pivot shaft.
    - f. Shock Absorber.
    - g. Control arm bushing.
  - 1.6 Springs used in suspension system.
    - Leaf Springs.
    - Coil Springs
    - Torsion bar.
    - Air Spring.
  - 1.7 Performance of all suspension system springs.
  - 1.8 Purpose of Shock Absorber.
  - 1.9 Explain construction ,types and working principle of Shock absorber.
  - 1.10 Faults in shock absorber

- Worn Out.
- Damaged.
- Oil leakage, Air leakage and Gas leakage.
- Bended /deflected.
- 1.11 Methods to change shock absorber.
- 1.12 Replace springs (Coils spring , Leaf spring and torsion bar).
- 1.13 Remedies for the following faults in springs
  - Fatigue.
  - Curb height
  - Curb weight.
- 1.14 Types of front Suspension System.
  - Long and Short arm Suspension System.
  - Independent Front Suspension system with ball joints.
  - Independent Front Suspension system with king pin.
  - Front Axle Suspension with Leaf Springs.
  - Torsion Bar Suspension system.
  - Macpherson strut Suspension system.
  - Aromatics Suspension system .
- 1.15 Types of Rear Suspension system.
  - Non-independent Suspension system.
  - Dead axle ( Leaf spring suspension system & Coil spring suspension system ).
  - Semi- independent Suspension system.
  - Independent rear Suspension system.
- 1.16 Function and Working of electronically controlled vehicle modulated suspension system.
- 1.17 Purpose of vehicle suspension system Leveling.
- 1.18 Manual and automatic leveling system.
- 1.19 Servicing of Ball joints , Control arm bushing, Strut, Stabilizer bar, torsion bar.
- 1.20 Replacement of Ball joints, Bushing strut, Leaf spring and Coil Spring.
- 1.21 Servicing of Springs.
- 1.22 Problems of Suspension systems.

## **STEERING SYSTEM**

- |           |  |                 |
|-----------|--|-----------------|
| <b>2.</b> | <b>Construction , types , working , fault diagnosing, servicing and overhauling of vehicle steering system.</b>  | <b>16 Hours</b> |
|           | 2.1 Purpose of Steering System.  |                 |
|           | 2.2 Types of steering system.  |                 |
|           | 2.3 Components of Steering System (Steering wheel, Steering rod, Steering column, Steering gear box, Steering linkage , ball joints , and Tie-rod ends). |                 |
|           | 2.4 Purpose of Steering lock .   |                 |
|           | 2.5 Energy absorbing steering column.  |                 |

- 2.6 Different types of energy absorbing steering column.
- 2.7 Rigid and collapsible steering column / energy absorbing steering column.
- 2.8 Gear-ratio of Steering gear box.
- 2.9 Types of Steering gear box i.e recirculating ball, rack & pinion, worm & worm wheel.
- 2.10 Purpose of Steering linkage.
- 2.11 Steering linkage arrangements i.e Pitman arm, centre link (relay rod), idler arm, steering knuckle arm, tie rod, and steering knuckle.
- 2.12 Procedure for servicing the manual gear box type steering system.
- 2.13 Function of Power Steering.
- 2.14 Pascal's Law.
- 2.15 Main components of Power steering System.
- 2.16 Construction and working of following types of Power Steering Systems.
  - a. Rack & Pinion type power Steering system..
  - b. Integral Power steering system.
  - c. External Piston Linkage type Power steering system.
  - d. Electronically controlled type Power Steering System.
- 2.17 Characteristics of fluid used in Power steering System.
- 2.18 Faults and their remedies of Power steering System.
- 2.19 State the purpose of steering geometry.
- 2.20 Describe the Steering Geometry angles (Caster, Camber, King pin Inclination, Toe-in, Toe-out, & Toe out on turn).
- 2.21 Effects of minor change in Steering geometry angles on vehicle.
- 2.22 Procedure for checking the Steering Geometry angles (Caster, Camber, King Pin Inclination, Toe-in, or Toe-out).
- 2.23 Pre-alignment visual inspection and road test i.e. (Curb Height, Tire Condition, Steering system inspection, Vehicle track, General vehicle appearance, Pulling, Excessive noise and Vibration, Hard Steering).
- 2.24 Procedure for the computerized wheel Alignment of vehicle.
- 2.25 Causes and remedies of following problems. (Tramp, shimmy, Bubbling, Poor return, excessive wheel play, pulling or drifting, Hard Steering, wandering, of steering system) .

## **BRAKE SYSTEM**

- |           |   |                 |
|-----------|---|-----------------|
| <b>3.</b> | <b>Purpose ,construction, working, fault diagnosing and Servicing of brake System.</b>  | <b>16 Hours</b> |
|           | 3.1 Purpose of Brake System.<br>3.2 Construction, working principle, and working of each component of following types of Brake Systems.<br>Mechanical Brake System. |                 |

- Hydraulic Brake System (Disk and Drum type).
- Hydraulic type (vacuum assisted) Power Brake System.
- Pneumatic Brake System.
- Electric Brake System.
- 3.3 Construction and working of Parking Brake System(Mechanical and Automatic type).
- 3.4 Effectiveness of brake depends upon (Area of Brake Lining, amount of pressure applied, radius of brake drum, co-efficient of friction , radius of car wheel).
- 3.5 Factors involved in effectiveness of brake system(friction, brake Force, effect of weight ,brake system temperature and speed on braking distance)
- 3.6 Function and working of following types of vehicle electronically controlled assisted brake systems.
  - Anti-Lock Braking System (ABS System).
  - Electronic brake Force Distribution system (EBD System).
  - Vehicle Stability Control System (VSE).
  - Vehicle Electronically Controlled Traction Control System(VTC).
  - Vehicle Automatic Parking Brake System.
  - Vehicle Electro-pneumatically controlled exhaust brake system.
- 3.7 Standard Procedure for vehicle brake bleeding.
- 3.8 Properties of brake Fluid.
- 3.9 Possible causes and their remedies of following brake system problems.
  - (Spongy paddle excessive, paddle free ply, uneven braking, brake dragging, brake noise)

## **WHEEL AND TIRE**

- |           |  |                 |
|-----------|--|-----------------|
| <b>4.</b> | <b>Purpose, construction, types &amp; working of wheel and tire.</b> | <b>12 Hours</b> |
|-----------|--|-----------------|
- 4.1 Purpose of Wheels..
  - 4.2 Construction and types of wheels.
  - 4.3 Causes of wheel unbalancing.
  - 4.4 Importance of Wheel balancing.
  - 4.5 Types of wheel balancing methods.
    - Mechanical method of wheel balancing(Static and Dynamic methods).
    - Computerized method of wheel balancing.
  - 4.6 Purpose of tire.
  - 4.7 Types of tires (tube & tubeless tire).
  - 4.8 Construction of following types of tire.
    - Bias type tire.
    - Belted Bias Tire.
    - Radial Ply Tire.
  - 4.9 Ply rating.
  - 4.10 Terminology of tire.
    - (Tire size, Tire maximum load rating, Tire maximum inflation pressure, Tread ply ,tread pattern , aspect ratio, Dot No, tire grade, Tire wear, tire traction, tire temperature resistance).
  - 4.11 Purpose of tube.

- 4.12 Material, valve stem , cap and care of tube valve.
- 4.13 Vulcanizing.
- 4.14 Equipments needed for vulcanizing.
- 4.15 Material and steps to be taken for vulcanizing.
- 4.16 Tire retrading
- 4.17 Procedure for tire inflation.
- 4.18 Checking of tire pressure.
- 4.19 Importance of tire rotation & rotation pattern .
- 4.20 Effect of tire over inflation ,under inflation, toe-in, toe-out, camber, cornering, wear & unbalanced tire and rim.
- 4.21 Tire pressure electronically monitoring system.
- 4.22 Wheels (rim) and its types.

### **SUPPLEMENTARY RESTRAINED SYSTEMS (SRS)**

- |     |  |                |
|-----|--|----------------|
| 5.  | <b>Purpose , construction and working of supplementary restrained systems (SRS)air bag control system.</b> | <b>4 Hours</b> |
| 5.1 | Purpose of Air Bag Control System.   |                |
| 5.2 | Components of Air Bag Control system.  |                |
| 5.3 | Construction & Working of Air Bag Control System.  |                |

#### **Recommended Textbooks:**

1. Suspension & steering system by Clifton owen.
- Modern Automotive Mechanics by James E. Duffy.
- Automotive Technology A System Approach by Jack Erjavec

**Instructional Objectives:**

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

### **SUSPENSION**

1. **Understand the function, importance , construction, types, working , fault diagnosing, leveling and servicing of vehicle suspension system.**
  - 1.1 Define the Suspension system.
  - 1.2 Enlist the main components of suspension system.
  - 1.3 Enlist the types of suspension systems.
  - 1.4 Describe the Independent and Non-independent Suspension system.
  - 1.5 Identify the Components of suspension system.
    - Control arm
    - Steering knuckle.
    - Ball Joint.
    - Springs (coil and leaf)
    - Pivot shaft.
    - Shock Absorber.
    - Control arm bushing.
  - 1.6 Describe the types of springs used in suspension system.
    - Leaf Springs.
    - Coil Springs
    - Torsion bar.
    - Air Spring.
  - 1.7 Compare the performance of all suspension system springs.
  - 1.8 State the Purpose of Shock Absorber.
- 1.9 Explain construction ,types and working principle of Shock absorber.
- 1.10 Describe remedies for following faults in shock absorber
  - Worn Out.
  - Damaged.
  - Oil leakage, Air leakage and Gas leakage.
  - Bended /deflected.
- 1.11 Describe the methods to change the shock absorber.
- 1.12 Replace Springs (Coils spring , Leaf spring and torsion bar).
- 1.13 Describe Remedies for the following faults in springs
  - Fatigue.
  - Curb height
  - Curb weight.
- 1.14 Explain the Types of front Suspension System.
  - Long and Short arm Suspension System.
  - Independent Front Suspension system with ball joints.

- Independent Front Suspension system with king pin.
- Front Axle Suspension with Leaf Springs.
- Torsion Bar Suspension system.
- Macpherson strut Suspension system.
- Aromatics Suspension system .
- 1.15 Explain the types of Rear Suspension system.
  - Non-independent Suspension system.
  - Dead axle ( Leaf spring suspension system & Coil spring suspension system ).
  - Semi independent Suspension system.
  - Independent rear Suspension system.
- 1.16 Describe the function and Working of electronically controlled vehicle modulated suspension system.
- 1.17 State purpose of vehicle suspension system Leveling.
- 1.18 Classify the leveling system like manual and automatic.
- 1.19 Explain the Servicing of Ball joints , Control arm bushing, Strut, Stabilizer bar, torsion bar.
- 1.20 Explain replacement of Ball joints, Bushing strut, Leaf spring and Coil Spring.
- 1.21 Describe Servicing of Springs.
- 1.22I Identify the problems of Suspension systems.

## **STEERING SYSTEM**

- 2. **Understand the construction , types , working , fault diagnosing, servicing and overhauling, of vehicle steering system.**
  - 2.1 State the purpose of Steering System.
  - 2.2 State the types of steering system.
  - 2.3 Identify the components of Steering System (Steering wheel, Steering rod, Steering column, Steering gear box, Steering linkage , ball joints , and Tie-rod ends).
  - 2.4 State the purpose of Steering lock .
  - 2.5 Define energy absorbing steering column.
  - 2.6 Describe different types of energy absorbing steering column.
  - 2.7 Compare rigid and collapsible steering column / energy absorbing steering column.
  - 2.8 Describe gear-ratio of Steering gear box.
  - 2.9 Explain the types of Steering gear box i.e recirculating ball, rack & pinion, worm & worm wheel.
  - 2.10 State the purpose of Steering linkage.
  - 2.11 Describe the Steering linkage arrangements i.e Pitman arm, centre link (relay rod), idler arm, steering knuckle arm, tie rod, and steering knuckle.
  - 2.12 Describe the procedure for servicing the manual gear box type steering system.
  - 2.13 State the function of Power Steering.
  - 2.14 Define the “Pascal’s Law”.

- 2.15 Enlist the Main components of Power steering System.
- 2.16 Describe the Construction and working of following types of Power steering Systems.
  - Rack & Pinion type power Steering system..
  - Integral Power steering system.
  - External Piston Linkage type Power steering system.
  - Electronically controlled type Power Steering System.
- 2.17 State the characteristics of fluid used in Power steering System.
- 2.18 Describe the faults and their remedies of Power steering System.
- 2.19 State the purpose of steering geometry.
- 2.20 Describe the Steering Geometry angles (Caster, Camber, Kin pin Inclination, Toe-in, Toe-out, Toe out on turn).
- 2.21 Describe the effects of minor change in Steering geometry angles on vehicle.
- 2.22 Explain the procedure for checking the Steering Geometry angles (Caster, Camber, King Pin Inclination, Toe-in, or Toe-out).
- 2.23 Describe the pre-alignment visual inspection and road test i.e. (Curb Height, Tire Condition, Steering system inspection, Vehicle track, General vehicle appearance, Pulling, Excessive noise and Vibration, Hard Steering).
- 2.24 Describe the procedure for the computerized wheel Alignment of vehicle.
- 2.25 Describe the causes and remedies of following problems. (Tramp, shimmy, Bubbling, Poor return, excessive wheel play, pulling or drifting, Hard Steering, wandering, of steering system) .

## **BRAKE SYSTEM**

### **3. Understand the purpose ,construction, working, fault diagnosing, and servicing of brake System.**

- 3.1 State the purpose of Brake System.
- 3.2 Describe the Construction, working principle, and working of each component of following types of Brake Systems.
  - Mechanical Brake System.
  - Hydraulic Brake System (Disk and Drum type).
  - Hydraulic type (vacuum assisted) Power Brake System.
  - Pneumatic Brake System.
  - Electric Brake System.
- 3.3 Describe the construction and working of Parking Brake System(Mechanical and Automatic type).
- 3.4 Explain how does brake effectiveness depend upon (Area of Brake Lining, amount of pressure applied, radius of brake drum, co-efficient of friction , radius of car wheel).
- 3.5 Describe factors involved in effectiveness of brake system(friction, brake Force, effect of weight ,brake system temperature and speed on braking distance)
- 3.6 Describe the function and working of following types of vehicle electronically controlled assisted brake systems.



- Anti-Lock Braking System (ABS System).
  - Electronic brake Force Distribution system (EBD System).
  - Vehicle Stability Control System (VSE).
  - Vehicle Electronically Controlled Traction Control System(VTC).
  - Vehicle Automatic Parking Brake System.
  - Vehicle Electro-pneumatically controlled exhaust brake system.
- 3.7 Describe the standard Procedure for vehicle brake bleeding.
- 3.8 Describe the Properties of brake Fluid.
- 3.9 Describe the possible causes and their remedies of following brake system problems.  
(Spongy paddle excessive, paddle free ply, uneven braking, brake dragging, brake noise)

## **WHEEL AND TYRE**

### **4. Understand the purpose, construction, types & working of wheel and tire.**

- 4.1 State the Purpose of Wheels..
- 4.2 Describe the construction and types of wheels.
- 4.3 Describe the Causes of wheel unbalancing.
- 4.4 Describe the importance of Wheel balancing.
- 4.5 Describe the following types of wheel balancing methods.
  - Mechanical method of wheel balancing(Static and Dynamic methods).
  - Computerized method of wheel balancing.
- 4.6 State the Purpose of tire.
- 4.7 Describe the types of tires (tube & tubeless tire).
- 4.8 Describe the construction of following types of tire.
  - Bias type tire.
  - Belted Bias Tire.
  - Radial Ply Tire.
- 4.9 Define Ply rating.
- 4.10 Describe the following terminology of tire.
  - (Tire size, Tire maximum load rating, Tire maximum inflation pressure, Tread ply ,tread pattern , aspect ratio, Dot No, tire grade, Tire wear, tire traction, tire temperature resistance).
- 4.11 State the Purpose of tube.
- 4.12 Describe tube material, valve stem , cap and care of tube valve.
- 4.13 Define vulcanizing.
- 4.14 Enlist equipments needed for vulcanizing.
- 4.15 Describe the materials and steps to be taken for vulcanizing.
- 4.16 Describe tire retrading
- 4.17 State procedure for tire inflation.
- 4.18 Describe checking of tire pressure.
- 4.19 Describe the importance of tire rotation & rotation pattern .
- 4.20 Describe the effect of tire over inflation ,under inflation, toe-in, toe-out, camber, cornering, wear & unbalanced tire and rim on the vehicle performance.

- 4.21 Describe the tire pressure electronically monitoring system.
- 4.22 Describe the wheels (rim) and its types.

### **SUPPLEMENTARY RESTRAINED SYSTEMS (SRS)**

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**5. Understand the purpose , construction and working of supplementary restrained systems (SRS)air bag control system.**

- 5.1 State the purpose of Air Bag Control System.
- 5.2 Enlist the Components of Air Bag Control system.
- 5.3 Describe the construction & Working of Air Bag Control System.

**List of Practicals:**

Draw the Lay-out of Suspension System.

Remove leaf springs from the frame, dismantle ,check and reassemble.

Remove coil springs from front suspension, check and refit.

Dismantle shock absorber, inspect, service and refit.

Perform complete overhauling of front suspension (independent) and refit it.

Perform Removal of steering gearbox , servicing and refitting.

Visually inspect the steering wheel free play.

Check camber angle, caster angle and toe-in by using wheel alignment equipment.

Perform wheel Balancing (static and dynamic)on computerize wheel balancing machine.

Draw the sketch of Hydraulic Brake System.

Disassemble and assemble the brake master cylinder, wheel cylinder and brake shoes mechanism.

Perform bleeding of hydraulic brakes system..

Adjust the free play of brake pedal.

Perform to brake shoes adjustment.

Dismantle , inspect, refill and assemble the telescopic shock absorber .

Physical test and check the working of shock absorber without removing from vehicle.

Visually inspection of suspension, steering and brake system .

Visually inspection of vehicle tire and wheel .

Perform removing wheel from the vehicle ,tire from the rim by using tire changer Machine & vulcanize it , refit, and reinstall.

Prepare a project (sectional/working model) relevant to the subject.

(this activity may be performed in a group of students).

Visit at Modern Automotive workshop , and Prepare a report relating to (Computerize wheel alignment & computerize wheel balancing).

**AD-224**

## **WORKSHOP PRACTICE-II**

Total Contact Hours		<b>T</b>	<b>P</b>	<b>C</b>
<b>Theory</b>	<b>64</b>	<b>2</b>	<b>6</b>	<b>4</b>
<b>Practical</b>	<b>192</b>			

**Pre-requisite:** I.C. Engines and Workshop Practice-I  
**AIMS.**

1. Understand the use of different tools, instruments, equipments for disassembly, assembly and testing of an engines.
2. Show skill in locating the faults of the engines.
3. Show skill in using lubrication equipment .
4. Understand periodic classes of lubrication .

### **Detail of Contents:**

## **AUTOMOTIVE HAND TOOLS**

### **1. Use of automotive hand tools**

**12 Hours**

- Automotive hand tools.
- a) Screw driver ( Flat, Philips/, impact)
  - b) Hammers
  - c) Pliers
  - d) Lock Pliers.
  - e) Spanners & Wrenches Set  
(Open end, Box type, Combination, Off set, Tubing)
  - f) Socket set (with all accessories).
  - g) Torque wrench
  - h) Pullers ( Gears, Bearing, Pulleys, Steering).
  - i) Oil Seal extractors and installers.
  - j) Tube bender , Tube cutter and Flaring tool.
  - k) Strap Wrench ( Oil Filter wrench)
  - l) automotive stethoscope
  - m) Valve Spring Compressor.
  - n) Piston Ring Compressor.
  - o) Piston Ring Expander.
  - p) Grease Gun
  - q) Flexible wire magnet.
  - r) Pop Rivet Plier.
  - s) Tin Snips.
  - t) Hack Saw.
  - u) Punches & Chisels.
  - v) Hollow punch set.
  - w) Spark plug spanner.
  - x) Allen Key

# **AUTOMOTIVE MEASURING TOOLS**

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- 2. Use of automotive measuring tools.** **4 Hours**
- 2.1. Automotive measuring tools.
- a) Steel Foot rule.
  - b) Spring Scale.
  - c) Venire Caliper.
  - d) Micrometer (inside & out side).
  - e) Dial Gauge.
  - f) Depth gauge.
  - g) Thickness / Feeler gauge.
  - h) Thread pitch gauge
  - i) Wire gauge.
  - j) Belt tension gauge.
  - k) Telescoping gauge.
  - l) Tire Pressure gauge.

## **AUTOMOTIVE WORKSHOP EQUIPEMENTS.**

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- 3. Purpose, types and use of automotive equipments.** **12 Hours**
- 3.1 Automotive equipments.
- a) Chain Pulley Block.
  - b) Car Lift ( Post Lift, Scissor Lift, Hydraulic lift)
  - c) Crane (hydraulic, pneumatic).
  - d) Spark Plug Cleaner Machine.
  - e) Automotive Tire changer.
  - f) Electronic Injector Testing Machine.
  - g) Heavy Duty Digital Tire inflator.
  - h) Engine repairing stand and repair trolley.
  - i) Compressor and pneumatic tool.
  - j) Ramp & Pits.
  - k) Waste Oil Receptacle .
  - l) Hydraulic press.
  - m) Mechanical Arbor press.
  - n) Drill Machine (Bench & Portable).
  - o) Grinder (Bench & Portable)
  - p) Radiator Pressure Cap tester.
  - q) Stud extractor.
  - r) Conveyers.
  - s) Jack ( mechanical, hydraulic)
  - t) Safety stands ( Floor stands).
  - u) Creeper.
  - v) Valve Ginding and Refacing Machine.
  - w) Cleaning Tank.

## **INTRODUCTION OF FASTENERS.**

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- 4. Function, types and construction of fasteners. 4 Hours**
- 4.1 Purpose of Fasteners.
  - 4.2 Fasteners and its types.
  - 4.3 Fasteners threads, pitch, and size.
  - 4.4 Nuts and Lock washers and its types.
  - 4.5 Purpose of Snap ring and its types.
  - 4.6 Purpose of Rivet and its types
  - 4.7 Fasteners thread Lubrication.

## **AUTOMOTIVE ENGINE TESTING INSTRUMENTS.**

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- 5. Purpose and use of automotive testing instruments. 6 Hours**
- 5.1 Instruments on engine.
    - c. Tachometer.
    - d. Compression Gauge.
    - e. Vacuum Gauge.
    - f. Engine Leakage Tester.
    - g. Ignition Timing Gun.

## **AUTOMOTIVE DIAGNOSTIC/TESTING**

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- 6. Purpose and use of automotive diagnostic techniques. 4 Hours**
- 6.1. Automotive Diagnosing Techniques.
    - Describe the basic rules (steps) of diagnosing of troubles.
    - Enlist troubles of vehicle in the light of driver complaints.
    - Identification of engine noises , their causes and their possible remedies.
    - Identification of engine faults , their causes and their possible remedies.
- 7. Use of engine analyzer, engine diagnostic scanner, dynamometer and exhaust gas analyzer. 6 Hours**
- 7.1 Engine Analyzer.
  - 7.2 Types ( Handy and portable computerized) and use of engine analyzer.
  - 7.3 Oscilloscope and its uses.
  - 7.4 Ignition pattern formation on oscilloscope
  - 7.5 Purpose of Automotive Diagnostic Scanner and its use.
  - 7.6 Purpose of Dynamometer.
  - 7.7 Types (Electrical and Hydraulic type), and use of
    - Dynamometer for testing Brake power and fuel consumption of an engine.
    - Describe the use of Universal Automotive Diagnostic Scanner/OBD-III
    - State the Purpose of Exhaust Gas Analyzer.
    - Describe the types ( 2,4,& 5-gas Analyzer) and use of exhaust Gas analyzer.
    - Describe the Safety Precautions for Tools and equipments.

## **AUTOMOTIVE**

### **LUBRICANTS / SEALS / GASKETS / BEARINGS.**

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8. **Importance and use of automotive lubricants.** **3 Hours**  
8.1 Purpose and importance of Lubricants( Oils).  
8.2 Types of Lubricants.  
8.3 Viscosity and Viscosity index.  
8.4 Additives in Lubricating oils.  
8.5 Parts of engine where Lubrication is necessary  
and Selection of proper Lubricant.  
8.6 Vehicle where Lubrication is necessary and  
Selection of proper Lubricant.
9. **Materials and application of seals and gaskets.** **2 Hours**  
9.1 Purpose and importance of Seals .  
9.2 Material , types, and application of seals.  
9.3 Purpose and importance of Gaskets .  
9.4 Material , types, and application of Gaskets.  
9.5 Causes and remedies of Seals and Gaskets Failure.
10. **Types, materials and application of bearing.** **3 Hours**  
10.1 Purpose of Bearings.  
10.2 Material , types(Friction & Antifriction), size, and  
application of Bearings.  
10.3 Antifriction bearings in vehicle with special reference(load and size).  
10.4 Inspection of antifriction Bearing.  
10.5 Methods of removing and installing of bearing.

### **MACHINING & REFINISHING OF AUTOMOTIVE ENGINE PARTS WITH USE OF MACHINES**

11. **Importance and use of automotive lubricants.** **3 Hours**  
11.1 Crank shaft grinding.  
11.2 Engine cylinder sleeving, boring and honing.  
11.3 Brake drum turning.  
11.4 Valve grinding, refacing and lapping.

### **QUALITY CONTROL**

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12. **Standards and their certification.** **1 Hour**  
12.1 Quality Control Standards for followings  
a. Workers timing.

Just in time (J.I.T)  
Brain Storming.  
Data Collection.  
Quality Control and their Systematic application.

**13. Quality and its measures. 2 Hours**

- 13.1 Characteristics of quality in materials, performance and reliability of the product.
- 13.2 Quality w.r.t design, conformance, performance and Services.
- 13.3 Quality control and quality assurance .
- 13.4 Total quality management .
- 13.5 ISO-9000 and its application.
- 13.6 ISO-14000 and its application.

## **SAFETY & PREVENTION**

**14. Fire accident and their prevention. 2 Hours**

- 14.1 Accidents and their prevention.
  - Causes of Fire hazards.
  - Describe the types of Fire .
  - Methods of fire extinguishing.
  - Types and use of fire extinguishers.
  - PASS Method for fire extinguisher.
- P- Pull to safety pin
- A- Aim to seat of fire
- S- Squeeze the valve
- S- Sweep

### **Recommended Textbooks:**

Automotive Excellence ( Volume 1 & 2 ) by McGRAW Hill International  
Automotive Tools manual by Haynes Techbook  
Modern Automotive Mechanics by James E. Duffy.  
Automotive Technology A System Approach by Jack Erjavec



**Instructional Objectives:**

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

**AUTOMOTIVE HAND TOOLS****1. Understand the use of automotive hand tools**

Describe the function, types, and use of following automotive hand tools.

Screw driver ( Flat, Philips/, impact)  
Hammers  
Pliers  
Lock Pliers.  
Spanners & Wrenches Set  
(Open end, Box type, Combination, Off set, Tubing)  
Socket set (with all accessories).  
Torque wrench  
Pullers ( Gears, Bearing, Pulleys, Steering).  
Oil Seal extractors and installers.  
Tube bender , Tube cutter and Flaring tool.  
Strap Wrench ( Oil Filter wrench)  
automotive stethoscope  
Valve Spring Compressor.  
Piston Ring Compressor.  
Piston Ring Expander.  
Grease Gun  
Flexible wire magnet.  
Pop Rivet Plier.  
Tin Snips.  
Hack Saw.  
Punches & Chisels.  
Hollow punch set.  
Spark plug spanner.  
Allen Key

**AUTOMOTIVE MEASURING TOOLS**

**Understand the use of automotive measuring tools.**

- 2.2. Describe the function, types and use of following automotive measuring tools.
- Steel Foot rule.
  - Spring Scale.
  - Vernier Caliper.
  - Micrometer (inside & out side).
  - Dial Gauge.
  - Depth gauge.
  - Thickness / Feeler gauge.
  - Thread pitch gauge
  - Wire gauge.
  - Belt tension gauge.
  - Telescoping gauge.
  - Tire Pressure gauge.

## **AUTOMOTIVE WORKSHOP EQUIPEMENTS.**

### **3. Understand the purpose, types and use of automotive equipments.**

3.1 Describe the purpose, types, and use of following automotive equipments.

- Chain Pulley Block.
- Car Lift ( Post Lift, Scissor Lift, Hydraulic lift)
- Crane (hydraulic, pneumatic).
- Spark Plug Cleaner Machine.
- Automotive Tire changer.
- Electronic Injector Testing Machine.
- Heavy Duty Digital Tire inflator.
- Engine repairing stand and repair trolley.
- Compressor and pneumatic tool.
- Ramp & Pits.
- Waste Oil Receptacle .
- Hydraulic press.
- Mechanical Arbor press.
- Drill Machine (Bench & Portable).
- Grinder (Bench & Portable)
- Radiator Pressure Cap tester.
- Stud extractor.
- Conveyers.
- Jack ( mechanical, hydraulic)
- Safety stands ( Floor stands).
- Creeper.
- Valve Ginding and Refacing Machine.
- Cleaning Tank.

## **INTRODUCTION OF FASTENERS.**

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**Understand the function, types and construction of fasteners.** 4.8 Describe the Purpose of Fasteners.

- 4.9 Describe Fasteners and its types.
- 4.10 Describe Fasteners threads, pitch, and size.
- 4.11 Describe Nuts and Lock washers and its types.
- 4.12 Describe the Purpose of Snap ring and its types.
- 4.13 Describe the Purpose of Rivet and its types
- 4.14 Describe Fasteners thread Lubrication.

## **AUTOMOTIVE ENGINE TESTING INSTRUMENTS.**

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**Understand the purpose and use of automotive testing instruments.**  
5.2 Describe the function, and use of following instruments on engine.

- Tachometer.
- Compression Gauge.
- Vacuum Gauge.
- Engine Leakage Tester.
- Ignition Timing Gun.

## **AUTOMOTIVE DIAGNOSTIC/TESTING**

---

**Understand the purpose and use of automotive diagnostic techniques.**  
6.2. State the Purpose of Automotive Diagnosing Techniques.  
Describe the basic rules (steps) of diagnosing of troubles.  
Enlist troubles of vehicle in the light of driver complaints.  
Identification of engine noises , their causes and their possible remedies.  
Identification of engine faults , their causes and their possible remedies.

**Understand the purpose , use of engine analyzer, engine diagnostic scanner, dynamometer and exhaust gas analyzer.**

- 7.1 State the Purpose of Engine Analyzer.
- 7.2 Describe the types ( Handy and portable computerized) and use of engine analyzer.
- 7.3 Describe Oscilloscope and its uses.
- 7.4 Demonstrate ignition pattern formation on oscilloscope
- 7.5 State the purpose of Automotive Diagnostic Scanner and its use.
- 7.6 State Purpose of Dynamometer.
- 7.7 Describe the types (Electrical and Hydraulic type), and use of Dynamometer for testing Brake power and fuel consumption of an engine.  
Describe the use of Universal Automotive Diagnostic Scanner/OBD-III  
State the Purpose of Exhaust Gas Analyzer.  
Describe the types ( 2,4,& 5-gas Analyzer) and use of exhaust Gas analyzer.

- e. Describe the Safety Precautions for Tools and equipments.

## **AUTOMOTIVE LUBRICANTS / SEALS / GASKETS / BEARINGS.**

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### **Understand purpose, types , importance and use of automotive lubricants. 8.1**

Describe the Purpose and importance of Lubricants( Oils).

8.2 Describe the types of Lubricants.

8.3 Describe Viscosity and Viscosity index.

8.4 Explain Oil additives in Lubricating oils.

8.5 Identify the Parts of engine where Lubrication is necessary and Selection of proper Lubricant.

8.6 Identify the different points of Vehicle where Lubrication is necessary and Selection of proper Lubricant.

### **Understand the purpose, types, materials and application of seals and gaskets.**

9.1 State Purpose and importance of Seals.

9.2 Describe the Material , types and application of seals.

9.3 State Purpose and importance of Gaskets .

9.4 Describe the Material , types and application of Gaskets.

9.5 Describe the Causes and remedies of Seals and Gaskets Failure.

### **Understand the purpose, types, materials and application of bearing.**

10.1 State the Purpose of Bearings.

10.2 Describe the material , types(Friction & Antifriction), size, and application of Bearings.

10.3 Use of antifriction bearings in vehicle with special reference(load and size).

10.4 Describe the inspection of antifriction Bearing.

10.5 Describe the methods of removing and installing of bearing.

## **MACHINING & REFINISHING OF AUTOMOTIVE ENGINE PARTS WITH USE OF MACHINES**

### **Understand purpose, types , importance and use of automotive lubricants. 11.1**

Describe crank shaft grinding.

11.2 Describe engine cylinder sleeve fitting, boring and honing.

11.3 Describe brake drum turning.

11.4 Describe valve grinding, refacing and lapping.

## **QUALITY CONTROL**

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### **Understand the quality control standards and their certification.**

12.1 Describe the Quality Control Standards for followings.

Workers timing.  
 Just in time (J.I.T)  
 Brain Storming.  
 Data Collection.  
 Quality Control and their Systematic application.

**Understand the quality and its measures.**

- 13.1 State the characteristics of quality in materials, performance and reliability of the product.
- 13.2 Quality w.r.t design, conformance, performance and Services.
- 13.3 Quality control and quality assurance.
- 13.4 Describe total quality Management.
- 13.5 Describe ISO-9000 and its application.
- 13.6 Describe ISO-14000 and its application.

**SAFETY & PREVENTION**

---

**Understand fire accident and their prevention.**

- 14.1 Describe fire accidents and their 14.
- 14.2 Describe the causes of fire hazards.
- 14.3 Describe the types of fire .
- 14.4 Describe the methods of fire extinguishing.
- 14.5 Describe the types and use of fire extinguishers.
- 14.6 Describe PASS Method for fire extinguisher. P- Pull to safety pin  
 B- Aim to seat of fire  
 S- Squeeze the valve  
 S- Sweep

**List of Practical:**

Identification of basic hand tools.  
Practice to use Piston Ring Compressor.  
Practice to use Valve spring Compressor.  
Practice to use Oil Filter wrenches.  
Practice to bend, cut and Flare the tube.  
6. Practice to change the tire by using the Jack properly .  
Measure the size of Crankshaft Journal by Using Micrometer .  
Practice the proper use of Pullers for the removal of Gears and Bearings,  
Check the Ovality and taperness of engine cylinder by using Dial Gauge.  
Practice to use Chain Pulley Block and Shop Crane for removal of engine  
from the Vehicle. (also practice to use tachometer for measuring engine RPM).  
11. Find the compression pressure of an engine Using Compression Gauge.  
Find the vacuum pressure of intake manifold Using Vacuum Gauge.  
find the Leakage of compression pressure by Using Cylinder Leakage Tester.  
Check and Adjust the ignition timing by using Ignition Timing Gun.  
Identify the different engine noises by using Stethoscope.  
Perform the minor engine Tune-up of an engine.  
Practice to use Automotive Diagnostic Scanner for Fault finding of Vehicle.  
Practice to use of Exhaust Gas Analyzer to check exhaust emission.  
Identify the Vehicle Lubricating Points and Lubricate them by using Grease Gun.  
Prepare Gas kit from given on a Sheet.  
Change Engine Head Gasket.  
Practice to use different kinds of Fire Extinguisher .  
Test exhaust emissions by using of exhaust gas analyzer.  
Use of engine analyzer to check and rectify faults in ignition system of S.I. engine.  
Prepare a project (model/ system with diagnosing instruments/equipments) relevant  
to the subject.(this activity may be perform in a group of students)  
Visit at Modern Automotive workshop to observe proper use of different kinds of  
tools, instruments and equipment.

Total Contact Hours		T	P	C
Theory	32	1	3	2
Practical	96			

**AIMS:** To transfer the knowledge of fundamentals of thermodynamics, laws and properties of gases, thermodynamic processes and cycles, formation and properties of steam, steam boilers and their performance, steam and Gas turbines, I.C. Engines, Air compressors and their performance, etc.

### Detail of Contents:

1. **Fundamentals of thermodynamics.** **3 Hours**
  - 1.1 State the following
    - a. Fundamentals of thermodynamics.
    - b. Units and Systems of Units.
  - 1.2 Thermodynamic systems and its types.
  - 1.3 State the following .
    - a. Heat.
    - b. Mass & Weight.
    - c. Force.
    - d. Work done.
    - e. Power
  - 1.4 Describe the the following.
    - Temperature.
    - Absolute temperature.
    - Temperature Scales.
    - Normal temperature & Pressure.
  - 1.5 Describe the following.
    - Pressure & Absolute pressure.
    - Gauge pressure & Vacuum pressure.
  - 1.6 State the following.
    - a. Energy, Potential energy, Kinetic energy, Chemical energy, Thermal/Heat energy.
    - b. Internal energy of the Gas.
    - c. The working Fluid.
    - d. Liquid, Vapor & Gas.
  - 1.7 Describe the following.
    - a. Laws of thermodynamics.
    - b. Law of conservation of energy.
2. **Laws and properties of perfect gases** **3 Hours**
  - 2.1 Perfect gas and its properties.
  - 2.2 Derive the mathematical relations.

- Boyle's law.
- Charles's law
- Joule's law
- 2.3 Derive the mathematical relations..
  - General gas equation
  - Characteristic Gas equation
  - Universal Gas equation
- 2.4 Describe the following.
  - The two specific heats of a gas and derive its mathematical relations.
- 2.5 State the following. a.
  - Enthalpy of a Gas

### 3. **Thermodynamics Processes and Cycles.** **8 Hours**

- 3.1 Thermodynamic process.
- 3.2 Classification /Types of thermodynamic processes
- 3.3 Describe the following.
  - The Non-flow-Reversible & Irreversible processes with the help of P-V diagram.
  - The constant volume process with the help of P-V diagram; also derive its mathematical relations for work done during expansion.
  - The constant pressure process with the help of P-V diagram; also derive its mathematical relations for work done during expansion.
  - The constant temperature process with the help of P-V diagram, also derive its mathematical relation for work done during expansion.
  - The adiabatic process with the help of P-V diagram; also derive its mathematical relations for work done during expansion
  - The polytrophic process with the help of P-V diagram also derive its mathematical relations for work done during expansion
- 3.4 Describe the following.
  - Thermodynamic cycle with the help of P-V diagram.
  - Types of thermodynamic cycles.
- 3.5 Reversible & Irreversible cycles with help of PV diagram
- 3.6 Explain the following.
  - CARNOT CYCLE with the help of P-V diagram; also derive its mathematical relations for Air Standard Efficiency during the cycle of operation.
  - OTTO CYCLE with the help of P-V diagram; also derive its mathematical relations for Air Standard Efficiency during the cycle of operation.
  - DIESEL CYCLE with the help of P-V diagram; also derive its mathematical relations for Air Standard Efficiency during the cycle of operation.
  - Joule's Cycle with the help of P-V diagram, also derive its mathematical relations for air standard efficiency during cycle of operation
  - DUAL COMBUSTION CYCLE with the help of P-V diagram; also derive its mathematical relations for Air Standard Efficiency during the cycle of operation.



- 4. Formation and properties of Steam. 2 Hours**
- 4.1 Steam formation and its properties
  - 4.2 Important terms used for steam
- 5. Understand the Steam Boilers & its performance. 4 Hours**
- 5.1 Working and general construction of a boiler
  - 5.2 Classification of boilers
  - 5.3 Selection factors of a good steam boiler
  - 5.4 Important terms used for steam boilers
  - 5.5 Explain the Following:
    - The construction and working of Simple Vertical Boiler with the help of neat sketch
    - The construction and working of COCHRAN Boiler (Multi tubular boiler) with the help of neat sketch
    - The construction and working of Babcock and Wilcox Boiler with the help of neat sketch
  - 5.6 List of boiler mountings & accessories:
  - 5.7 Comparison between Water tube and Fire tube boilers
  - 5.8 Mathematical expressions of following
    - Performance of boiler
    - Equivalent evaporation of boiler
    - Efficiency of boiler

The formulae for the calculation of power /H.P and efficiency of boiler
- 6. Steam and Gas Turbines. 3 Hours**
- 6.1 Classification of turbines
  - 6.2 De-Level Impulse turbine with the help of neat sketch .
  - 6.3 PARSON'S Reaction turbine with the helping neat sketch .
  - 6.4 Gas Turbines.
- 7. Internal Combustion Engines. 4 Hours**
- 7.1 State the following.
    - Torque, and it's unit in SI system.
    - Mean effective pressure.
    - Indicated power and its formula..
    - Brake Horse power and its formula.
    - Measurement of Brake Horse power.
    - Friction Horse power.
    - Mechanical efficiency.
    - Thermal efficiency.
    - Volumetric efficiency.

**8. Air Compressors and their performance(Reciprocating & Rotary). 5 Hours**

- 8.1 Introduction of Air Compressors
- 8.2 Types of Air Compressors(Reciprocating & Rotary)
- 8.3 Terms used for Air Compressors
- 8.4 Single stage reciprocating Air Compressor with the help of PV diagram and sketch.
- 8.5 Work done per cycle by a single stage reciprocating Air Compressor without and with clearance volume, considering the following laws of compression.
  - Isothermal Compression.
  - Isentropic compression.
  - Polytrophic compression.
- 8.6 Multistage compression and its advantages.
- 8.7 Two stage reciprocating air compressor with intercooler; also derive its mathematical Expression for the work done per cycle considering polytrophic law of compression .
- 8.5 Power required to drive a single stage and two stages reciprocating Air compressors; also derive its formulae
- 8.6 Reciprocating and rotary air compressors
- 8.7 Problems regarding work done and power required to drive the reciprocating air compressors (for single stage and multistage).

**Recommended Textbooks:**

Applied Thermodynamics T.D Eastop, A. Mcconkey

Engineering Thermodynamics by Rayner Joel

Heat Engines by D.A Low (McGraw Hill Book Company , New York)

4. Mechanical Technology (Thermal Engineering) By R.S Khurmi

Heat Applied to Heat Engines by Metcalfe

**Instructional Objectives:**

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

**Understand the fundamentals of thermodynamics.**

- 1.1 State the following
  - Fundamentals of thermodynamics.
  - Units and Systems of Units.
- 1.2 Describe the thermodynamic systems and its types.
- 1.3 State the following .
  - Heat.
  - Mass & Weight.
  - Force.
  - Work done.
  - Power
- 1.4 Describe the the following.
  - Temperature.
  - Absolute temperature.
  - Temperature Scales.
  - Normal temperature & Pressure.
- 1.5 Describe the following.
  - Pressure & Absolute pressure.
  - Gauge pressure & Vacuum pressure.
- 1.6 State the following.
  - Energy, Potential energy, Kinetic energy,
  - Chemical energy, Thermal/Heat energy.
  - Internal energy of the Gas.
  - The working Fluid.
  - Liquid, Vapor & Gas.
- 1.7 Describe the following.
  - Laws of thermodynamics.
  - Law of conservation of energy.

**Understand the laws and properties of perfect gases**

- 2.1 State the perfect gas and its properties.
- 2.2 Describe the following and derive its mathematical relations.
  - Boyle's law.
  - Charles's law
  - Joule's law
- 2.3 Describe the following; also derive its mathematical relations.
  - General gas equation
  - Characteristic Gas equation

Universal Gas equation

2.4 Describe the following.

The two specific heats of a gas and derive its mathematical relations.

2.5 State the following.

Enthalpy of a Gas

### **Understand the Thermodynamics Processes and Cycles. 3.1**

State the thermodynamic process.

3.2 State Classification /Types of thermodynamic processes

3.3 Describe the following.

The Non-flow-Reversible & Irreversible processes with the help of P-V diagram.

The constant volume process with the help of P-V diagram; also derive its mathematical relations for work done during expansion.

The constant pressure process with the help of P-V diagram; also derive its mathematical relations for work done during expansion.

The constant temperature process with the help of P-V diagram, also derive its mathematical relation for work done during expansion.

The adiabatic process with the help of P-V diagram; also derive its mathematical relations for work done during expansion

The polytrophic process with the help of P-V diagram also derive its mathematical relations for work done during expansion

3.4 Describe the following.

Thermodynamic cycle with the help of P-V diagram.

Types of thermodynamic cycles.

3.5 Describe the Reversible & Irreversible cycles with help of PV diagram

3.6 Explain the following.

CARNOT CYCLE with the help of P-V diagram; also derive its mathematical relations for Air Standard Efficiency during the cycle of operation.

OTTO CYCLE with the help of P-V diagram; also derive its mathematical relations for Air Standard Efficiency during the cycle of operation.

DIESEL CYCLE with the help of P-V diagram; also derive its mathematical relations for Air Standard Efficiency during the cycle of operation.

Joule's Cycle with the help of P-V diagram, also derive its mathematical relations for air standard efficiency during cycle of operation

DUAL COMBUSTION CYCLE with the help of P-V diagram; also derive its mathematical relations for Air Standard Efficiency during the cycle of operation.

### **Understand the Formation and properties of Steam.**

4.1 Describe the steam formation and its properties

4.2 State the important terms used for steam

### **Understand the Steam Boilers & its performance .**

- 5.1 Describe the working and general construction of a boiler
- 5.2 Describe the classification of boilers
- 5.3 State the selection factors of a good steam boiler
- 5.4 Describe the important terms used for steam boilers
- 5.5 Explain the Following:
  - The construction and working of Simple Vertical Boiler with the help of neat sketch
  - The construction and working of COCHRAN Boiler (Multi tubular boiler) with the help of neat sketch
  - The construction and working of Babcock and Wilcox Boiler with the help of neat sketch
- 5.6 State the List of boiler mountings & accessories:
- 5.7 Make a Comparison between Water tube and Fire tube boilers
- 5.8 Describe the following with the help of mathematical expressions
  - Performance of boiler
  - Equivalent evaporation of boiler
  - Efficiency of boiler

The formulae for the calculation of power /H.P and efficiency of boiler

### **Understand the Steam and Gas Turbines.**

- 6.1 State the introduction and classification of turbines
- 6.2 Explain construction and working of De-Level Impulse turbine with the help of neat sketch .
- 6.3 Explain the construction and working of PARSON'S Reaction turbine with the helping neat sketch .
- 6.4 Describe the introduction of Gas Turbines.

### **Understand the Internal Combustion Engines.**

- 7.1 State the following.
  - Torque, and it's unit in SI system.
  - Mean effective pressure.
  - Indicated power and its formula..
  - Brake Horse power and its formula.
  - Measurement of Brake Horse power.
  - Friction Horse power.
  - Mechanical efficiency.
  - Thermal efficiency.
  - Volumetric efficiency.

### **Understand the Air Compressors and their performance(Reciprocating & Rotary).**

- 8.1 State the introduction of Air Compressors
- 8.2 Describe the types of Air Compressors(Reciprocating & Rotary)
- 8.3 State the terms used for Air Compressors
- 8.4 Describe the construction and working of single stage reciprocating Air Compressor with the help of PV diagram and sketch.

- 8.5 Describe the work done per cycle by a single stage reciprocating Air Compressor without and with clearance volume, considering the following laws of compression.  
Isothermal Compression.  
Isentropic compression.  
Polytrophic compression.
- 8.6 Describe the multistage compression and its advantages.
- 8.7 Describe the two stage reciprocating air compressor with intercooler; also derive its mathematical Expression for the work done per cycle considering polytrophic law of compression .
- 8.8 Describe the power required to drive a single stage and two stages reciprocating Air compressors; also derive its formulae
- 8.9 Make a comparison of reciprocating and rotary air compressors
- 8.10 Solution of the problems regarding work done and power required to drive the reciprocating air compressors (for single stage and multistage).

**List of Practicals:**

Pressure measurement by barometer.

Solve problems based on laws of perfect gases.

Solve problems Based on heating and expansion of gases .

Solve problems based on air cycles.

Solve problems based on Steam Boilers.

Solve problems based on performance of I.C. Engines.

Solve problems based on air compressors.

Performance test of reciprocating air compressor .

Performance test of Gas turbine.

Visit at thermal power plant to familiar with the working environment.

**TOTAL CONTACT HOURS**

Theory: 64 hours

Practical: 96 hours

T	P	C
2	3	3

**Pre-requisite:** None

- AIMS**
1. Know the transmission of power in Agriculture
  - Know the use of rubber tire for farm equipment
  - Know the farm mechanization
  - Know the tillage & traction dynamics of Tractor
  - Understand the primary tillage machinery
  - Understand the secondary tillage machinery
  7. Understand the planting and seeding equipment
  8. Know the Spraying Equipment

**COURSE CONTENTS:**

- |  |                |
|--|----------------|
| <b>1. TRANSMISSION OF POWER</b>                                  | <b>8 hours</b> |
| 1.1 Introduction   |                |
| 1.2 Direct drives  |                |
| 1.3 Pulleys and belts  |                |
| 1.4 Length of V belt   |                |
| 1.5 Pulleys and sheaves  |                |
| 1.6 Rules for belts  |                |
| 1.7 Precautions in using belts                                   |                |
| 1.8 Sprocket wheels and chains                                   |                |
| 1.9 Power take-off shafts and universal joints                   |                |
| 1.10 Flexible shafting   |                |
| <b>2. RUBBER TIRES FOR FARM EQUIPMENT</b>                        | <b>4 hours</b> |
| 2.1 Advantages of rubber tires                                   |                |
| 2.2 Disadvantages of rubber tires                                |                |
| 2.3 Types of rubber tires  |                |
| 2.4 Agricultural tire code                                       |                |
| 2.5 Ply rating of tires  |                |
| 2.6 Tire size  |                |
| 2.7 Inflation pressures  |                |
| 2.8 Rim for tractor and implement tires                          |                |
| 2.9 Life of Agricultural pneumatic tires                         |                |
| 2.10 Traction of tires   |                |
| 2.11 Effect of weighting tires                                   |                |
| 2.12 Blasting of rubber tires                                    |                |
| 2.13 Define rolling resistance & soil deformation under Tires    |                |
| <b>3. FARM MECHANIZATION</b>                                     | <b>4 hours</b> |
| 3.1 Introduction of Farm Mechanization                           |                |
| 3.2 Advantages of Farm Mechanization                             |                |
| 3.3 Disadvantages of Farm Mechanization                          |                |
| 3.4 Employment opportunities in agricultural power and machinery |                |
| 3.5 Skills and competencies needed for job entry                 |                |



- |        |  |                     |
|--------|--|---------------------|
| 4.     | Tractor  | 8 Hours             |
| 4.1    | traction & Tractor   |                     |
| 4.2    | Purpose and Advantages of Tractor  |                     |
| 4.3    | Makes & models of tractors in Pakistan                                       |                     |
| 4.4    | Structure of Tractor & weight transfer                                       |                     |
| 4.5    | Specification /salient features of different Tractors in Pakistan            |                     |
| 4.6    | Types of tractor w.r.t. HP & working   |                     |
| 4.9    | Tractor hour meter purpose & working principal                               |                     |
| 4.10   | Tractors instrument panel & Control levers (Draft control, position control, |                     |
| 4.11   | Periodic maintenance chart of tractor  |                     |
| 4.13   | Safety precautions regarding tractor Operations (safety signs for tractor)   |                     |
| 4.14   | Tractive force & Tractive efficiency   |                     |
| 4.15   | Static Equilibrium & center of gravity                                       |                     |
| 4.16   | Weight transfer & dynamic equilibrium  |                     |
| <br>5. | <br><b>PRIMARY TILLAGE MACHINERY</b>   | <br><b>10 hours</b> |
| 5.1    | Tillage  |                     |
| 5.2    | Objectives of tillage  |                     |
| 5.3    | Purpose of primary tillage machinery   |                     |
| 5.4    | Mold board plows   |                     |
| 5.5    | Types of bottoms of M.B.Plows  |                     |
| 5.6    | Types of shares of M.B. Plows  |                     |
| 5.7    | Rolling coulters of M.B. Plows   |                     |
| 5.8    | Types of M.B.Plows   |                     |
| 5.9    | Power requirements of M.B.Plows  |                     |
| 5.10   | Disk plow  |                     |
| 5.11   | Chisel plows   |                     |
| 5.12   | Sub- soilers   |                     |
| 5.13   | Rotary plows   |                     |
| 5.14   | Hitches of plows   |                     |
| 5.15   | laser land lever   |                     |
| <br>6. | <br><b>SECONDARY TILLAGE MACHINERY</b>                                       | <br><b>10 hours</b> |
| 6.1    | Purpose of secondary tillage machinery                                       |                     |
| 6.2    | Harrows  |                     |
| 6.3    | Uses of disk harrows   |                     |
| 6.4    | Types of disk harrows  |                     |
| 6.5    | Component parts of disk harrows  |                     |
| 6.6    | Draft of disk harrows  |                     |
| 6.7    | Spike tooth harrows  |                     |
| 6.8    | Spring tooth harrows   |                     |
| 6.9    | Special harrows  |                     |
| 6.10   | Purpose of cultivators   |                     |
| 6.11   | Row crop cultivators   |                     |
| 6.12   | Field cultivator   |                     |
| 6.13   | Rotary hoe   |                     |
| 6.14   | Rotary tiller  |                     |
| <br>7. | <br><b>PLANTING AND SEEDING EQUIPMENT</b>                                    | <br><b>10 hours</b> |
| 7.1    | Purpose of planting and seeding equipment                                    |                     |
| 7.2    | Row-Crop planters  |                     |
| 7.3    | Planter parts  |                     |
| 7.4    | Planting depth   |                     |
| 7.5    | Working of gram drills   |                     |

- 7.6 Classification and sizing of gram drills
- 7.7 Metering system of gram drills
- 7.8 Furrow openers
- 7.9 Seed metering rate of planter or drill
- 7.10 Preparing planting and seeding machinery
- 7.11 Calibrating the planter
- 7.12 Calibrating the gram drill

**8. WEED INSECT AND SOIL FERTILITY CONTROL EQUIPMENT 10 hours**

- 8.1 Purpose of crop production chemicals
- 8.2 Types of machinery used for weed, insect and fertility control
- 8.3 Liquid application equipment
- 8.4 Low pressure sprayers
- 8.5 High pressure sprayers
- 8.6 Recirculating sprayers
- 8.7 Mist applicators
- 8.8 Types of pumps for sprayers
- 8.9 Nozzles for sprayers
- 8.10 Selection of tip of nozzle
- 8.11 Strainers of sprayers
- 8.12 Controls of sprayers
- 8.13 Agitators of sprayers
- 8.14 Supply tank of sprayers
- 8.15 Pipes of sprayers
- 8.16 Specialized metering pumps
- 8.17 Dry chemical application equipment
- 8.18 Calibrating the sprayers
- 8.19 Maintaining chemical application equipment

**BOOKS RECOMMENDED:**

Farm Machinery and Equipment By: Harris Pearson Smith  
 Agricultural Power and Machinery By: Jacobs Harrell  
 Farm Tractor By S.C Rai  
 Fundamentals of Tractor & energy conservation By Faqeer Muhammad Chaudery  
 Dr. Gulam Sarwar

## INSTRUCTIONAL OBJECTIVES

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

### UNDERSTAND THE TRANSMISSION OF POWER IN AGRICULTURE

- 1.1 State the different methods of power transmission.
- 1.2 Define direct drive.
- 1.3 Describe pulleys and belts.
- 1.4 State the formula to measure length of v-belt.
- 1.5 Describe materials of pulleys and sheaves for v-belts.
- 1.6 State precaution while using belts.
- 1.7 Describe the sprocket, wheels and chains.
- 1.8 Describe the of P.T.O shafts and its working
- 1.9 Describe the working of universal joints.
- 1.10 Describe the use of flexible shafting

### UNDERSTAND THE USE OF RUBBER TIRES FOR FARM EQUIPMENT

- 2.1 State the advantages and disadvantages of rubber tires.
- 2.2 Describe the size, types of Agriculture rubber tires and their code numbering.
- 2.3 Define play rating of tire.
- 2.4 Explain inflation pressures of tires.
- 2.5 Describe the rims for tractors and implement tires.
- 2.6 Enlist the factors influencing on the life of agricultural pneumatic tires.
- 2.7 Describe the term traction of tires.
- 2.8 Describe the effect of tire weighting and tires blasting.

### UNDERSTAND THE FARM MECHANIZATION

- 3.1 Describe farm mechanization
- 3.2 State the advantages and disadvantages of farm mechanization
- 3.3 Identify the employment opportunities in agricultural power and machinery Sector.
- 3.4 List the skills and competencies needed for job entry in Agriculture.

### UNDERSTAND THE TRACTOR MAIN FEATURES AND CLASSIFICATION

- 4.1 Define traction.
- 4.2 Describe the Purpose and Advantages of Tractor.
- 4.3 Enlist Manufacturers and Different models of tractors Used in Pakistan.
- 4.4 Enlist the main Parts of Tractor.
- 4.5 Describe the Specification /salient features of different Tractors used in Pakistan.
- 4.6 Describe Types of tractor w.r.t. HP.
- 4.7 Describe Tractor Hour Meter purpose.
- 4.8 Describe Tractors instrument panel
- 4.9 Describe Control levers (Draft control, position control, Response control)
- 4.10 Prepare Periodic maintenance chart of tractor
- 4.11 Enlist the Safety precautions regarding tractor Operation.
- 4.12 Periodic maintenance chart of tractor
- 4.13 Define Tractive force & Tractive efficiency
- 4.14 Define Static Equilibrium & center of gravity
- 4.15 Define Weight transfer & dynamic equilibrium

## **PRIMARY TILLAGE**

### **UNDERSTAND THE PRIMARY TILLAGE MACHINERY**

- 5.1 Define tillage
- 5.2 Enlist the objectives of tillage
- 5.3 State the purposes of primary tillage machinery
- 5.4 Describe the Purpose, function and working of subsoilers
- 5.5 Describe the function, construction and types of chisel plows
- 5.6 Describe the purpose, Parts, types of Mould Board, types of bottom and types of shares of Mould Board
- 5.7 Explain the purpose, construction and Parts of Disk Plow
- 5.8 Describe the purpose and types of Rotary Plows
- 5.9 Explain the principle of hitching Procedure of Implements
- 5.10 Purpose advantages and working of Laser land leveling

## **SECONDARY TILLAGE**

### **UNDERSTAND THE SECONDARY TILLAGE MACHINERY**

- 6.1 State the purposes of secondary tillage machinery.
- 6.2 Define harrows.
- 6.3 Describe the uses of disk harrows.
- 6.4 Explain the types of disk harrows.
- 6.5 Describe the component parts of disk harrows.
- 6.6 Describe the function and construction of Spike tooth harrow.
- 6.7 Explain the Purpose and construction of spring tooth harrow.
- 6.8 Describe the function of special harrows.
- 6.9 Describe the purpose and Function of cultivators.
- 6.10 Explain the function of rotary tiller.

### **UNDERSTAND PLANTING AND SEEDING EQUIPMENT**

- 7.1 Describe purposes of planting and seeding equipment.
- 7.2 Describe the parts of Planter.
- 7.3 Describe the Rice Planter.
- 7.4 Enlist the Components of Rice Planter.
- 7.5 Describe the Working of Rice Planter.
- 7.6 Explain the function and working of planter.
- 7.7 Describe the method of controlling planter depth.
- 7.8 Describe the working of grain drill
- 7.9 Describe the classification and sizing of grain drills
- 7.10 Explain the metering system of grain drill
- 7.11 Describe the purpose and types of furrow openers of drills
- 7.13 Explain the Procedure of preparing planting and seeding machinery.
- 7.14 Explain the method of calibrating the planter
- 7.15 Explain the method of calibrating the grain drill

### **UNDERSTAND THE WORKING OF WEED, INSECT, AND SOIL FERTILITY CONTROL EQUIPMENT**

- 8.1 Describe the purpose of crop production chemicals
- 8.2 Describe the types of machinery used for weed, insect and fertility control
- 8.3 Describe the working of liquid application equipment
- 8.4 Describe the Low Pressure sprayers.

- 8.5 Describe the High Pressure sprayers.
- 8.6 Explain the working of recirculating sprayers.
- 8.7 Describe the function of Mist applicator.
- 8.8 Describe the Parts of Boom Sprayer.
- 8.9 Explain the types of pumps used in sprayers.
- 8.10 Describe the types of nozzles used in sprayers.
- 8.11 Enlist the factors of selection of nozzle tip
- 8.12 Explain the strainers used in sprayers.
- 8.13 Explain the controls of sprayers.
- 8.14 Describe the function of agitator in the sprayers
- 8.15 Describe the tanks of sprayers.
- 8.16 Describe the function and material of pipes and hoses of sprayers.
- 8.17 Describe dry chemical application equipment
- 8.18 Explain the calibration of sprayers
- 8.19 Describe the methods of maintaining chemical application equipment.
- 8.20 Field and machine capacities and efficiencies

**LIST OF PRACTICALS**

- 1 Practice to Drive Tractor in the open field under the supervision of class instructor
2. Perform service, adjustments and maintenance of belts and chain.
  - Perform shop and field adjustments of Mould.Board plows.
  - Perform shop and field adjustments of Chiesel Plow.
  - Perform shop and field adjustments of disk plows.
  - Perform shop and field adjustments of cultivators.
  - Perform shop and field adjustments of rotavator.
  - Perform shop and field adjustments of harrows.
  - Perform shop and field adjustments of sub-soiler.
  - Perform shop and field adjustments of grain drill.
  - Calibrate the grain drill & planter in shop.
  - Calibrate the Boom sprayer in shop.
  - Calibrate the fertilizer broadcaster in shop.
  - Perform hitching of different tillage machinery.
  - Practice to operate different tillage equipment.
  - Practice on planting and seeding machine for field operation.
  - Practice to operate fertilizer broadcaster in the field
  - Calibrate the field sprayers in the workshop
  - Prepare a seed bed for sowing of crops and vegetable
  - Visit of Tractor assembling industry
  - Visit of Farm Machinery manufacturing industry
  - visit of modern progressive farm

**Total contact hours**

Theory:	32 hours	T	P	C
Practical:	96 hours	1	3	2

**Pre-requisite: None**

- AIMS 1.** Understand the agriculture, its origin and importance of the crop husbandry.  
 Understand the general features of the province like area, Population, Mountains, forests and climates etc.  
 Understand the importance, objects , system of irrigation sources and measurements of water.  
 Understand the botanical knowledge of different crops, habitats, main parts of crop and other cultural practices.

**COURSE CONTENTS:**

- 1. THE SCIENCE OF AGRICULTURE (2 hours)**
  - 1.1 History of agriculture and its origin.
  - 1.2 Importance of agriculture.
  - 1.3 Different branches of agriculture.
  - 1.4 Factors of crop production.
  - 1.5 Sciences allied to agriculture.
- 2. AGRICULTURAL METEROLOGY (2 hours)**
  - 2.1 Agricultural meteorology and state its importance
  - 2.2 Effect of weather and climate on agriculture .
  - 2.3 Effect of temperature and humidity on agriculture.
  - 2.4 Classification of climate.
  - 2.5 Factors on which weather and climates depend.
  - 2.6 Weather forecasting & its importance
  - 2.7 Use of barometer & rain gauges
- 3. IRRIGATION AND ITS ROLE IN AGRICULTURE (3 hours)**
  - 3.1 Irrigation in agriculture and state its importance.
  - 3.2 Conditions for artificial irrigation.
  - 3.3 Objectives and sources of irrigation.
  - 3.4 Duty of water and factors on which duty of water depends.
  - 3.5 Various systems of irrigation.
  - 3.6 Objectives of pressurized irrigation system and its types.
  - 3.7 Components & working of Drip irrigation system
  - 3.8 Components & working of sprinkler irrigation .
  - 3.9 Factors on which irrigation depends
  - 3.10 Water Management Techniques.
  - 3.11 Irrigation scheduling, Field Capacity and Depletion of moisture.
- 4. CROP ROTATION AND FALLOWING (2 hours)**
  - 4.1 Crop rotation and state its advantages
  - 4.2 Scientific, exhaustive and restorative crop rotation
  - 4.3 Cropping intensity and its economic importance to Agriculture

- 4.4 Following of land and its advantages
- 4.5 Calculation of cropping intensity.

**5. WEEDS AND IDENTIFICATION OF PLANTS (2 hours)**

- 5.1 Weeds in rabi & kharif and identify losses caused by weeds
- 5.2 Dissemination of weed seeds
- 5.3 Classification of weeds and eradication of weeds
- 5.4 Identification of Weeds Plants
- 5.5 Classification of Field crops.
- 5.6 Factors of crop production.

**6. CULTIVATION OF SUGAR CROPS AND FIBER CROPS. (3 hours)**

- 6.1 Cultivation of Sugar- cane and its importance, Locality and soil, Land preparation, growing season, Seed rate, method of sowing, manuring , irrigation, interculture, yield and harvesting.
- 6.2 Cultivation of Sugar- beet and its importance, Locality and soil, Land preparation, growing season, Seed rate, method of sowing, manuring , irrigation, yield and harvesting.
- 6.3 Cultivation of cotton and its importance locality and soil, land preparation manuring, growing season, seed rate, sowing method, irrigation, harvesting/picking and field.

**7. CULTIVATION OF GRAIN CROPS. (3 hours)**

- 7.1 Cultivation of Rice and its importance, Locality and soil, land preparation, manuring, Growing season, seed rate and sowing method, puddlig, irrigation harvesting/threshing and yield.
- 7.2 Cultivation of Maize and its importance, Locality and soil, land preparation, manuring, Growing season, seed rate and sowing method, irrigation interculture, harvesting/threshing and yield.
- 7.3 Cultivation of Wheat and its importance, Locality and soil, land preparation, manuring, Growing season, seed rate and sowing method, irrigation harvesting/threshing and yield.

**8. CULTIVATION OF FODDER CROPS. (3 hours)**

- 8.1 Cultivation of shaftal and its importance, Locality and soil, land preparation, manuring, Growing season, seed rate and sowing method, irrigation interculture ,harvesting and yield.
- 8.2 Cultivation of berseem and its importance, Locality and soil, land preparation manuring, Growing season, seed rate and sowing method, irrigation interculture, harvesting and yield.
- 8.3 Cultivation of jowar and its importance, Locality and soil, land preparation manuring, Growing season, seed rate and sowing method, irrigation ,harvesting and yield.

**9. THE OIL SEED CROPS. (3 hours)**

- 9.1 Cultivation of Jojoba and its importance, Locality and soil, Land preparation, growing season, Seed rate, method of sowing, manuring , irrigation, yield and harvesting.
- 9.2 Cultivation of Sun flower and its importance, Locality and soil, Land preparation, growing season, Seed rate, method of sowing, manuring , irrigation, yield and



- harvesting.
- 9.3 Cultivation of Jetrofa and its importance, Locality and soil, Land preparation, growing season, Seed rate, method of sowing, manuring , irrigation, yield and harvesting.
- 9.4 Cultivation of canola and its importance, Locality and soil, Land preparation, growing season, Seed rate, method of sowing, manuring , irrigation, yield and harvesting
- 9.5 Cultivation of castor oil plant (hernoli, Arend) and its importance, Locality and soil, Land preparation, growing season, Seed rate, method of sowing, manuring , irrigation, yield and harvesting

#### **10.TUNNEL FARMING & KITCHEN GARDENING.**

**(3 hours)**

- 10.1 Purpose & importance of tunnel farming
- 10.2 Types of tunnels (Low, High & Walk in tunnel)
- 10.3 Vegetables and crop nursery farming under tunnels
- 10.4 Greenhouse effect and environment controlling under tunnel
- 10.5 Advantages & Methods of Kitchen gardening
- 10.5 Crop Diseases and their remedies under tunnel

#### **CULTIVATION OF ROOT AND VEGETABLE CROPS.**

**(3 hours)**

- 11.1 Classification of Root crops
- 11.2 Cultivation of potatoes its importance, locality , soil, land preparation, growing season, seed rate, sowing method, irrigation and harvesting.
- 11.3 Classification of vegetable crops according to season and nature
- 11.4 Cultivation of Chilies with respect to its importance, locality and soil, land preparation, growing season, seed rate and sowing method, irrigation and harvesting.
- 11.5 Cultivation of Onion with respect to its importance, locality and soil, land preparation, growing season, seed rate and sowing method, irrigation and harvesting.

#### **THE GRAIN PRESERVATION AND PROCESS (2hours)**

- 12.1 Grain Preservation its types and importance
- 12.2 Methods of Grain Preservation
- 12.3 Processes in grain preservation

#### **13 PUMPS, TUBEWELL AND TURBINES (2 hours)**

- 13.1 Describe irrigation pump and tube well.
- 13.2 Enlist components of pump and tube well.
- 13.4 Describe the components of well turbine and its types.
- 13.5 Explain the troubleshooting and their Remedies of Tube well and well Turbine.

#### **BOOKS RECOMMENDED**

A Text Book of Agriculture Vol. I&II - By: Muhammad Ibrahim Bajwa.  
 Agriculture - By: Khuda Bux Bucha  
 Crops and fodder - By: Khuda Bux Bucha

**INSTRUCTIONAL OBJECTIVES:**

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

**UNDERSTAND THE SCIENCE OF AGRICULTURE**

- 1.1 State the history of agriculture and its origin.
- 1.2 State importance of agriculture.
- 1.3 Explain different branches of agriculture.
- 1.4 Describe the factors of crop production.
- 1.5 Describe the sciences allied to agriculture.

**UNDERSTAND AGRICULTURAL METEOROLOGY**

- 2.1 Define agricultural meteorology and state its importance
- 2.2 Describe the effect of weather and climate on agriculture.
- 2.3 Describe the effect of temperature and humidity on agriculture.
- 2.4 Give classification of climate.
- 2.5 Describe the factors on which weather and climates depend.
- 2.6 Describe Weather forecasting & its importance
- 2.7 Describe Use of barometer & rain gauges

**UNDERSTAND IRRIGATION AND ITS ROLE IN AGRICULTURE**

- 3.1 Define irrigation in agriculture and state its importance.
- 3.2 Describe the conditions for artificial irrigation.
- 3.3 Describe the objectives and sources of irrigation.
- 3.4 Describe duty of water and factors on which duty of water depends.
- 3.5 Describe the various systems of irrigation. (Border irrigation, basin irrigation, Furrow irrigation, Syphon irrigation, Pressurized Irrigation)
- 3.6 Define the objectives of pressurized irrigation system and its types (Trickle Irrigation, sprinkler & rain guns)
- 3.7 Enlist the components & working of Drip irrigation system
- 3.8 Enlist the components & working of sprinkler irrigation (Fixed, Moveable, Solid, Side roll, Central Pivot, Rain Gun)
- 3.9 Enlist the factors on which irrigation depends
- 3.10 Describe Water Management Techniques, Water resources and Water measurement methods (Techniques & Devices)
- 3.11 Describe irrigation scheduling, Field Capacity and Depletion of moisture,

**UNDERSTAND CROP ROTATION AND FALLOWING**

- 4.1 Define crop rotation and state its advantages
- 4.2 Describe the scientific, exhaustive and restorative crop rotation
- 4.3 Describe the cropping intensity and its economic importance to Agriculture
- 4.4 Describe the Following of land and its advantages
- 4.5 Calculation of cropping intensity.

**UNDERSTAND WEEDS AND IDENTIFICATION OF PLANTS**

- 5.1 Enlist weeds in rabi & kharif and identify losses caused by weeds

- 5.2 Describe the dissemination of weed seeds
- 5.3 Describe the classification of weeds and eradication of weeds
- 5.4 Describe the identification of Plants
- 5.5 Give classification of Field crops according to,  
season,  
duration of life cycle,  
nature of cultivation and  
use.
- 5.6 Describe the various factors of crop production.

#### **UNDERSTAND CULTIVATION OF SUGAR CROPS AND FIBER CROPS.**

- 6.1 Describe cultivation of Sugar- cane and its importance, Locality and soil, Land preparation, growing season, Seed rate, method of sowing, manuring, irrigation, interculture, yield and harvesting.
- 6.2 Describe cultivation of Sugar- beet and its importance, Locality and soil, Land preparation, growing season, Seed rate, method of sowing, manuring, irrigation, yield and harvesting.
- 6.3 Describe cultivation of cotton and its importance locality and soil, land preparation manuring, growing season, seed rate, sowing method, irrigation, harvesting/picking and field.

#### **UNDERSTAND CULTIVATION OF GRAIN CROPS.**

- 7.1 Describe cultivation of Rice and its importance, Locality and soil, land preparation and manuring, Growing season, seed rate and sowing method, puddling, irrigation harvesting/threshing and yield.
- 7.2 Describe cultivation of Maize and its importance, Locality and soil, land preparation and manuring, growing season, seed rate and sowing method, irrigation interculture, harvesting/threshing and yield.
- 7.3 Describe cultivation of Wheat and its importance, Locality and soil, land preparation and manuring, Growing season, seed rate and sowing method, irrigation harvesting/threshing and yield.

#### **UNDERSTAND CULTIVATION OF FODDER CROPS.**

- 8.1 Describe cultivation of shaftal and its importance, Locality and soil, land preparation and manuring, Growing season, seed rate and sowing method, irrigation interculture, harvesting and yield.
- 8.2 Describe cultivation of berseem and its importance, Locality and soil, land preparation and manuring, Growing season, seed rate and sowing method, irrigation interculture, harvesting and yield.
- 8.3 Describe cultivation of jowar and its importance, Locality and soil, land preparation and manuring, Growing season, seed rate and sowing method, irrigation, harvesting and yield.

#### **9.UNDERSTAND THE OIL SEED CROPS.**

- 9.1 Describe cultivation of Jojoba and its importance, Locality and soil, Land preparation, growing season, Seed rate, method of sowing, manuring, irrigation, yield and harvesting.
- 9.2 Describe cultivation of Sun flower and its importance, Locality and soil, Land preparation, growing season, Seed rate, method of sowing, manuring, irrigation, yield and harvesting.
- 9.3 Describe cultivation of Jetrofa and its importance, Locality and soil, Land preparation, growing season, Seed rate, method of sowing, manuring , irrigation, yield and harvesting.

- 9.4 Cultivation of canola and its importance, Locality and soil, Land preparation, growing season, Seed rate, method of sowing, manuring , irrigation, yield and harvesting
- 9.5 Cultivation of castor oil plant (hernoli, Arend) and its importance, Locality and soil, Land preparation, growing season, Seed rate, method of sowing, manuring , irrigation, yield and harvesting

#### **TUNNEL FARMING & KITCHEN GARDENING.**

- 10.1 Describe Purpose & importance of tunnel farming
- 10.2 Describe Types of tunnels (Low, High & Walk in tunnel)
- 10.3 Describe vegetables and crop nursery farming under tunnels
- 10.4 Describe Greenhouse effect and environment controlling under tunnel
- 10.5 Describe Advantages & Methods of Kitchen gardening
- 10.5 Describe Crop Diseases and their remedies under tunnel

#### **UNDERSTAND CULTIVATION OF ROOT AND VEGETABLE CROPS.**

- 11.1 Give classification of Root crops
- 11.2 Describe cultivation of potatoes with respect to its importance, locality and soil, land preparation, growing season, seed rate and sowing method, irrigation and harvesting.
- 11.3 Give classification of vegetable crops according to season and nature
- 11.4 Describe cultivation of Chilies with respect to its importance, locality and soil, land preparation, growing season, seed rate and sowing method, irrigation and harvesting.
- 11.5 Describe cultivation of Onion with respect to its importance, locality and soil, land preparation, growing season, seed rate and sowing method, irrigation and harvesting.

#### **UNDERSTAND THE GRAIN PRESERVATION AND PROCESS**

- 12.1 Describe Grain Preservation its types and importance
- 12.2 Describe the Methods of Grain Preservation
- 12.3 Enlist the processes in grain preservation

#### **UNDERSTAND PUMPS, TUBEWELL AND TURBINES**

- 13.1 Describe irrigation pump and tube well.
- 13.2 Enlist components of pump and tube well.
- 13.4 Describe the components of well turbine and its types.
- 13.5 Explain the troubleshooting and their Remedies of Tube well and well Turbine.

**LIST OF PRACTICALS**

- 1      Practice to Drive Tractor in the open field under the supervision of class instructor  
Practice to hitch cultivator with tractor  
Practice to hitch PTO driven farm equipment with tractor  
Practice to mount and dismount farm equipment with tractor in the workshop and field  
Practice to plow the field with cultivators  
Practice to plow the field with rotavator.  
Practice to use the grain drill  
Practice to use the planters  
Practice to plan the lay out for various crops  
Practice to prepare the seedbed for sowing of different crops  
Prepare a Tunnel in the Field.  
Practice to sowing of various vegetable crops in open field.  
Collect and record Rabi and Kharif weeds during season  
Practice to grow crop in tunnel farming  
Practice to grow vegetable in kitchen gardening  
Practice to use barometer & Rain Gauges  
Practice to Apply fertilizing and weed control  
Practice to Record Pest Scouting  
Visit to progressive Modern Agriculture Farm
- 20    Visit to agricultural research station  
Visit of irrigation techniques at modern farm  
Visit of grain processing industry (Punjab Seed Corporation)  
Visit of metrological station  
Visit to Agricultural Research Station for different crops like sugarcane, potato, jajoba, cotton, maize wheat & rice
- 26    Visit to bio gas plant

## اسلامیات / مطالعہ پاکستان

نصاب (سال سوم)

حصہ اول	اسلامیات	Gen 311	ٹی	پی	سی
			1	0	1

حصہ دوم مطالعہ پاکستان

کل وقت 20 گھنٹے

### موضوعات

- 1 قرآن مجید  
سورة الفاتحة۔ آية الكرسي۔ سورة البقرة کی آخری آیات از امن الرسول تا آخر سورة اخلاص  
معترجمہ وشرع
- 2 دس منتخب احادیث معترجمہ وشرع  
- بنی الاسلام علی خمس شهادة ان لا اله الا الله و اقام الصلوة و ايتاء  
الزکوة و حج البيت و صوم رمضان  
- الدين النصيحة  
- المستشار الموتى  
- للمؤمن على المؤمن ست خصال يعودہ اذا مرض و يشمتہ اذا مات  
و يجيبہ اذا دعاه و يسلم عليه اذا لقيه و يشمت اذا عطس و ينصح له  
اذا غاب او شهد لا تخن من خانك  
- لا يدخل الجنة قاطع  
- ان الله حرم عليكم عقوق الامهات و اضاعة المال  
- يسرا ولا تعسرا بشراً ولا تنفرا  
- ذاق طعم الايمان من رضى بالله و بالاسلام ديناً و بمحمد نبياً  
- افضل الذكر لا اله الا الله  
3 حقوق و فرائض  
حصول تعليم بطور فرض ، والدین اور اولاد کے حقوق و فرائض ، ہمسایہ کے حقوق
- 4 اسلام کی اخلاقی اقدار  
صبر و استقلال۔ عفو و درگزر۔ ایفائے عہد۔ اخوت۔ ایثار و قربانی

ٹی پی سی

1 0 1

کل وقت 20 گھنٹے

(غیر مسلم طلباء کے لئے)

Gen-311

نصاب اخلاقیات

سال سوم

موضوعات

- احساس ذمہ داری
- مثبت ذہن
- عدل و انصاف
- قومی خدمت کا جذبہ
- فکر و نظر کی پاکیزگی
- احترام آدمیت
- شائستگی
- عفو و درگزر
- بردباری
- خود انحصاری
- اثر و نفوذ
- جامعیت
- اپنی ذات کی معرفت (بذریعہ ہم عصر طلباء۔ اساتذہ۔ اہم شخصیات، ادارہ)

## منتخب احادیث

عمومی مقصد۔ احادیث کی روشنی میں اسلامی تعلیمات پر عمل پیرا ہو سکے۔

### خصوصی مقاصد

- احادیث کا ترجمہ بیان کر سکے۔
- احادیث کی تشریح کر سکے۔
- معاشرتی اور انفرادی زندگی میں احادیث سے راہنمائی حاصل کر سکے۔

## حقوق و فرائض

عمومی مقصد۔ اسلامی معاشرے کا ایک اچھا فرد بن سکے۔

### خصوصی مقاصد

- والدین کے حقوق و فرائض بیان کر سکے۔
- ہمسائیوں کے حقوق بیان کر سکے۔
- اسلام میں حقوق و فرائض کی اہمیت بیان کر سکے۔
- حقوق و فرائض کی آگاہی کی صورت میں اپنے اندر خدمت خلق کا جذبہ پیدا کر سکے۔

## اسلامی اقدار

عمومی مقصد۔ طالب علم:

جان سکے گا کہ تعلیم کا مقصد حسن اخلاق سے متصف ہونا ہے

### خصوصی مقاصد

- اخلاق کے معنی و مفہوم کو بیان کر سکے۔
- اسلام میں حسن اخلاق کی اہمیت بیان کر سکے۔
- قرآن و سنت کی روشنی میں صبر و استقلال کی اہمیت بیان کر سکے۔
- اسلام میں غفور و درگزر کی اہمیت بیان کر سکے۔
- ایفائے عہد کی اہمیت بیان کر سکے۔
- اخوت کے معنی و مفہوم کو بیان کر سکے۔
- اخوت اسلامی کی اہمیت بیان کر سکے۔
- اسلام کی اعلیٰ اقدار کو اپنا کر مثالی معاشرہ پیدا کر سکے۔



نصاب (سال سوم)

مطالعہ پاکستان

Gen-311

ٹی پی سی

1 0 1

کل وقت 12 گھنٹے

حصہ دوم

قیام پاکستان

موضوعات

باؤنڈری کمیشن

ریڈ کلف ایوارڈ

تقسیم بنگال و بھارت

تقسیم پنجاب

مسئلہ مہاجرین

ریاستوں کا الحاق

ریاست جموں و کشمیر

نہری پانی کا تنازعہ

قرارداد مقاصد

علماء کے بائیس نکات

1956 - 1962 اور 1973 کے دساتیر کی اسلامی دفعات

پاکستان کا محل وقوع اور اس کی جغرافیائی اہمیت

قدرتی وسائل (تیل، گیس، کوئلہ)

مطالعہ پاکستان

حصہ دوم

قیام پاکستان

تدریسی مقاصد

عمومی مقصد  
قیام پاکستان کے بعد درپیش مسائل سے آگاہی حاصل کرے اور بیان کرے۔

خصوصی مقاصد

باؤنڈری کمیشن کی تشکیل اور اس کے فرائض بیان کر سکے۔

ریڈ کلف ایوارڈ کے بارے میں بیان کر سکے۔

Total Contact Hours		T	P	C
Theory	32	1	0	1

**Pre-requisite:** The students shall already be familiar with the language concerned.

**AIMS.**

1. Develop communication skills.
2. Understand basic principles of good and effective business writing in commercial and industrial fields.
3. Develop knowledge and skill to write technical report with confidence and accuracy.

**Detail of Contents:**

1. **Communication process.** **6 Hours**
  - 1.1 Purposes of communication.
  - 1.2 Communication process.
  - 1.3 Distortions in communication.
  - 1.4 Consolidation of communication
  - 1.5 Communication flow.
  - 1.6 Communication for self development.
2. **Oral communication skills.** **6 Hours**
  - 2.1 Significance of speaking.
  - 2.2 Verbal and non-verbal messages.
  - 2.3 Strategic steps of speaking.
  - 2.4 Characteristics of effective oral messages.
  - 2.5 Communication Trafficking.
  - 2.6 Oral presentation.
3. **Questioning skills.** **3 Hours**
  - 3.1 Nature of question.
  - 3.2 Types of questions.
  - 3.3 Characteristics of a good question.
  - 3.4 Questioning strategy
4. **Listening skills.** **5 Hours**
  - 4.1 Principles of active listening.
  - 4.2 Skills of active listening.
  - 4.3 Barriers to listening.
  - 4.4 Reasons of poor listening.
  - 4.5 Giving Feedback.
5. **Interviewing skills.** **3 Hours**
  - 5.1 Significance of interviews.

- 5.2 Characteristics of interviews.
- 5.3 Activities in an interviewing situation
- 5.4 Types of interviews.
- 5.5 Interviewing strategy.
  
- 6. **Report writing.** **3 Hours**
  - 6.1 Goals of report writing
  - 6.2 Report format.
  - 6.3 Types of reports.
  - 6.4 Report writing strategy.
  
- 7. **Reading comprehension.** **2 Hours**
  - 7.1 Reading problems.
  - 7.2 Four Reading skills.
  
- 8. **Group communication.** **4 Hours**
  - 8.1 Purposes of conducting meetings.
  - 8.2 Planning a meeting.
  - 8.3 Types of meetings.
  - 8.4 Selection f a group for meeting.
  - 8.5 Group leadership skills.
  - 8.6 Running a successful meeting.
  - 8.7 Active participation techniques.

### **RECOMMENDED BOOKS**

Sh. Ata-ur-Rehman Effective Business Communication & Report Writing.  
 Ulman J.N. Could JR. Technical Reporting.

**Instructional Objectives:****Understand the communication process.**

- 1.1 State the benefits of two way communication.
- 1.2 Describe a model of communication process.
- 1.3 Explain the major communication methods used in organization.
- 1.4 Identify the barriers to communication and methods of overcoming these barriers.
- 1.5 Identify misconceptions about communication.

**Understand the process of oral.**

- 2.1 Identify speaking situations with other peoples.
- 2.2 Identify the strategy steps of speaking.
- 2.3 Identify the characteristics of effective speaking.
- 2.4 State the principles of one-way communication.
- 2.5 State the principles of two-way communication.
- 2.6 Identify the elements of oral presentation skills.
- 2.7 Determine the impact of non-verbal communication on oral communication.

**Determine the uses of questioning skills to gather and clarify information in the oral communication process.**

- 3.1 Identify different types of questions.
- 3.2 Determine the purpose of each type of question and its application.
- 3.3 Identify the hazards to be avoided when asking questions.
- 3.4 Demonstrate questioning skills.

**Demonstrate the use of active listening skill in the oral communication process.**

- 4.1 State the principles of active listening.
- 4.2 Identify skills of active listening.
- 4.3 Identify barriers to active listening.
- 4.4 State the benefits of active listening.
- 4.5 Demonstrate listening skills.
- 4.6 Explain the importance of giving and receiving feed back.

**Determine the appropriate interview type for the specific work-related situation and conduct a work-related interview.**

- 5.1 State the significance of interviews.
- 5.2 State the characteristics of interviews.
- 5.3 Explain the activities in an interviewing situation.
- 5.4 Describe the types of interviews.
- 5.5 Explain the interviewing strategy.
- 5.6 Prepare instrument for a structured interview.

**Prepare a report out-line, based on subject matter and audience.**

- 6.1 Identify the different types of reports.
- 6.2 Determine when to use an informal or formal report presentation.
- 6.3 Identify the stages of planning a report.

- 6.4 Identify the parts of a report and choose the parts appropriate for each type of report.
- 6.5 Draft a report outline.

**Demonstrate reading comprehension.**

- 7.1 Identify major reading problems.
- 7.2 Identify basic reading skills.
- 7.3 State methods of previewing written material.
- 7.4 Identify methods of concentration when reading.
- 7.5 Demonstrate reading comprehension.

**Understand the principles of group communications.**

- 8.1 State the purpose and characteristics of major types of meeting.
- 8.2 Explain responsibilities of a meeting/committee.
- 8.3 Identify problems likely to be faced at meeting and means to overcome these problems.
- 8.4 Distinguish between content and process at meetings.
- 8.5 Explain the key characteristics of a good group facilitator.

Total Contact Hours		T	P	C
Theory	64	2	3	3
Practical	96			

**Pre-requisite:** IC ENGINE

**AIMS.**

Understand the construction and working of Intake and Exhaust system.  
 Understand the construction and working of carburetor Fuel supply system.  
 Understand the construction and working of LPG Fuel supply system.  
 Understand the construction and working of CNG Fuel supply system.  
 Understand the construction and working of EFI Fuel supply system.  
 Show skill in maintenance and repair of fuel injection pumps & governors.  
 Understand the construction and working of Variable valve timing.  
 Understand the construction and working of Vehicle cruisetronic system.  
 Understand the basis working of Hybrid vehicle.  
 Understand the basis working of Locomotive engine.

### Detail of Contents:

#### **PART-I**

1. **Fuel and its types use in automobile.** **4 Hours**
  - 1.1 Fuel and its basic properties.
  - 1.2 Fuel rating factors.
    - Octane Rating.
    - Cetane Rating.
  - 1.3 Types of fuels and their chemical formulae , use in automobiles.
  - 1.4 Extraction of crude oil and its fractionating process.
2. **Air / fuel ratio.** **3 Hours**
  - 2.1 Composition of Air.
  - 2.2 Atmospheric pressure.
  - 2.3 Ideal Air / Fuel ratio .
  - 2.4 Ideal Air / Fuel ratio for Petrol & Diesel engine, by chemical equation.
  - 2.5 Air / Fuel ratio for different speeds of an engine.
3. **Various intake system for IC engines.** **4 Hours**
  - 3.1 Purpose of intake system of I.C engines.
  - 3.2 Various type of intake system of I.C engines.
  - 3.3 Air capacity
  - 3.4 Features of intake manifold.
  - 3.5 Purpose of air cleaner.
  - 3.6 Working of different types of air cleaner.
  - 3.7 Positive crank case ventilation system (PCV System),

- 4. Engine exhaust system components. 6 Hours**
  - 4.1 Purpose of engine exhaust system.
  - 4.2 Components of engine exhaust system
  - 4.3 Purpose of Muffler/Silencer.
  - 4.4 Exhaust Gas Recirculating system (EGR System),
  - 4.5 Working of different types of engine exhaust systems.
  - 4.6 Purpose of Catalytic Convertor.
  - 4.7 Working principle of different types of Catalytic Convertor.
  - 4.8 Main features of exhaust manifold.
  - 4.9 Exhaust manifold Heat Shield.
  - 4.10 Back Pressure of engine exhaust system.
  - 4.11 Back pressure effects on engine Performance.
- 5. Working of turbocharger . 4 Hours**
  - 5.1 Volumetric efficiency of I.C engine.
  - 5.2 Factors effecting Volumetric efficiency of IC engine.
  - 5.3 Purpose of turbocharger.
  - 5.4 Construction and working of turbocharger.
  - 5.5 Turbo-lag
  - 5.6 Operation of Waste Gate control valve.
  - 5.7 Purpose and working of intercooler.
  - 5.8 Turbocharger and supercharger.
- 6. Various fuel supply systems of I.C engine. 4 Hours**
  - 6.1 Various fuel supply system.
  - 6.2 Construction of fuel tank .
  - 6.3 Purpose of fuel gauge.
  - 6.4 Construction and working of fuel gauge circuit.
  - 6.5 Construction and working of evaporative fuel emission control system.
  - 6.6 Function and types of fuel filter.
- 7. Different types of fuel pumps. 3 Hours**
  - 7.1 Function of fuel pump.
  - 7.2 Types of fuel pump.
  - 7.3 Construction and working of mechanical/diaphragm type fuel pump.
  - 7.4 Construction and working of electric type fuel pump.
- 8. Purpose, construction, working, and adjustment of carburetor. 7 Hours**
  - 8.1 Atomization, vaporization & carburetion.
  - 8.2 Atmospheric pressure, gauge pressure and absolute pressure.
  - 8.3 Air-fuel ratio for different engine working conditions.
  - 8.4 Purpose of Carburetor.
  - 8.5 Venturi effect.
  - 8.6 Carburetor Circuits/Systems.
  - 8.7 Construction and working of Carburetor following circuits/systems.
    - a. Float Circuit.

- Idle Circuit.
- High speed Circuit.
- Power Circuit.
- Accelerator Pump Circuit.
- Choke circuit (Mechanical/electric choke).
- 8.8 Air-fuel mixture adjustment at idle speed.
- 8.9 Carburetor types w.r.t No of barrels, No of venturis, Air draft.
- 8.10 Carburetor troubleshooting.

**9. Construction and working of LPG fuel supply system. 3 Hours**

- 9.1 Liquefied petroleum Gas (LPG) fuel.
- 9.2 Components of LPG fuel supply system.
- 9.3 Electronically controlled LPG fuel supply system.
- 9.4 Advantages and disadvantages of LPG fuel system with gasoline fuel system.

**10. Construction and working of CNG fuel supply system. 3 Hours**

- 10.1 Compressed Natural Gas (CNG) fuel.
- 10.2 Components of CNG fuel supply system.
- 10.3 Component of electronically controlled CNG fuel supply system.
- 10.4 Working of electronically controlled LNG fuel supply system.
- 10.5 Advantages and disadvantages of CNG/LNG fuel system with gasoline fuel system.

## **PART-II**

**11. Electronically controlled Gasoline fuel injection system. 6 Hours**  
**(EFI system).**

- 11.1 Advantages and disadvantages of electronically controlled gasoline fuel injection system (EFI System)
- 11.2 Sub-systems of EFI System.
- 11.3 Fuel delivery & Air induction sub-systems of EFI System.
- 11.4 Function, construction, circuit & working of following sensors.  
(Air Flow meter ,Map sensor ,Air temperature sensor, Water temperature sensor, Throttle position sensor, , Knock sensor, RPM sensor, Oxygen sensor).
- 11.5 Function, construction and circuit working of following actuators.  
(Injectors, Ignition system igniter, Idle speed control valve).
- 11.6 Purpose of Microcomputer/Electronic Control Unit (ECU).
- 11.7 Working of EFI Systems w.r.t D-Jetronics system, L-Jetronics system, and K/KE-Jetronics system.
- 11.8 Construction and working of EFI Systems w.r.t Multiport Fuel Injection system(MPFI system) and Throttle Body Fuel injection system(TBI system).
- 11.9 Working of drive by wire system(DBW).

**12. Working of hybrid vehicle. 1 Hour**

- 12.1 Hybrid Vehicle.



	12.2 Components of Hybrid Vehicle.	
	12.3 Working principle of Hybrid Vehicle.	
	12.4 Types of Hybrid Vehicle Drives.	
	12.5 Advantages & disadvantages of Hybrid Vehicle.	
<b>13</b>	<b>Working of Zero emission vehicle (electric vehicle).</b>	<b>1 Hour</b>
	13.1 Zero Emission vehicle (Electric vehicle).	
	13.2 Components of Zero Emission vehicle (Electric vehicle).	
	13.3 Working principle of Zero Emission vehicle (Electric vehicle).	
	13.4 Advantages & disadvantages of Zero Emission vehicle	
<b>14</b>	<b>Working of diesel engine.</b>	<b>10 Hours</b>
	14.1 Properties of diesel fuel.	
	14.2 Working principle of four strokes diesel engine.	
	14.3 Main Components of diesel fuel supply system	
	14.4 Purpose of diesel fuel filter.	
	14.5 Construction and working of diesel fuel filter.	
	14.6 Purpose of diesel water sedimentor.	
	14.7 Construction and working of diesel water sedimentor.	
	14.8 Purpose of primer/lifty pump.	
	14.9 Construction and working of primer/lifty pump.	
	14.10 Function of diesel fuel feed pump.	
	14.11 Types and working of diesel fuel feed pumps.	
	14.12 Construction and working of Distributor type (rotary) Diesel Fuel injection Pump.	
	14.13 Construction and working of In-Line type Diesel Fuel injection Pump.	
	14.14 Function of Governor.	
	14.15 Types and working of Governors.	
	14.16 Phasing and calibration.	
	14.17 Procedure of phasing and calibration of diesel fuel injection pumps.	
	14.18 Procedure of setting of timing of diesel fuel injection pump.	
	14.19 Function of diesel fuel injector.	
	14.20 Types and working of diesel fuel injectors.	
	14.21 Purpose of high pressure lines.	
	14.22 Purpose of diesel engine glow plugs.	
	14.23 Construction and working of diesel engine glow plugs.	
	14.24 Electronically controlled Diesel Fuel Injection System.	
	14.25 Electronically controlled Diesel Fuel Injection System & Common Rail direct injection(CRDI).	
<b>15</b>	<b>Working of vehicle cruisetronics control system.</b>	<b>1 Hour</b>
	15.1 Purpose of Vehicle Cruisetronics Control System.	
	15.2 Components of Vehicle Cruisetronics Control System.	
	15.3 Working principle of Vehicle Cruisetronics Control System.	

<b>16</b>	<b>Construction and working principal of variable valve timing . control system.</b>	<b>2 Hours</b>
16.1	Purpose of Variable valve timing control systems (VVT-i/ i-VTEC / VANOS/VCT).	
16.2	Components of Variable valve timing control systems (VVT-i/ i-VTEC / VANOS/VCT).	
16.3	Working principles of Variable valve timing control systems (VVT-i/ i-VTEC / VANOS/VCT).	
<b>17</b>	<b>Construction and working principle of Locomotive engine.</b>	<b>1 Hour</b>
17.1	Main components of Locomotive Engine.	
17.2	Basic working principle of Locomotive Engine.	
<b>18</b>	<b>Basic working principle of jet engine.</b>	<b>1 Hour</b>
18.1	Main components of jet engine.	
18.2	Working principle of jet engine.	

### **Recommended Textbooks:**

Modern Automotive Mechanics by James E. Duffy.  
Automotive Technology A System Approach by Jack Erjavec  
Automotive Electricity, Electronics & Computer Controls  
by Barry Hollembeak

**Instructional Objectives:****PART-I**

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

**Understand the fuel and its types use in automobile. 1.1**

Define fuel and its basic properties.

1.2 Describe the following Fuel rating factors.

Octane Rating.

Cetane Rating.

1.3 Describe different types of fuels and their chemical formulae , use in automobiles.

1.4 Briefly describe the extraction of crude oil and its fractionating process.

**Understand the air / fuel ratio.**

2.1 Describe the composition of Air.

2.2 Define Atmospheric pressure.

2.3 Describe Ideal Air / Fuel ratio .

2.4 Calculate the ideal Air / Fuel ratio for Petrol & Diesel engine, by chemical equation.

2.5 Describe the Air / Fuel ratio for different speeds of an engine.

**Understand working of various intake system for IC engines. 3.1**

State the Purpose of intake system of I.C engines.

3.2 List the components of various type of intake system of I.C engines.

3.3 Define air capacity

3.4 Describe main features of intake manifold.

3.5 State purpose of air cleaner.

3.6 Describe the working of different types of air cleaner.

3.7 Describe the purpose, construction and working of positive crank case ventilation system (PCV System),

**Understand working of engine exhaust system components. 4.1**

State the purpose of engine exhaust system.

4.2 Enlist the components of engine exhaust system

4.3 State purpose of Muffler/Silencer.

4.4 Describe the purpose, construction and working of Exhaust Gas Recirculating system (EGR System),

4.5 Describe the working of different types of engine exhaust systems.

4.6 Describe the purpose of Catalytic Convertor.

4.7 Describe the working principle of different types Catalytic Convertor.

4.8 Explain the main features of exhaust manifold.

4.9 State the function of exhaust manifold Heat Shield.

- 4.10 Define the Back Pressure of engine exhaust system.
- 4.11 Describe the back pressure effects on engine Performance.

### **Understand the working of turbocharger .**

- 5.1 Define Volumetric efficiency of I.C engine.
- 5.2 Describe factors effecting on Volumetric efficiency of an IC engine.
- 5.3 State purpose of turbocharger.
- 5.4 Describe the construction and working of turbocharger.
- 5.5 Define turbo-lag
- 5.6 Describe operation of Waste Gate control valve.
- 5.7 Describe purpose and working of intercooler.
- 5.8 Differentiate between turbocharger and supercharger.

### **Understand working of an various fuel supply systems of I.C engine. 6.1**

- Enlist components of various fuel supply system.
- 6.2 Describe construction of fuel tank .
- 6.3 State purpose of fuel gauge.
- 6.4 Describe construction and working of fuel gauge circuit (balancing coil and themister type).
- 6.5 Describe construction and working of evaporative fuel emission control system.
- 6.6 State function and types of fuel filter.

### **Understand working of different types of fuel pumps. 7.1**

- State the function of fuel pump.
- 7.2 Enlist the types of fuel pump.
- 7.3 Describe construction and working of mechanical/diaphragm type fuel pump.
- 7.4 Describe the construction and working of electric type fuel pump.

### **Understand Purpose, construction, working, and adjustment of carburetor. 8.1**

- Define atomization, vaporization & carburetion.
- 8.2 Differentiate between atmospheric pressure, gauge pressure and absolute pressure.
- 8.3 Describe air-fuel ratio for different engine working conditions.
- 8.4 State purpose of Carburetor.
- 8.5 Describe venturi effect.
- 8.6 Enlist name of Carburetor Circuits/Systems.
- 8.7 Describe the construction and working of Carburetor following circuits/systems.
  - Float Circuit.
  - Idle Circuit.
  - High speed Circuit.
  - Power Circuit.
  - Accelerator Pump Circuit.
  - g. Choke circuit (Mechanical/electric choke).
- 8.8 Describe air-fuel mixture adjustment at idle speed.
- 8.9 Describe carburetor types w.r.t No of barrels, No of venturies, Air draft.

**Understand the construction and working of LPG fuel supply system.**

- 9.1 Define Liquefied petroleum Gas (LPG) fuel.
- 9.2 Enlist components of LPG fuel supply system.
- 9.3 Explain the working of each component of electronically controlled LPG fuel supply system.
- 9.4 Compare advantages and disadvantages of LPG fuel system with gasoline fuel system.

**Understand the construction and working of CNG fuel supply system.**

- 10.1 Define Compressed Natural Gas (CNG) fuel.
- 10.2 Enlist components of CNG fuel supply system.
- 10.3 Explain the working of each component of electronically controlled CNG fuel supply system.
- 10.4 Describe the construction and working of electronically controlled LNG fuel supply system.
- 10.5 Compare advantages and disadvantages of CNG/LNG fuel system with gasoline fuel system.

**PART-II**

**Understand electronically controlled Gasoline fuel injection system.**

**(EFI system).**

- 11.1 State the advantages and disadvantages of electronically controlled gasoline fuel injection system (EFI System)
- 11.2 Enlist the sub-systems of EFI System.
- 11.3 Describe the construction and working of Fuel delivery & Air induction sub-systems of EFI System.
- 11.4 Describe the function, construction, circuit & working of following sensors  
(Air Flow meter ,Map sensor ,Air temperature sensor, Water temperature sensor, Throttle position sensor, , Knock sensor, RPM sensor, Oxygen sensor).
- 11.5 Describe the function, construction and circuit working of following actuators.  
(Injectors, Ignition system igniter, Idle speed control valve).
- 11.6 State the purpose of Microcomputer/Electronic Control Unit (ECU).
- 11.7 Describe the working of EFI Systems w.r.t D-Jetronics system, L-Jetronics system, and K/KE-Jetronics system.
- 11.8 Describe the construction and working of EFI Systems w.r.t Multiport Fuel Injection system(MPFI system) and Throttle Body Fuel injection system(TBI system).
- 11.9 Describe the working of drive by wire system(DBW).

**Understand the working of hybrid vehicle.**

- 12.1 State the Hybrid Vehicle.
- 12.2 Enlist main Components of Hybrid Vehicle.
- 12.3 Describe the working principle of Hybrid Vehicle.
- 12.4 Describe the Types of Hybrid Vehicle Drives.
- 12.5 Describe the advantages & disadvantages of Hybrid Vehicle.

### **Understand the working of Zero emission vehicle (electric vehicle).**

- 13.1 Define Zero Emission vehicle (Electric vehicle).
- 13.2 Enlist main Components of Zero Emission vehicle (Electric vehicle).
- 13.3 Describe the working principle of Zero Emission vehicle (Electric vehicle).
- 13.4 Describe the advantages & disadvantages of Zero Emission vehicle

### **Understand the working of diesel engine.**

- 14.1 State the properties of diesel fuel.
- 14.2 Describe the working principle of four strokes diesel engine.
- 14.3 Enlist the main Components of diesel fuel supply system
- 14.4 State the purpose of diesel fuel filter.
- 14.5 Describe the construction and working of diesel fuel filter.
- 14.6 State the purpose of diesel water sedimentor.
- 14.7 Describe the construction and working of diesel water sedimentor.
- 14.8 State the purpose of primer/lifty pump.
- 14.9 Describe the construction and working of primer/lifty pump.
- 14.10 State function of diesel fuel feed pump.
- 14.11 Describe the types and working of diesel fuel feed pumps.
- 14.12 Describe the construction and working of Distributor type (rotary) Diesel Fuel injection Pump.
- 14.13 Describe the construction and working of In-Line type Diesel Fuel injection Pump.
- 14.14 State the function of Governor.  
Describe the types and working of Governors.
- 14.15 Define phasing and calibration.
- 14.16 Explain the procedure of phasing and calibration of diesel fuel injection pumps.
- 14.17 Explain the procedure of setting of timing of diesel fuel injection pump.
- 14.18 State the function of diesel fuel injector.
- 14.19 Describe the types and working of diesel fuel injectors.
- 14.20 State the purpose of high pressure lines.
- 14.21 State the purpose of diesel engine glow plugs.
- 14.22 Describe the construction and working of diesel engine glow plugs.
- 14.23 Enlist the components of Electronically controlled Diesel Fuel Injection System.
- 14.24 Describe the construction and working of each components of Electronically controlled Diesel Fuel Injection System & Common Rail direct injection (CRDI).

### **15 Understand the working of vehicle cruissetronics control system.**

- 15.1 State the Purpose of Vehicle Cruissetronics Control System.
- 15.2 Enlist the components of Vehicle Cruissetronics Control System.
- 15.3 Describe the working principle of Vehicle Cruissetronics Control System.

### **16 Understand the basic construction and working principle of variable valve timing control system.**

- 16.1 State the Purpose of Variable valve timing control systems (VVT-i/

- i-VTec / VANOS/VCT).
- 16.2 Enlist the components of Variable valve timing control systems (VVT-i/ i-VTec / VANOS/VCT).
- 16.3 Describe the working principles of Variable valve timing control systems (VVT-i/ i-VTec / VANOS/VCT).

**17 Understand the basic construction and working principal of .  
Locomotive engine.**

- 17.1 Enlist Main components of Locomotive Engine.
- 17.2 Describe basic working principle of Locomotive Engine.

**Understand the basic working principle of jet engine.**

- 18.1 Enlist the Main components of jet engine.
- 18.2 Describe the basic working principle of jet engine.

**List of Practical:**

- Identify the components of Air intake system.
- Dismantle dry type air cleaner assembly & replace its filter element and re-assemble it.
- Dismantle service and assemble oil bath type air cleaner.
- Identify the parts of turbo charger & service it.
- Identify the components of exhaust system.
- Practice to replace and service the muffler.
- Practice to remove & reinstall fuel tank after cleaning.
- Dismantle fuel gage sending unit and check resistance effect of float movement .
- Remove and reinstall electric fuel pump from the fuel tank.
- Dismantle a carburetor, clean parts, trace out various circuits ,and carry out adjustments.
- Dismantle LPG regulator kit, clean parts and trace out various circuits.
- Dismantle CNG regulator kit , clean parts and trace out various circuits.
- Identify the components of EFI system.
- Practice of fault finding by Coding and Decoding of EFI System manually .
- Practice of fault finding by Automotive Diagnostic Scanner.
- Identify components of diesel fuel supply system.
- Dismantle, service, assemble , testing and readjusting pressure of the injector.
- Dismantle and assemble the distributor type diesel fuel injection pump.
- Dismantle and assemble the in- line type diesel fuel injection pump.
- Carryout phasing of diesel fuel injection pumps on the test bed .
- Carryout calibration of diesel fuel injection pumps on the test bed
- Carryout setting of timing of diesel fuel injection pump on engine.
- Identify components of Vehicle variable valve timing control system.
- Identify components of Vehicle Cruisetronic control system.
- Identify main components of Hybrid Vehicle.
- Prepare a project (sectional / working model ) relevant to the subject.(this activity may be performed in a group of students).
- Identify main components of Electric Vehicle. Visit at railway workshops for the demonstration to Identify the main components of Locomotive engine.
- 28. .Visit at Modern automotive workshop for the demonstration of the use of an automotive equipment.



<b>Total Contact Hours</b>		<b>T</b>	<b>P</b>	<b>C</b>
<b>Theory</b>	<b>64</b>	<b>2</b>	<b>3</b>	<b>3</b>
<b>Practical</b>	<b>96</b>			

**Pre-requisite:** IC ENGINE + WORKSHOP PRACTICE-I AIMS.

- Understand the working of mechanical transmission system
- Repair and maintain conventional transmission from clutch and gear box to final drive unit.
- Understand the working of automatic and hydraulic transmission.
- Develop skill in servicing, repair of Electronically controlled automatic transmission systems.
- Understand gear ratio and working of epicyclic gear train.

## **Detail of Contents:**

### **PART-I**

1. **Purpose & terminology of automotive transmission system.** **4 Hours**
  - 1.1 Purpose of Automotive Transmission System.
  - 1.2 Terminology.  
( Torque, Velocity, Tractive effort, Air Resistance, Gradient Resistance, Rolling Resistance, Maximum vehicle speed, Constant velocity.
  
2. **Automotive transmission system Lay-out.** **4 Hours**
  - 2.1 Power Train.
  - 2.2 Main Components of Automotive Transmission System.
  - 2.3 Automotive Transmission Lay-outs, types, and their advantages.
    - 2-Wheeler drive.
    - Front engine front wheel drive.
    - Rear engine rear wheel drive.
    - Front engine rear wheel drive.
    - 4-Wheel drive.
  
3. **Purpose, types, and working of gears.** **6 Hours**
  - 3.1 Purpose of Gear.
  - 3.2 Basic Configuration of Gear.
  - 3.3 Different types of gears and their working.
  - 3.4 Gear train.
  - 3.5 Following gear Trains.
    - a. Simple Gear Train
    - b. Compound Gear Train.

- c. Reverse Gear Train.
- 3.6 Gear Ratio, Torque Ratio, Velocity Ratio.
- 3.7 Numerical problems regarding gear ratio, torque ratio, and speed ratio.
  
- 4. **Purpose, types, construction and working of clutch.** **6 Hours**
  - 4.1 Function of Clutch.
  - 4.2 Main parts of clutch.
  - 4.3 Various types of Clutches used in automotive.
    - a. Single Plate Clutch.
    - b. Multi Plate Clutch.
    - c. Dry and Wet type Clutch.
    - d. Diaphragm type Clutch.
  - 4.4 Material used for Clutch Lining
  - 4.5 Cable operated Clutch mechanism(Mechanical linkage).
  - 4.6 Hydraulically operated Clutch mechanism.
  - 4.7 Construction and working principle of Fluid Coupling.
  - 4.8 Causes and remedies of clutch faults.
  
- 5. **Working of manual transmission and transaxle.** **12 Hours**
  - 5.1 Importance of Gear Box.
  - 5.2 Types, Construction and working of following types of mechanical Gear Boxes.
    - a. Sliding Mesh type Gear Box.
    - b. Constant Mesh type (Synchromesh)Gear Box.
  - 5.3 Positions and working of Gear Shift Mechanism.
  - 5.4 Free Wheeling.
  - 5.5 Purpose, Construction, and working of Overdrive Mechanism.
  - 5.6 Purpose, Construction, and working of transaxle Gear Box.
  - 5.7 Gear Ratio of manual gear box in 1<sup>st</sup> gear, 2<sup>nd</sup> gear, 3<sup>rd</sup> gear, 4<sup>th</sup> gear, and in reverse gear.
  - 5.8 Properties of Gear Box oil.
  - 5.9 Problems, causes and possible remedies of Manual type gear boxes.
  - 5.10 Purpose of the 4-Wheel Drive mechanism.
  - 5.11 Construction and working of 4-Wheel Drive Mechanism.

## **PART-II**

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- 6. **Purpose ,construction, types and working of propeller shaft.** **4 Hours**
  - 6.1 Purpose of Propeller Shaft.
  - 6.2 Working of each component of propeller shaft.
    - a. Universal joint and Slip Joint.
    - b. Constant Velocity Joint.
    - c. Hotchkiss drive and torque tube type drive.
  - 6.3 Faults, Causes and possible remedies of Propeller Shaft.

- 7. Purpose ,construction, and working of differential gear box. 4 Hours**
- 7.1 Purpose of Differential Gear Box.
  - 7.2 Components of Differential Gear Box.
  - 7.3 Construction and Working of Differential Gear Box.
  - 7.4 Gear Ratio of Differential Gear Box.
  - 7.5 Properties of Differential Gear Box oil .
  - 7.6 Purpose and working of Limited Slip Differential (LSD).
  - 7.7 Problems, Causes and possible remedies of Differential Gear Box .
- 8. Purpose ,construction, types and working of drive axles. 4 Hours**
- 8.1 Purpose of drive axle .
  - 8.2 Live axle and Dead axle.
  - 8.3 Types of Rear Axle.
    - a. Semi floating axle.
    - b. Three quarter floating axle.
    - c. Full floating axle.
  - 8.4 Types of Axle Housing.
    - a. Banjo type Axle Housing.
    - b. Slit type Axle Housing.
  - 8.5 Axle to weight ratio.
  - 8.6 Axle Hub.
  - 8.7 Problems, Causes and possible remedies of axle faults.
- 9. Working of automatic transmission and transaxle. 20 Hours**
- 9.1 Advantages and Disadvantages of Manual and Automatic Transmission.
  - 9.2 Construction and working of each components of following types of Automatic Transmission (Gear Box).
    - a. Epicyclic or Planetary Gear train type Electronically Controlled Automatic Transmission(ECT).
    - b. Progressive Shift Schedule Management Technology (Prosmatic Transmission Gear Box ).
    - c. Continuously Variable Transmission (CVT).
    - d. 4-Wheel Drive Electronically controlled transaxle (4-W ECT ).
  - 9.3 Properties of Automatic Transmission Fluid.
  - 9.4 Advantages and Disadvantages of Manual and Automatic Transmission.
  - 9.5 Problems, Causes and possible remedies of automatic transmission

### **Recommended Textbooks:**

Automotive Excellence ( Volume 1 & 2 ) by McGRAW Hill International  
 Automotive Mechanics ( Volume 1 & 2 ) by Ed May  
 Automotive Technology A System Approach by Jack Erjavec  
 Modern Automotive Mechanics by James E. Duffy.

**Instructional Objectives:**

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

**PART-I****Understand the purpose & terminology of automotive transmission system.**

- 1.1 State the Purpose of Automotive Transmission System.
- 1.2 Describe the following terminology.  
( Torque, Velocity, Tractive effort, Air Resistance, Gradient Resistance, Rolling Resistance, Maximum vehicle speed, Constant velocity.

**Understand the automotive transmission system Lay-out.**

- 2.1 Define Power Train.
- 2.2 Enlist the Main Components of Automotive Transmission System.
- 2.3 Describe Automotive Transmission Lay-outs, types, and their advantages.
  - 2-Wheeler drive.
    - Front engine front wheel drive.
    - Rear engine rear wheel drive.
    - Front engine rear wheel drive.
  - 4-Wheel drive.

**Understand the purpose, types, and working of gears.**

- 3.1 State the Purpose of Gear.
- 3.2 Explain the Basic Configuration of Gear.
- 3.3 Describe different types of gears and their working.
- 3.4 Define Gear train.
- 3.5 Describe following gear Trains.
  - Simple Gear Train
  - Compound Gear Train.
  - Reverse Gear Train.
- 3.6 Define Gear Ratio, Torque Ratio, Velocity Ratio.
- 3.7 Solve the numerical problems regarding gear ratio, torque ratio, and speed ratio.

**Understand the purpose, types, construction and working of clutch.**

- 4.1 State the Function of Clutch.
- 4.2 Enlist the main parts of clutch.
- 4.3 Describe Various types of Clutches used in automotive.
  - Single Plate Clutch.
  - Multy Plate Clutch.
  - Dry and Wet type Clutch.
  - Diaphragm type Clutch.

- e) Centrifugal clutch.
- 4.4 Describe the material use for Clutch Lining
- 4.5 Describe Cable operated Clutch mechanism(Mechanical linkage).
- 4.6 Describe the Hydraulically operated Clutch mechanism.
- 4.7 Explain the construction and working principle of Fluid Coupling.
- 4.8 Describe the causes and remedies of clutch faults.

**Understand the construction , types and working of manual transmission and transaxle.**

- 5.1 Describe the importance of Gear Box.
- 5.2 Describe the types, Construction and working of following types of mechanical Gear Boxes.
  - Sliding Mesh type Gear Box.
  - Constant Mesh type (Synchromesh)Gear Box.
- 5.3 Explain the positions and working of Gear Shift Mechanism.
- 5.4 Describe Free Wheeling.
- 5.5 Describe purpose, Construction, and working of Overdrive Mechanism.
- 5.6 Describe purpose, Construction, and working of transaxle Gear Box.
- 5.7 Find out the Gear Ratio of manual gear box in 1<sup>st</sup> gear, 2<sup>nd</sup> gear, 3<sup>rd</sup> gear, 4<sup>th</sup> gear, and in reverse gear.
- 5.8 Describe Properties of Gear Box oil.
- 5.9 Describe problems, causes and possible remedies of Manual type Gear Boxes.
- 5.10 State the purpose of the 4-Wheel Drive mechanism.
- 5.11 Describe the construction and working of 4-Wheel Drive Mechanism.

## **PART-II**

**Understand the purpose ,construction, types and working of propeller shaft.**

- 6.1 State Purpose of Propeller Shaft.
- 6.2 Describe construction and working of each component of propeller shaft.
  - a. Universal joint and Slip Joint.
  - b. Constant Velocity Joint.
  - c. Hotchkiss drive and torque tube type drive.
- 6.3 Describe the faults, Causes and possible remedies of Propeller Shaft.

**Understand the purpose ,construction, and working of differential gear box.**

- 7.1 State the Purpose of Differential Gear Box.
- 7.2 Enlist Components of Differential Gear Box.
- 7.3 Explain the Construction and Working of Differential Gear Box.
- 7.4 Find out the Gear Ratio of Differential Gear Box.
- 7.5 Describe Properties of Differential Gear Box oil .
- 7.6 Describe the purpose and working of Limited Slip Differential (LSD).
- 7.7 Describe the problems,Causes and possible remedies of Differential

**Understand the purpose ,construction, types and working of drive axles.**

- 8.1 State the Purpose of drive axle .
- 8.2 Differentiate between the Live axle and Dead axle.
- 8.3 Describe the types of Rear Axle.
  - a. Semi floating axle.
  - b. Three quarter floating axle.
  - c. Full floating axle.
- 8.4 Describe Types of Axle Housing.
  - a. Banjo type Axle Housing.
  - b. Slit type Axle Housing.
- 8.5 Describe axle to weight ratio.
- 8.6 Describe Axle Hub.
- 8.7 Describe the problems, Causes and possible remedies of axle faults.

**Understand the construction , types and working of automatic transmission and transaxle.**

- Describe the Advantages and Disadvantages of Manual and Automatic Transmission.
- 9.1 Describe the construction and working of each components of following types of Automatic Transmission (Gear Box).
  - a. Epicyclic or Planetary Gear train type Electronically Controlled Automatic Transmission(ECT).
  - b. Progressive Shift Schedule Management Technology
  - c. (Prosmatic Transmission Gear Box ).
  - d. Continuously Variable Transmission (CVT).
  - e. 4-Wheel Drive Electronically controlled transaxle (4-W ECT ).
- 9.2 Describe Properties of Automatic Transmission Fluid.
- 9.3 Describe the Advantages and Disadvantages of Manual and Automatic Transmission.
- 9.4 Describe problems, Causes and possible remedies of Automatic Transmission

**List of Practical:**

Draw various Vehicle Layouts for 2-wheeler, 3-wheeler, and 4-wheeler and compare them.

Identify the main units of automotive Transmission system.

Identify different types of Gears.

Remove and reinstall Clutch assembly.

Re-align the Clutch Plate.

Adjust the Clutch Pedal free play .

Identify the Problems of Clutch Plate and Pressure plate assembly.

Remove and reinstall the transmission gear box on the vehicle.

Dismantle and assemble the Synchromesh type gear box , identify clean and inspect the parts, and also calculate the gear ration in 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, and reverse gear.

Study the working of gear shift mechanism.

Study the transfer case working.

Check working of Freewheeling devices.

Identify the parts of synchronizing unit.

Disassemble and Identify the main parts of overdrive mechanism.

Remove, inspect and reinstall the propeller shaft.

Dismantle , inspect and reassemble the universal and Slip joints parts.

Check play and noise in constant velocity joint.

Remove rear axle , inspect and re-install it.

Remove and inspect gear box bearings oil seal, and reinstall them.

Disassemble , inspect and reassemble the Planetary gear train type electronically controlled automatic transmission(ECT) and identify all the components.

Visit at modern automotive workshop for the demonstration of disassembling, inspection, identification of parts and reassembling of( Prosmatic transmission gear box & continuously variable transmission (CVT) gear box.

Prepare a project (sectional / working model ) relevant to the subject. (this activity may be perform in a group of students)

Diagnose the troubles of automatic transmission using automotive diagnostic scanner and rectify them.

<b>Total Contact Hours</b>		<b>T</b>	<b>P</b>	<b>C</b>
<b>Theory</b>	<b>32</b>	<b>1</b>	<b>3</b>	<b>2</b>
<b>Practical</b>	<b>96</b>			

**Pre-requisite:** I.C. Engines and Workshop Practice-II AIMS.

Understand the motor vehicle inspection

Understand the inspecting vehicle license, registration, and insurance.

Understand the tire and wheel, suspension system, steering system, front end alignment, brakes, lighting and electrical system.

Understand the inspection vehicle glazing, vehicle body and accessories, fuel system, exhaust system, automotive emission control.

Understand the inspection of Heavy Duty Vehicles like Buses, Trucks with respect to tires, wheels, suspension, steering, brakes, lighting body and engine systems.

### **Detail of Contents:**

## **PART 1: INSPECTION OF PASSENGER CARS AND LIGHT TRUCKS**

1. **Motor vehicle inspection and accidents.** **2 Hours**
  - 1.1. Procedure of motor vehicle inspection
  - 1.2. Road condition.
  - 1.3. Driver condition.
  - 1.4. Vehicle condition.
  - 1.5. Basic types of vehicles inspection programs.
  
2. **Introduction of vehicle inspection.** **2 Hours**
  - 2.1. Safety measures taken during inspection.
  - 2.2. Inspection procedure covers.
  - 2.3. Typical inspection stations.
  - 2.4. Two bay inspection stations.
  - 2.5. Single bay inspection station.
  - 2.6. Through type inspection stations.
  
3. **Inspection of vehicle license, registration and insurance.** **3 Hours**
  - 3.1. Explain the certificate of title.
  - 3.2. Define vehicle identification Number (VIN).
  - 3.3. Define engine identification Number (EIN).
  - 3.4. Define transmission identification Number (TIN).
  - 3.5. State the importance of proof of insurance.
  - 3.6. State agreement on legal papers.
  
4. **Tire and wheel inspection.** **2 Hours**
  - 4.1. Tire inflation and tire wear.



- 4.2. Method of checking of tire pressure and inflation.
  - 4.3. Method of tire and tube inspection.
  - 4.4. Tire and wheel inspection procedure.
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5. **Inspection of vehicle suspension system.** **4 Hours**
    - 5.1. Spring, shock-absorber and tracking inspection.
    - 5.2. Inspection procedure for spring, shock-absorber and tracking.
    - 5.3. Method of inspection of the electronic controls of transmission system.
    - 5.4. Method of inspection of the electronic controls of suspension system.
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6. **Inspection of vehicle steering system.** **3 Hours**
    - 6.1. Steering system, steering column, front wheel bearing, ball steering gear and linkage inspection.
    - 6.2. Method of the power steering inspection.
    - 6.3. Method of inspection of steering linkage for looseness.
    - 6.4. Method of inspection of the electronic controls of steering system.
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7. **Front-end linkage and brake inspection of vehicles.** **3 Hours**
    - 7.1. Frond-end alignment inspection procedure.
    - 7.2. Typical alignment procedure.
    - 7.3. Brakes inspection procedure.
    - 7.4. Brake test at inspection station.
    - 7.5. Method of performing the visual inspection of Hydraulic brake system.
    - 7.6. Method of inspection of vacuum brake system.
    - 7.7. Method of operating inspection of hydraulic system.
    - 7.8. Method of inspection of the electronic controls of brake system.
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8. **Inspection of vehicle lighting and electric system.** **1 Hour**
    - 8.1. Method of inspection of vehicle lighting and electric system.
    - 8.2. Preparation for head light inspection.
    - 8.3. Method of headlight aiming with mechanical aimer.
    - 8.4. Method of inspection of other lights.
    - 8.4. Safety starting switch inspection.
- 
9. **Inspection of vehicle glazing .** **1 Hour**
    - 9.1. Development of laminated wind shields.
    - 9.2. Automotive safety glazing.
    - 9.3. Types of safety glass.
    - 9.4. Inspecting vehicle glazing.
    - 9.5. Reasons for rejecting vehicle.
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10. **Inspection of vehicle body and accessories.** **2 Hours**
    - 10.1. Body sheet metal, Fenders, Doors, Hoods, Floor pan and

- energy-Absorbing Bumpers.
- 10.2. Method of inspection of Bumpers, Seats, Seat-Belts and Sun visor.
- 10.3. Method of inspection of outside Mirrors, Interior Mirrors, wind- Shield wiper, Windshield-washer and Defroster.
- 10.4. Method of inspection of the electronic controls of vehicle body accessories system.

**11. Inspection of vehicle fuel exhaust and emission control system.**

**1 Hour**

- 11.1. Method of inspection of fuel system.
- 11.2. Method of inspection of the exhaust smoke.
- 11.3. Method of inspection of vapor-recovery system, Air-injection system and positive Crankcase Ventilation System.(PCV)
- 11.4. Method of inspection of the Exhaust-Gas Recirculation (EGR) and ignition System.
- 11.5. Method of inspection of the electronic controls of fuel system.

## **PART 2: INSPECTIONS OF HEAVY-DUTY MOTOR VEHICLES**

**12. Tires, wheel, steering, alignment and suspension system of trucks and buses**

**3 Hours**

- 12.1. Trucks, Pick-ups, Vans, Utility Vehicles, Tractors, Trailers and Buses.
- 12.2. Special problems in the inspection of Heavy duty Vehicles.
- 12.3. Method of inspection of Tires and Wheels, Front suspension of Bus and trucks.
- 12.4. Method of inspection Lash, travel and column of steering system.
- 12.5. Method of inspection under vehicle linkage and leaf spring.
- 12.6. Method of inspection steering linkage and King pin play.
- 12.7. Method of inspection Front Alignment and Tracking.
- 12.8. Method of inspection of the air suspension, air suspension-retractable Axle with independent suspension.
- 12.9. Method of inspection of the electronic controls of heavy duty vehicle steering and suspension systems.

**13. Brakes, lighting and electric system of heavy motor vehicle.**

**2 Hours**

- 13.1. Performance inspection checks.
- 13.2. Method of inspection of hydraulic, mechanical and emergency brake system.
- 13.3. Inspection features of air-system, vacuum system and parking Brakes .
- 13.4. Procedure for emergency-brake inspection.
- 13.5. Procedure of the trailer emergency brakes and electric-brake in trailers.
- 13.6. Inspection of bus air brake parking and emergency.
- 13.7. preparation for headlight inspection and Neutral safety starting switch inspection.
- 13.8. Method of inspection of the electronic controls of heavy duty vehicle brake and lighting system

**14. Inspection of heavy duty vehicles body and engine system.**

**1 Hour**

- 14.1. Inspection of vehicle glazing and body and accessories.
- 14.2. Inspection procedure of interior and exterior rearview mirrors.
- 14.3. Inspection procedure of floor pan, body and sheet metal fire extinguisher and first aid kit.
- 14.4. Inspection of seat belts, visors, energy absorbing bumpers, wind shield wiper and washer.
- 14.5. Inspection of fuel exhaust and emission control system.
- 14.6. Method of inspection of the electronic controls of heavy duty vehicle body and engine systems.

**PART 3: INSPECTIONS OF SCHOOL BUSES**

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**15. Inspection of body and accessories of school-bus.**

**2 Hours**

- 15.1. Special school bus checks and preventive maintenance program.
- 15.2. Inspection of school-bus-glazing, lighting and electric system.
- 15.3. Inspection of brakes, body and accessories of school-bus.
- 15.4. Inspection of Fuel, Exhaust and Emission Control System.
- 15.5. Inspection of wheels and tires, Steering Alignment and Suspension.

**Recommended Textbooks:**

Motor Vehicle Inspection by W. H. Crouse & D. L. Anglin  
A Practical Approach to Motor Vehicle  
Engineering & maintenance by Allan Bonnick

**Instructional Objectives:**

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

## **PART 1: INSPECTION OF PASSENGER CARS AND LIGHT TRUCKS**

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**Know motor vehicle inspection and accidents**

- 1.1. State the procedure of motor vehicle inspection
- 1.2. State road condition.
- 1.3. State driver condition.
- 1.4. State vehicle condition.
- 1.5. Explain basic types of vehicles inspection programs.

**Understand introduction of vehicle inspection.**

- 2.1.State the safety measures taken during inspection.
- 2.2.Explain the inspection procedure covers.
- 2.3.Enlist the typical inspection stations.
- 2.4.Explain the two bay inspection stations.
- 2.5.Explain the single bay inspection station.
- 2.6.Explain drive through type inspection stations.

**Know inspection of vehicle license, registration and insurance**

- 3.1.Explain the certificate of title.
- 3.2.Define vehicle identification Number (VIN).
- 3.3.Define engine identification Number (EIN).
- 3.4.Define transmission identification Number (TIN).
- 3.5.State the importance of proof of insurance.
- 3.6.State agreement on legal papers.

**Understand tire and wheel inspection.**

- 4.1.Define the term tire inflation and tire wear.
- 4.2.State the method of checking of tire pressure and inflation tires.
- 4.3.Explain the method of tire and tube inspection.
- 4.4.Discuss the tire and wheel inspection procedure.

**Understand the inspection of vehicle suspension system**

- 5.1. Explain spring, shock-absorber and tracking inspection.
- 5.2. Explain the inspection procedure for spring, shock-absorber and tracking.
- 5.3. State the method of inspection of the electronic controls of transmission system.
- 5.4. State the method of inspection of the electronic controls of suspension system.

**Understand the inspection of vehicle steering system.**

- 6.1. Explain steering system, steering column, front wheel bearing, ball joint, steering gear and linkage inspection.
- 6.2. Explain method of the power steering inspection.
- 6.3. State the method of inspection of steering linkage for looseness.
- 6.4. State the method of inspection of the electronic controls of steering system.

#### **Understand the front-end linkage and brake inspection of vehicles.**

- 7.1. Explain the front-end alignment inspection procedure.
- 7.2. Explain the typical alignment Procedure.
- 7.3. Discuss the brakes inspection Procedure.
- 7.4. Discuss brake test at inspection station.
- 7.5. Explain the method of performing the visual inspection of hydraulic brake system.
- 7.6. Explain the method of inspection of vacuum brake system.
- 7.7. Explain the method of operating inspection of hydraulic system.
- 7.8. State the method of inspection of the electronic controls of brake system.

#### **Understand the inspection of vehicle lighting and electric system**

- 8.1. State the method inspection of vehicle lighting and electric system.
- 8.2. Discuss preparation for head light inspection.
- 8.3. Explain the method of Headlight aiming with Mechanical Aimer.
- 8.4. Explain method of inspection of other lights.
- 8.5. Describe the safety starting switch inspection.

#### **Understand the inspection of vehicle glazing**

- 9.1. Discuss development of laminated wind shields.
- 9.2. Define automotive safety glazing.
- 9.3. Explain types of safety glass.
- 9.4. Explain inspecting vehicle glazing.
- 9.5. Discuss reasons for rejecting vehicle.

#### **Understand the inspection of vehicle body and accessories**

- 10.1. Describe body sheet metal, Fenders, Doors, Hoods, Floor pan and energy-Absorbing Bumpers.
- 10.2. Explain the method inspection of Bumpers, Seats, Seat-Belts and Sun visor.
- 10.3. Explain the method inspection of outside Mirrors, Interior Mirrors, Wind- Shield wiper, Windshield-washer and Defroster.
- 10.4. State the method of inspection of the electronic controls of vehicle body accessories system.

#### **Understand the inspection of vehicle fuel exhaust and emission control system**

- 11.1. State the method of inspection of fuel system.
- 11.2. State the method of inspection of the Exhaust smoke.
- 11.3. Explain the method of inspection of Vapor-Recovery system, Air-injection system and positive Crankcase Ventilation System.(PCV)
- 11.4. Explain the method of inspection of the Exhaust-Gas Recirculation (EGR) and ignition System.
- 11.5. State the method of inspection of the electronic controls of fuel system.

## **PART 2: INSPECTIONS OF HEAVY-DUTY MOTOR VEHICLES**

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### **Understand the inspection of tires, wheel, steering, alignment and suspension system of trucks and buses**

- 12.1. Define Trucks, Pick-ups, Vans, Utility Vehicles, Tractors, Trailers and Buses.
- 12.2. Identify special problems in the inspection of Heavy duty Vehicles.
- 12.3. Explain the method of inspection of Tires and Wheels, Front suspension of Bus and trucks.
- 12.4. Explain the method of inspection Lash, travel and column of steering system.
- 12.5. Explain the method of inspection under vehicle linkage and leaf spring.
- 12.6. Explain the method of inspecting steering linkage and Kingpin play.
- 12.7. Explain the method of inspection Front Alignment and Tracking.
- 12.8. Explain the method of inspection of the air suspension, air suspension-retractable Axle with independent suspension.
- 12.9. State the method of inspection of the electronic controls of heavy duty vehicle steering and suspension systems.

### **Understand the inspection of brakes, lighting and electric system of heavy motor vehicle**

- 13.1. Discuss performance inspection checks.
- 13.2. Explain the method of inspection of hydraulic, mechanical and emergency brake system.
- 13.3. Discuss inspection features of air-system vacuum system and parking brakes in trailers..
- 13.4. Explain procedure for emergency-brake inspection.
- 13.5. Explain inspection procedure of the trailer emergency brakes and electric-brake in trailers.
- 13.6. Explain inspection of bus air brake parking and emergency.
- 13.7. Explain preparation for headlight inspection and Neutral safety starting switch inspection.
- 13.8. State the method of inspection of the electronic controls of heavy duty vehicle brake and lighting system

### **Understand inspecting heavy duty vehicles body and engine system**

- 14.1. Explain inspection of vehicle glazing body and accessories.
- 14.2. Explain inspection procedure of interior and exterior rearview mirrors.
- 14.3. Explain inspection procedure of floor pan, body and sheet metal fire extinguisher and first aid kit.
- 14.4. Explain inspection of seat belts, visors, energy absorbing bumpers, wind shield wiper and washer.
- 14.5. Explain inspection of fuel exhaust and emission control system.
- 14.6. State the method of inspection of the electronic controls of heavy duty vehicle body and engine systems.

## **PART 3:   INSPECTIONS OF SCHOOL BUSES**

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### **Understand the inspection of body and accessories of school-bus**

- 15.1.Enlist special school bus checks and preventive maintenance program.
- 15.2.Discuss the inspection of school-bus-glazing, lighting and electric system.
- 15.3.Discuss inspection of brakes, body and accessories of school-bus.
- 15.4.Explain inspection of Fuel, Exhaust and Emission Control System.
- 15.5.Explain inspection of wheels and tires, Steering Alignment and Suspension.

## **AD-312    MOTOR VEHICLE INSPECTION**

### **List of Practicals:**

#### **Part - I**

Study the Vehicles and their systems.

Inspect vehicle tires and wheels

Inspect Vehicle tracking.

Inspect vehicle shock absorber visually, on the vehicle & off the vehicle.

Inspect Vehicle Suspension system and, Front-End Alignment

Inspect the Vehicle steering system.

Inspect vehicle Brake System.

Inspect Vehicle lighting and electric system

Inspect Vehicle Glazing and Fuel System.

Inspect Vehicle Body and Accessories.

Inspect Exhaust system of Vehicle.

Inspect Vehicle emission controls.

Locate the Special Problems in Vehicle .

#### **Part - II**

Inspect the Heavy Duty Vehicles.

Inspect Tire and wheels of Heavy Duty Vehicles.

Inspect Vehicle tracking.

Inspect suspension and steering system of Heavy Duty Vehicles.

Inspect Brakes System of Heavy Duty Vehicles.

Inspect lighting and Electric System of Heavy Duty Vehicles.

Inspect Heavy Duty Vehicle Body and Engine Systems.

Inspect Preventive- Maintenance Program.

Prepare Comprehensive Vehicle Inspection Report.

Prepare Certificate of registration.

Prepare Certificate of Title for a Vehicle.

Visit at regional office of Motor Vehicle Examiner for the  
demonstration of inspection of Light & Heavy duty Vehicles.



## **AD-373 COMPUTER APPLICATION IN CAD & AUTOMATION**

<b>Total Contact Hours</b>		<b>T</b>	<b>P</b>	<b>C</b>
<b>Theory</b>	<b>64</b>	<b>2</b>	<b>3</b>	<b>3</b>
<b>Practical</b>	<b>96</b>			

**Pre-requisite:** Computer Science Fundamentals.

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

- Understand the importance of computer application in preparing drawing with the help of Auto CAD software and organizing automation
- Apply CAD commands to draw geometrical figures
- Prepare drawing of Auto components by using Auto CAD software
- Use CAD to make three dimensional simple views (3D view)
- Know basic principles of computer applications in Automation (CAM) and Robotics

### **Detail of Contents:**

#### **1-CAD (Computer Aided Design/Drawing)**

**5 Hours**

- 1.1 CAD Introduction
- 1.2 CAD History
- 1.3 2D and 3D CAD
- 1.4 AutoCAD and other designing software
- 1.5 AutoCAD installation

#### **2-Interfacing with AutoCAD**

**5 Hours**

- 2.1 Beginning AutoCAD
- 2.2 Navigating the Graphical User Interface (GUI)
- 2.3 Picking/ Choosing Commands
- 2.4 Opening Drawings, Beginning New Drawings/files, Closing Drawings/files and AutoCAD Saving files in other location, renaming files/folder

#### **3-Using Accurate Drawing Techniques**

**5 Hours**

- 3.1 Picking Points with the help of Osnap
- 3.2 Using Object Snaps; Object Snap settings
- 3.3 Inputting Coordinates
- 3.4 Using Dynamic Input
- 3.5 Typing Numbers
- 3.6 Aligning Points with Object Snap Tracking
- 3.7 Obtaining distances with distance command

<b>4-Displaying Areas of a Drawing</b>	<b>2.5 Hours</b>
4.1 Viewing the Entire Drawing	
4.2 Enlarging or Reducing the Image on the Screen	
4.3 Viewing Adjacent Areas	
4.4 Using command Zoom (All options)	
<b>5-Working with Object Properties</b>	<b>2.5 Hours</b>
5.1 Using the Properties Tool Palette	
5.2 Creating and Assigning Layers	
5.3 Working With Colors, Line types and Line weights	
5.4 Use of ORTHO, SNAP and Grid in Auto CAD	
<b>6-Creating and Editing Shapes</b>	<b>9 Hours</b>
6.1 Erasing and deleting Objects	
6.2 Drawing Lines using coordinate systems, Circle, Polygons and Rectangles	
6.3 Moving and Copying Objects	
6.4 Adding Fillets and Chamfers	
6.5 Trimming and Extending Objects (with options)	
6.6 Joining Objects	
6.7 Offsetting Objects	
6.8 Stretching Objects	
6.9 Mirroring Objects	
6.10 Creating Patterns with Array (polar and rectangular options)	
6.11 Scaling and Rotating Objects	
6.12 Using Blocks from Design Center and Tool Palette	
6.13 Filling Areas with a Pattern (Hatch), types of Hatch, options of Hatch	
<b>7-Adding Text and Dimensions</b>	<b>5 Hours</b>
7.1 Choosing an Annotation Scale	
7.2 Adding a Note Using Multiline Text and single line text	
7.3 Creating linear, Aligned and Angular Dimensions	
7.4 Adding Diameter and Radius Dimensions, use of dimension continue and Base line	
7.5 Creating Multiline Leaders, applying tolerances	
<b>8-Printing</b>	<b>3 Hours</b>
8.1 Choosing the Plotter print/Printer, Area, Paper Size, Orientation and Color	
8.2 Adding a Sheet Format (Layout)	
8.3 Setting the Drawing Scale	
<b>9-Modeling in 3D</b>	<b>9 Hours</b>
9.1 3D viewing techniques	
9.2 Working with simple and composite solids	
9.3 Creating complex solids and surfaces	
9.4 Modifying objects in 3D space/ editing solids	

- 9.5 Converting 3D objects/ Setting up a rendering with materials and lights
- 9.6 Working with the User Coordinate System

### **10-Drawing of Auto Mobile Components**

**5 Hours**

- 10.1 Simple parts in detail
- 10.2 Components as assembly (only two component assemblies)
- 10.3 introduction of 3 Dimension in pictorial, oblique and isometric

### **11-Automation (CAM)**

**7 Hours**

- 11.1 Importance of CAM in production
- 11.2 Concept of 3-axes movements of machine table, spindle and tools by computer.
- 11.3 Changing of tools at sequence
- 11.4 CAM programming

### **12-ROBOTICS**

**6 Hours**

- 12.1 What is robot and its importance in production?
- 12.2 Principle of robotics
- 12.3 Mechanical methods and components used in robotics
- 12.4 Idea of computer programming for operation of robots
- 12.5 Types of operations/processes which can be done by robot e.g. assembling, fitting of engine Parts, chassis and body of vehicle.
- 12.6 Welding techniques in vehicle body building with use of robots.

#### **Recommended Textbooks:**

Auto CAD-2012 for Engineers & Designers by Professor Smam Tichro.  
Masering Auto CAD 2008 and Auto CAD LT 2008 by George Omura.

# **AD-373 COMPUTER APPLICATION IN CAD & AUTOMATION**

## **Instructional Objectives:**

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

### **1-Understand CAD (Computer Aided Design/Drawing) Basics**

- 1.1 Define Auto CAD and describe its uses, purpose, advantages and importance in industry
- 1.3 Describe 2D and 3D CAD
- 1.4 Describe AutoCAD and other designing software
- 1.5 Explain AutoCAD installation

### **2- Understand Interfacing with AutoCAD**

- 2.1 Describe Beginning of AutoCAD
- 2.2 Describe Navigating the Graphical User Interface (GUI)
- 2.3 Describe Picking/ Choosing Commands
- 2.4 Explain opening drawings, beginning new drawings/files, Closing drawings/files and AutoCAD
- 2.5. Saving files in other location, renaming files/folder

### **3- Understand Using Accurate Drawing Techniques**

- 3.1 Describe Picking Points with the help of Osnap
- 3.2 Explain Using Object Snaps; Object Snap settings
- 3.3 Describe Inputting Coordinates
- 3.4 Describe Using Dynamic Input
- 3.5 Describe Typing Numbers
- 3.6 Describe Aligning Points with Object Snap Tracking
- 3.7 Describe obtaining distances with distance command

### **4- Understand Displaying Areas of a Drawing**

- 4.1 Describe Viewing the Entire Drawing
- 4.2 Describe Enlarging or Reducing the Image on the Screen
- 4.3 Describe Viewing Adjacent Areas
- 4.4 Explain Using command Zoom (All options)

### **5- Understand Working with Object Properties**

- 5.1 Explain Using the Properties Tool Palette
- 5.2 Explain Creating and Assigning Layers
- 5.3 Discuss Working With Colors, Line types and Line weights
- 5.4 Explain Use of ORTHO, SNAP and Grid in Auto CAD

### **6- Understand Creating and Editing Shapes**

- 6.1 Describe Erasing and deleting Objects
- 6.2 Explain Drawing Lines using coordinate systems, Circle, Polygons and Rectangles
- 6.3 Describe Moving and Copying Objects
- 6.4 Explain Adding Fillets and Chamfers
- 6.5 Explain Trimming and Extending Objects

- 6.6 Describe Joining Objects
- 6.7 Describe Offsetting Objects
- 6.8 Describe Stretching Objects
- 6.9 Describe Mirroring Objects
- 6.10 Describe Creating Patterns with Array (polar and rectangular options)
- 6.11 Describe Scaling and Rotating Objects
- 6.12 Explain Using Blocks from Design Center and Tool Palette
- 6.13 Explain Filling Areas with a Pattern (Hatch), types of Hatch, options of Hatch

## **7- Understand Adding Text and Dimensions**

- 7.1 Discuss Choosing an Annotation Scale
- 7.2 Describe Adding a Note Using Multiline Text and single line text
- 7.3 Explain Creating linear, Aligned and Angular Dimensions
- 7.4 Explain Adding Diameter and Radius Dimensions, use of dimension continue and Base line
- 7.5 Explain Creating Multiline Leaders, applying tolerances

## **8- Understand Printing**

- 8.1 Discuss Choosing the Plotter print/Printer, Area, Paper Size, Orientation and Color
- 8.2 Discuss Adding a Sheet Format (Layout)
- 8.3 Discuss Setting the Drawing Scale

## **9- Understand Modeling in 3D**

- 9.1 Describe 3D viewing techniques
- 9.2 Describe Working with simple and composite solids
- 9.3 Describe Creating complex solids and surfaces
- 9.4 Explain Modifying objects in 3D space/ editing solids
- 9.5 Explain Converting 3D objects/ Setting up a rendering with materials and lights
- 9.6 Explain Working with the User Coordinate System

## **10- Understand Drawing of Auto Mobile Components**

- 10.1 Explain Simple parts in detail
- 10.2 Explain Components as assembly (only two component assemblies)
- 10.3 Explain introduction of 3 Dimension in pictorial, oblique and isometric

## **11- Understand Automation (CAM)**

- 11.1 Describe Importance of CAM in production
- 11.2 Describe Concept of 3-axes movements of machine table, spindle and tools by computer.
- 11.3 Describe Changing of tools at sequence
- 11.4 Define CAM and describe CAM programming

## **12- Understand Robotics**

- 12.1 Define robot and its importance in production
- 12.2 Describe Principle of robotics
- 12.3 Describe Mechanical methods and components used in robotics
- 12.4 Describe Idea of computer programming for operation of robots
- 12.5 Describe Types of operations/processes which can be done by robot e.g. assembling, Fitting of engine Parts, chassis and body of vehicle.
- 12.6 Explain Welding techniques in vehicle body building with use of robots.

**List of Practicals:**

- 1-Basic requirements of PC for loading AUTO CAD software into computer memory (Installation)
- 2-Practice loading AUTO CAD software into computer memory
- 3- Practice CAD abbreviations, short cut keys for Line, Arc, Circle, Erase, etc...
- 4- Practice to draw straight lines using polar coordinate on graph paper
- 5-Setup drawing area limits using CAD
- 6- Practice for turning grid ON /OFF, and snap ON /OFF and create drawings using snap & grid settings
- 7-Draw a line with Line command with DDE
- 8-Create a Layer for title block and draw title block with line command and assign layer to it.
- 9- Practice for Zoom command (all options)
- 10- Practice for filling title block with text command (multiline or single line)
- 11- Practice for plotting the drawing on Plotter or Printer
- 12-Create a new drawing, save it, rename it and save it in other location/drive/folder
- 13- Draw a circle with circle command
- 14- Draw an inclined line with Line command
- 15- Practice with Undo and Redo commands
- 16- Practice for Modify commands
- 17- Practice for Draw commands
- 18- Basic drawing lines technique
  - Direct distance method
  - Relative polar coordinate system
  - Relative Cartesian coordinate system
  - Absolute coordinate system
- 19-Draw detail of AUTO CAD screen/Graphical User Interface (GUI)
- 20- Practice of Key combinations and Function Keys

**Total contact hours**

Theory:	32 hours	T	P	C
Practical:	96 hours	1	3	2

**Pre-requisite:        None**

- AIMS 1.**        Understand the science of Geology with emphasis on Agriculture  
                 Understand the soil and its formation  
                 Understand the physical properties of soil  
                 Understand the water logging and land drainage  
                 Understand the manures  
                 Understand the inorganic manures or artificial fertilizers and  
                 organic Manures  
                 Understand the fertility of soil

**COURSE CONTENTS**

- 1.        AGRICULTURAL GEOLOGY        4 hours**
- 1.1        Introduction of Geology
  - 1.2        Origin of earth
  - 1.3        Composition of Earth's crust
  - 1.4        Minerals
  - 1.5        Common minerals
  - 1.6        Groups of minerals
  - 1.7        Rocks
  - 1.8        Classification of rocks
  - 1.9        Classification according to composition
  - 1.10       Classification according to origin
  - 1.11       Characteristics of igneous, sedimentary and metamorphic rocks
- 2.        SOIL AND ITS FORMATION        4 hours**
- 2.1        Weathering
  - 2.2        Weathering agencies
  - 2.3        Classification of weathering agencies
  - 2.4        Soil
  - 2.5        Sub-soil
  - 2.6        Difference between soil & sub-soil
  - 2.7        Functions of soil
  - 2.8        Classification of soil according to geology, texture, water supply, chemical composition (pedology), topography, implements and climate or temperature
- 3.        PHYSICAL PROPERTIES OF SOIL        6 hours**
- 3.1        Texture of soil
  - 3.2        Structure of soil
  - 3.3        Specific gravity of soil
  - 3.4        Specific gravities of various soils
  - 3.5        Kinds of specific gravity
  - 3.6        Pore space
  - 3.7        Types of pore space
  - 3.8        Cohesion

- 3.9 Plasticity
- 3.10 Shrinkage
- 3.11 Organic matters of soil
- 3.12 Effects of organic matters on soil
- 3.13 Methods to increase organic matters
- 3.14 Soil moisture
- 3.15 Forms of soil water
- 3.16 Wilting point
- 3.17 Wilting co-efficient
- 3.18 Water requirements of crops
- 3.19 Factors of water requirements of crops
  
- 4. WATER LOGGING AND LAND DRAINAGE 4 hours**
  - 4.1 Water logging
  - 4.2 ILL effects of water-logging
  - 4.3 Areas affected by water logging
  - 4.4 Control of water logging
  - 4.5 Remedial measure of water logging
  - 4.6 Land drainage
  - 4.7 Benefits of drainage
  - 4.8 Type of Drainage
  - 4.9 Factors of depth and size of drains
  - 4.10 Care of drains
  
- 5. MANURES 4 hours**
  - 5.1 Definition of manure
  - 5.2 Classification of manures
  - 5.3 Effect of manures on soil
  - 5.4 Major plant food elements
  - 5.5 Role of main plant food elements in plant life
  - 5.6 Minor or trace plant food elements
  - 5.7 Classification of organic manures
  - 5.8 Farm yard manures
  - 5.9 Factors of composition of F.Y.M
  - 5.10 Composite manure
  - 5.11 Green manure
  - 5.12 Miscellaneous organic manures
  - 5.13 Bio Fertilizers
  
- 6. INORGANIC MANURES OR ARTIFICIAL FERTILIZERS 6 hours**
  - 6.1 Inorganic manures or artificial fertilizer
  - 6.2 Main artificial fertilizers
  - 6.3 Importance of Nitrogenous fertilizers
  - 6.4 Manufacture of nitrogenous fertilizers
  - 6.5 Methods of application of nitrogenous fertilizers
  - 6.6 Importance of phosphatic fertilizers
  - 6.7 Manufacture of phosphatic fertilizers
  - 6.8 Methods of application of phosphatic fertilizers
  - 6.9 Importance of photassic fertilizers
  - 6.10 Manufacture of photassic fertilizers
  - 6.11 Methods of application of photassic fertilizers
  - 6.12 Complete fertilizer
  - 6.13 Preparation of complete fertilizer



6.14 Unit value of manures

**7. SOIL FERTILITY**

**4 hours**

7.1 Soil fertility

7.2 Fertility evaluation

7.3 Effects of fertility on crops

7.4 Improvement of soil fertility

**BOOKS RECOMMENDED**

M. Ibrahim Bajwa, A Textbook of Agriculture

Henry D. Forth, Fundamentals of soil Science

## **INSTRUCTIONAL OBJECTIVES**

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

### **UNDERSTAND AGRICULTURAL GEOLOGY.**

- 1.1. Define geology
- 1.2. Explain the origin of earth
- 1.3. State the composition of earth crust.
- 1.4. Define mineral
- 1.5. Enlist common minerals
- 1.6. Describe the grouping of minerals
- 1.7. Define rocks
- 1.8. Classify rocks.
- 1.9. Explain the classes of rocks according to the composition
- 1.10. Explain the classes of rocks according to the origin
- 1.11. Identify the characteristics of igneous, sedimentary and metamorphic rocks.

### **UNDERSTAND SOIL AND ITS FORMATION**

- 2.1. Define the term weathering
- 2.2. Describe the weathering agencies.
- 2.3. Explain the classes of weathering agencies.
- 2.4. Describe soil
- 2.5. Describe sub-soil
- 2.6. Differentiate between soil and sub-soil
- 2.7. State the functions of soil
- 2.8. Explain soil according to geology, texture, water supply, chemical composition, topography, resistance afforded by implements and climate or temperature.

### **UNDERSTAND PHYSICAL PROPERTIES.**

- 3.1. Describe the texture of soil
- 3.2. Explain the structure of soil
- 3.3. Describe the specific gravity of soil
- 3.4. Enlist the specific gravities of various soil
- 3.5. Explain the kinds of specific gravity of soil
- 3.6. Define pore space
- 3.7. Explain the types of pore space.
- 3.8. Define the term cohesion
- 3.9. Define the term plasticity
- 3.10. Define the term shrinkage
- 3.11. Explain the organic matters of soil
- 3.12. State the effects of organic matters on soil
- 3.13. Describe the methods to increase the organic matters in the soil
- 3.14. Describe the purpose of soil moisture
- 3.15. Explain the forms of soil water
- 3.16. Define the wilting point
- 3.17. Describe the term wilting co-efficient
- 3.18. Explain Describe the water requirements of soil
- 3.19. Describe the factors influencing water requirements of crops.

### **UNDERSTAND WATER LOGGING AND LAND DRAINAGE**

- 4.1 Define water logging
- 4.2 State the ill effects of water logging
- 4.3 Describe the areas affected by water logging
- 4.4 Explain the methods to control water logging
- 4.5 Describe the remedial measures of water logging
- 4.6 Describe land drainage
- 4.7 State the benefits of drainage.
- 4.8 Explain the types of drainage
- 4.9 Describe the factors on which depth and size of drain depend.
- 4.10 Describe the care of drains.

### **UNDERSTAND MANURES.**

- 5.1 Define manure.
- 5.2 Classification of manures
- 5.3 Describe the effect of manures on soil
- 5.4 List the major plant food elements
- 5.5 Describe the role of main plant food elements in plant life.
- 5.6 Enlist the minor plant food elements
- 5.7 Classify of organic manures
- 5.8 Explain the farm yard manure
- 5.9 Describe the factors of composition of F.Y.M.
- 5.10 Explain the purpose and method of preparing compost manure
- 5.11 Describe the green manure
- 5.12 Explain miscellaneous organic manures
- 5.13 Describe the function of bio fertilizer
- 5.14 Explain the method of preparing bio fertilizer
- 5.15 Explain the benefits of bio fertilizers

### **UNDERSTAND INORGANIC MANURES OR ARTIFICIAL FERTILIZERS.**

- 6.1 Describe the inorganic manures or artificial fertilizer
- 6.2 Enlist the main artificial fertilizers
- 6.3 Describe the importance of nitrogenous fertilizers
- 6.4 Explain the method of manufacturing of nitrogenous fertilizers application of
- 6.5 Explain the methods of application of nitrogenous fertilizers
- 6.6 Describe the importance of phosphatic fertilizers.
- 6.7 Explain the methods of manufacturing of phosphatic fertilizers.
- 6.8 Explain the methods of application of phosphatic fertilizers
- 6.9 Describe the importance potassic fertilizers
- 6.10 Explain the method of manufacture of potassic fertilizers.
- 6.11 Explain the methods of application of potassic fertilizers
- 6.12 Explain complete fertilizers
- 6.13 Explain the method of preparation of complete fertilizer
- 6.14 Explain the method of calculating the unit value of manures.

### **UNDERSTAND SOIL FERTILITY**

- 7.1 Describe the soil fertility
- 7.2 Explain the evaluation of fertility of soil
- 7.3 Enlist the effects of fertility on crops
- 7.4 Explain the methods of improvement of soil fertility

**LIST OF PRACTICALS**

Collect soil samples of different soils by soil sampler or soil auger.  
Perform different soil tests on samples (field capacity determination, water condition, percolation rate, texture determination, Structure guessing).  
Identify the different fertilizers physically.  
Observe the effects of various fertilizers on crops production.  
Practice in using the fertilizers by different methods.  
Preparation of different manures.  
Visit to Agricultural Farms.  
visit of agricultural research station of different crops  
Prepare a mixed fertilizer.  
Calculate the unit value of manures.  
Visit to fertilizer manufacturing factory (like Fauji fertilizer, Pak Arab, Dawood Hercules, Anglo fertilizer).  
Visit to SCRAP site

## AF-313 FARM MACHINERY-II

### Total contact hours:

Theory:	64 hours	T	P	C
Practical:	96 hours	2	3	3

### Pre-requisite: Farm Machinery-I

- AIMS 1.** Understand the hay and forage harvesting equipment.  
Understand the reapers and cutter binders, their working and construction  
Understand the stationery thresher, their use, working and construction  
Understand the grain harvesting equipment, their use and working  
Understand the working, construction and use of specialized harvesting equipment  
Understand the working, construction and use of root-harvesting machines  
Know the use of power and machinery management and field and machine capacities

### COURSE CONTENTS:

- 1. HAY AND FORAGE HARVESTING EQUIPMENT 9 hours**
  - 1.1 Purpose of hay and forage harvesting equipment
  - 1.2 Working of cutter bar assembly of mower
  - 1.3 Parts of cutter bar assembly of mower
  - 1.4 Different types of mowers
  - 1.5 Working and functions of rotary mowers
  - 1.6 Purpose, and different types of Hay conditioners
  - 1.7 Purpose, and types of windrowers
  - 1.8 Purpose, working types and construction of rakes
  - 1.9 Types working and use of loaders and stakers
  - 1.10 Purpose, types working and use of hay balers
  - 1.11 Purpose, types and working of forage harvesters
  - 1.12 Function of forage harvester parts (flail types)
  - 1.13 Factors effecting the performance of forage harvesters, mowers, rakes, balers and hay conditioners.
- 2. REAPERS AND CUTTER BINDERS 9 hours**
  - 2.1 Introduction/purpose of reapers
  - 2.2 Reapers -cum -cutter binders
  - 2.3 Driving and cutting mechanisms
  - 2.4 Plate form and elevator
  - 2.5 Binder head and knotter head
  - 2.6 Safety precautions for the efficient use of reaper and cutter binders
- 3. STATIONERY THRESHERS 9 hours**
  - 3.1 Purpose, working and construction of stationary threshers
  - 3.2 Setting of the Stationary thresher
  - 3.3 Pre-checks and safety to use threshers
  - 3.4 Lubrication, care and maintenance of threshers
  - 3.5 Care of storing of threshers
  - 3.6 Repair and servicing of the threshers
  - 3.7 Operation difficulties, causes and their remedies
  - 3.8 Over-hauling and adjustments of threshers

- 3.9 field capacity & field efficiency of threshers
- 4. GRAIN HARVESTING EQUIPMENT 9 hours**
- 4.1 Purpose and use of combine harvesters
  - 4.2 Advantages and disadvantages of combines
  - 4.3 Types, working and function of combines
  - 4.4 Grain losses during harvesting , causes and their remedies
  - 4.5 Different mechanisms of combines
  - 4.6 Operation and adjustments of a combines
  - 4.7 Factors effecting the performance of a combines
- 5. SPECIALIZED HARVESTING EQUIPMENT 9 hours**
- 5.1 Purpose, types and working of corn pickers
  - 5.2 Mechanisms of combine/ corn picker
  - 5.3 Calculation of field losses in corn pickers
  - 5.4 Safety care for use of corn pickers
  - 5.5 Factor effecting performance of corn picker/harvester
  - 5.6 Cotton strippers and their types
  - 5.7 Safety care during the operation of cotton strippers
  - 5.8 Factors affecting the performance of cotton strippers
  - 5.9 Cotton pickers and their types
  - 5.10 Different mechanisms of cotton pickers
  - 5.11 Doffing of the cotton from the spindles
  - 5.12 Factor affecting the performance of cotton Pickers
- 6. ROOT HARVESTING EQUIPMENT 9 hours**
- 6.1 Potato diggers and their types
  - 6.2 Mechanisms of potato harvesters
  - 6.3 Working and safety care to use potato harvesters
  - 6.4 Purpose and types of sugar beet harvesters
  - 6.5 Topping, lifting and cleaning of beets
  - 6.6 Systems of sugar beet combine
  - 6.7 Types and operation of peanut harvesters
  - 6.8 Factors effecting the performance of potato, sugar beet, and peanut harvester
- 7. POWER AND MACHINERY MANAGEMENT 10 hours**
- 7.1 Purpose of machinery management
  - 7.2 Cost analysis of Different Farm machines
  - 7.3 Factors reducing the operating cost of machinery
  - 7.4 Factor for the selection of farm machinery
  - 7.4 Field Capacity calculation for different farm implements
  - 7.5 Field Efficiency calculation of Tractor & cultivating Implements

### **BOOKS RECOMMENDED**

Farm Machinery and Equipment By: Harris P. Smith  
 Agricultural Power and Machinery By: Jaccob Harrel  
 Elements of Farm Machinery By: A.C. Srivastava  
 Farm Tractor By S.C Rai  
 Fundamentals of Tractor & energy conservation By Faqeer Muhammad Chaudery  
 & Dr. Gulam Sarwar

## **INSTRUCTIONAL OBJECTIVES**

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

### **UNDERSTAND THE PURPOSE, WORKING AND USE OF HAY AND FORAGE HARVESTING EQUIPMENT**

- 1.1 State the purpose of Hay and Forage Harvesting Equipment
- 1.2 Explain the working of cutter bar assembly of mower
- 1.3 Enlist parts of cutter bar assembly of mower
- 1.4 Describe different types of mowers
- 1.5 Explain working and functions of rotary mowers
- 1.6 Explain the purpose, and different types of Hay conditioners
- 1.7 Explain the purpose, and types of windrowers
- 1.8 Describe purpose, working and construction of rakes
- 1.9 State types, working and use of loaders and stackers
- 1.10 State types, working and use of Hay Balers
- 1.11 Explain purpose, types and working of Forage Harvesters
- 1.12 Explain function of Forage Harvester parts (Flail types)
- 1.13 Describe factors effecting the performance of Hay and Forage Harvesters (mowers, rakes, balers and hay conditioners)

### **UNDERSTAND THE WORKING AND FUNCTIONS OF REAPERS AND CUTTER BINDERS**

- 2.1 State the purpose of reapers
- 2.2 Explain reapers -cum -cutter binders
- 2.3 Explain driving and cutting mechanisms of cutter binder
- 2.4 Explain plate form and elevator of reaper-binders
- 2.5 Describe the binder head and knotter head
- 2.6 Enlist safety precautions for the efficient use of reaper and cutter binders

### **UNDERSTAND THE WORKING, CONSTRUCTION AND USE OF STATIONERY THRESHERS**

- 3.1 Explain the purpose, working and construction of stationary threshers
- 3.2 Explain the setting of the stationary thresher
- 3.3 Enlist pre-checks and safety to be observe in the use of threshers
- 3.4 Explain the methods of lubrication, care and maintenance of threshers
- 3.5 State the precautions to be taken in the storage of threshers
- 3.6 Describe procedure for repair and servicing of the threshers
- 3.7 Describe the operation difficulties, causes and their remedies
- 3.8 Explain over-hauling and adjustments of threshers
- 3.9 Explain the functioning of multi crop threshers

### **UNDERSTAND THE FUNCTION AND WORKING OF GRAIN HARVESTING EQUIPMENT**

- 4.1 Explain the purpose, function and use of combine harvesters
- 4.2 Describe advantages and disadvantages of combines
- 4.3 Explain types, working and functions of combines
- 4.4 Explain grain losses during harvesting, causes and their remedies
- 4.5 Describe the different mechanisms of combines
- 4.6 Describe the operation and adjustments of a combine

- 4.7 Enlist factors affecting the performance of a combine

## **UNDERSTAND VARIOUS SPECIALIZED HARVESTING EQUIPMENTS**

- 5.1 Explain the purpose, types and working of corn pickers
- 5.2 Describe various mechanisms of combine/ corn picker
- 5.3 Calculate the field losses in corn pickers
- 5.4 Enlist safety cares in the use of corn pickers
- 5.5 Explain factors effecting performance of corn picker/harvester
- 5.6 Explain cotton strippers and their types
- 5.7 Enlist the safety precautions in the operation of cotton strippers
- 5.8 Explain the factors affecting the performance of cotton strippers
- 5.9 State the cotton pickers and their types
- 5.10 Explain the different mechanisms of cotton pickers
- 5.11 Describe the doffing of the cotton from the spindles
- 5.12 Describe the factors effecting the performance of cotton harvesters

## **UNDERSTAND THE PURPOSE, FUNCTION, WORKING AND USE OF ROOT HARVESTING EQUIPMENT**

- 6.1 Explain Potato diggers and their types
- 6.2 Explain various mechanisms of potato harvesters
- 6.3 Describe the working and safety care to be used in potato harvesters
- 6.4 Describe the purpose and types of sugar beet harvesters
- 6.5 Explain the topping, lifting and cleaning of beets
- 6.6 Describe the systems of sugar beet combine
- 6.7 Explain the types and operation of peanut harvesters
- 6.8 Describe the factors effecting the performance of potato, sugar beet, and peanut harvester

## **UNDERSTAND THE POWER AND MACHINERY MANAGEMENT**

- 7.1 State the purpose of machinery management
- 7.2 Explain cost analysis of machines
- 7.3 Enlist the factors reducing the operating cost of machinery
- 7.4 Explain the factor involved in the selection of farm machinery
- 7.5 Explain the purpose, types and working of sprayers
- 7.6 Explain pumps, nozzles, nozzle tips and control of sprayers
- 7.7 Describe the agitators, supply tank and pipes/ hoses of sprayers
- 7.8 Describe dry chemicals application equipment and their types
- 7.9 Explain calibration of sprayers
- 7.10 Explain the repair and maintenance of equipment used for chemicals
- 7.11 Describe various field and machine capacities and efficiencies



**LIST OF PRACTICALS**

Adjustment, maintain and over haul different tillage equipment in the shop like tine cultivator, Disc plow, chisel plow, M.B. Plough, Disc Harrow, reaper etc

Perform on field adjustments on mowers

Service, repair and maintain mower cutter bar assembly

Register and align of cutter bar of mower

Study and identify different mechanism of hay bailers, rakes, wind rowers

Study different hay-conditioners in the shop

Service changing, cutters changing, rasp bar changing in repair and maintain stationary threshers

Identify different mechanisms of multi crop thresher and combine harvester and make adjustment necessary to reduce operational difficulties in the shop

Study different mechanisms of a self propelled combine harvester in the shop

Repair service and adjust a combine harvester

Repair and maintain potato harvester/ digger

Study the functions of corn and cotton harvester

Visit to Agricultural Engineering Workshop

Visit to the Farm Machinery Institute, Islamabad

Visit to Agricultural Mechanization Research Institute, Multan

Visit to center for agricultural machinery institute (CAMI)

Visit to farm implements manufacturing industry

Visit to Tractor assembling industry

Visit to Bahawalpur engineering limited Bahawalpur

Visit to combine harvester repairing workshop Gujranwala

**EARTH MOVING MACHINERY****Total contact hours**

Theory:	32 hours	T	P	C
Practical:	96 hours	1	3	2

**Pre-requisite:** Applied Physics

**AIMS 1.** Understand the hydraulic, reservoirs lines, fittings, accumulators, oil coolers, and actuators.

Understand the types, construction and working principles of dozers, scrapers, loaders, excavators, dump trucks, and material handling devices.

**Course Contents**

**HYDRAULIC SYSTEM , RESERVOIRS, HYDRAULIC LINES AND FITTINGS**  
(4 Hours)

- 1.1 Hydraulic System
- 1.2 components of Hydraulic system
- 1.3 Function of reservoirs
- 1.4 Fitting of reservoirs
- 1.5 Location of reservoir
- 1.6 Importance of hydraulic lines and fittings
- 1.7 Pipes and tubing
- 1.8 Pipe fittings
- 1.9 Hydraulic hose
- 1.10 Hose ends and adapters.

**2 THE ACCUMULATORS AND OIL COOLERS** (3 Hours)

- 2.1 Accumulator
- 2.2 Design and operation of accumulators
- 2.3 Servicing of accumulators
- 2.4 Disassemble and reassembling of accumulators
- 2.5 Purpose and function of oil coolers
- 2.6 Servicing of oil coolers

**3 HYDRAULIC PUMP AND VALVE** (2 Hours)

- 3.1 Hydraulic pump
- 3.2 Working principle of hydraulic pumps
- 3.3 Parts Of hydraulic pumps
- 3.4 Purpose and types of hydraulic pumps
- 3.5 Hydraulic valve
- 3.6 Purpose and types of hydraulic valve
- 3.7 Working principle of hydraulic valve

**4 THE WORKING OF ACTUATORS** (3 Hours)

- 4.1 Function of actuators.
- 4.2 Actuators designing
- 4.3 Operations of actuators
- 4.4 Hydraulic cylinder actuators
- 4.5 Single-acting cylinder actuators
- 4.6 Cylinder-rams
- 4.7 Operation of cylinder-ram
- 4.8 Double-acting cylinder actuator
- 4.9 Actuators operation
- 4.10 Specially designed double-acting cylinders

- 4.11 Power steering cylinders
- 4.12 Operation of power steering cylinders
- 4.13 Working of telescoping actuators
- 4.14 Operation of telescoping actuators
- 4.15 Working rotary actuators
- 4.16 Operation of rotary actuators
- 5.DOZER AND BULLDOZER (2 Hours)**
  - 5.1 Classification of earth moving machinery
  - 5.2 Purpose dozer
  - 5.3 Construction of dozer
  - 5.4 Application of dozer
  - 5.5 Use of bulldozer
  - 5.6 Dozer blade
  - 5.7 Types of dozer blades
  - 5.8 Function of ripper
  - 5.9 Types of rippers
  - 5.10 Advantages/disadvantages of wheel mounted dozer
  - 5.11 Advantages/disadvantages of crawler mounted tractors
- 6. SCRAPER (2 Hours)**
  - 6.1 Purpose of scrapers
  - 6.2 Construction of scrapers
  - 6.3 Types of scrapers
  - 6.4 Operation of scrapers
  - 6.5 Construction of elevating scraper
- 7. LOADER (2 Hours)**
  - 7.1 Purpose of loader
  - 7.2 Operation of loader
  - 7.3 Types of loader
  - 7.4 Construction of loader
  - 7.5 Application of loader
  - 7.6 Purpose, construction and working principle of belt loader
- 8. EXCAVATOR AND TRENCHER. (2 Hours)**
  - 8.1 Excavator
  - 8.2 Types of excavator
  - 8.3 Advantages and each type of excavator
  - 8.4 Construction and working principle of hydraulic excavator
  - 8.5 Construction and working principle of excavator loader
  - 8.6 Construction and working principle of bucket wheel excavator
  - 8.7 Construction and working principle of trencher
- 9. SHOVELS, HOE & DRAG LINE (2 Hours)**
  - 9.1 Shovels
  - 9.2 Types of shovels
  - 9.3 Construction and working principle of dipper or power shovel
  - 9.4 Factors of selection of power shovel
  - 9.5 Operation of power shovel
  - 9.6 Power shovels applications
  - 9.7 Specification of power shovel
  - 9.8 Construction and working principle of hoe.
  - 9.9 Uses of hoe.
  - 9.10 Construction and working principle of dragline.
  - 9.11 Types of buckets of dragline.
  - 9.12 Uses of clamshell.

- 9.13 Classification of buckets of clamshell.
- 9.14 Construction and working principle of clamshell.
- 10 CRANES (1 Hours)**
  - 10.1 Uses of cranes
  - 10.2 Classes of cranes.
  - 10.3 Construction and working principle of each type of crane.
  - 10.4 Categories of cranes available in the market
  - 10.5 Crane capacities
- 11 THE WORKING OF MOTOR GRADERS (2 Hours)**
  - 11.1 Uses motor graders
  - 11.2 Construction motor graders
  - 11.3 Kinds of work for which motor graders are used
  - 11.4 Adjustment of blade of graders
  - 11.5 Operation of graders
  - 11.6 Special attachments of motor graders
- 12 THE WORKING OF HAULING EQUIPMENT (1 Hours)**
  - 12.1 Purpose of hauling equipment
  - 12.2 Types of construction work of vehicles
  - 12.3 Types of off-highway dump trucks
  - 12.4 Working and uses of each type of off- highway dump trucks
  - 12.5 Construction of dump trucks
- THE WORKING OF MATERIAL HANDLING DEVICES (1 Hours)**
  - 13.1 Need of material handling devices
  - 13.2 Uses of material handling devices
  - 13.3 Types of mechanical material handling devices
  - 13.4 Lifting and lowering devices
- THE PURPOSE AND WORKING OF CONVEYOR (2 Hours)**
  - 14.1 Purpose of conveyor
  - 14.2 Types of conveyor
  - 14.3 Working belt conveyor
  - 14.4 Advantages of belt conveyor
  - 14.5 Components of belts conveyor
- 15 THE TRANSPORTING AND ROPEWAY (1 Hours)**
  - 15.1 Transporting devices
  - 15.2 Working principle of each transporting device
  - 15.3 Purpose of aerial transport
  - 15.4 Working of cable ways
  - 15.5 Uses of rope ways
  - 15.6 Types rope ways
- 16 DISCUSS INTERNATIONAL HYDRAULIC, PNEUMATIC, CODES AND SYMBOLS (2 Hours)**
  - 16.1 International Hydraulic and Pneumatic Code and Symbols
  - 16.2 International Pneumatic Code and Symbols
  - 16.4 Application of international Hydraulic Code and Symbols
  - 16.5 International Pneumatic Code and Symbols

## **AF-322 INSTRUCTIONAL OBJECTIVES**

**On the completion of this course the student will able to...**

### **UNDERSTAND THE HYDRAULIC SYSTEM , RESERVOIRS, HYDRAULIC LINES AND FITINGS**

- 1.1 Define the Hydraulic System
- 1.2 Describe the components of Hydraulic system
- 1.3 Sketch the components of Hydraulic system
- 1.4 State the function of reservoirs
- 1.5 State the function of reservoirs
- 1.6 Enlist of fitting of reservoirs
- 1.7 Describe the location of reservoir
- 1.8 State the importance of hydraulic lines and fittings
- 1.9 Differentiate between pipes and tubing
- 1.10 Describe the pipe fittings
- 1.11 Describe the hydraulic hose
- 1.12 Describe hose ends and adopters.

### **UNDERSTANDING THE ACCUMULATORS AND OIL COOLERS**

- 2.1 State the purpose of accumulator
- 2.2 Describe the design and operation of accumulators
- 2.3 Explain the servicing of accumulators
- 2.4 Describe disassemble and reassembling of accumulators
- 2.5 Describe the purpose and function of oil coolers
- 2.6 Explain the oil coolers
- 2.7 Describe the servicing of oil coolers

### **UNDERSTANDING HYDRAULIC PUMP AND VALVE**

- 3.8 Define hydraulic pump
- 3.9 Explain the working of principle of hydraulic pumps
- 3.10 Explain parts Of hydraulic pumps
- 3.11 Describe purpose and types of hydraulic pumps
- 3.12 Define hydraulic valve
- 3.13 Define purpose and types of hydraulic valve
- 3.14 Explain working principle of hydraulic valve

## **4 UNDERSTANDING THE WORKING OF ACTUATORS**

- 4.1 State the function of actuators.
- 4.2 Explain base actuators Construction.
- 4.3 Describe the Operations of actuators
- 4.4 Explain base actuators design
- 4.5 Describe the hydraulic cylinder actuators
- 4.6 Discuss single-acting cylinder actuators
- 4.7 Describe the cylinder-rams

- 4.8 Explain the operation of cylinder-ram
- 4.9 Describe the double-acting cylinder actuator
- 4.10 Discuss the actuators operation
- 4.11 Discuss the specially designed double-acting cylinders
- 4.12 Explain power steering cylinders
- 4.13 Discuss the operation of power steering cylinders
- 4.14 Explain the working of telescoping actuators
- 4.15 Discuss the operation of telescoping actuators
- 4.16 Explain the working rotary actuators
- 4.17 Discuss the operation of rotary actuators

## **UNDERSTANDING DOZER AND BULLDOZER**

- 5.1 State the classification of earth moving machinery
- 5.2 State the purpose dozer
- 5.3 Explain the application of dozer
- 5.4 Describe the construction of dozer
- 5.5 State the use of bulldozer
- 5.6 Describe the dozer blade
- 5.7 Describe the types of dozer blades
- 5.8 Explain the function of ripper
- 5.9 Explain the types of rippers
- 5.10 State the advantages of wheel mounted dozer
- 5.11 State the advantages of crawler mounted tractors

## **6 UNDERSTAND SCRAPER**

- 6.1 State the purpose of scrapers
- 6.2 Explain the construction of scrapers
- 6.3 Describe the types of scrapers
- 6.4 Describe the operation of scrapers
- 6.5 Explain the construction of elevating scraper

## **7 UNDERSTAND LOADER**

- 7.1 Describe the purpose of loader
- 7.2 Explain the operation of loader
- 7.3 Explain the types of loader
- 7.4 Describe the construction of loader
- 7.5 State the application of loader
- 7.6 Explain the purpose, construction and working principle of belt loader

## **UNDERSTAN EXCAVATOR AND**

**TRENCHER.** 8.1 Define excavator

- 8.2 Enlist types of excavator
- 8.3 Identify the advantages and each type of excavator
- 8.4 Explain the construction and working principle of hydraulic excavator
- 8.5 Explain the construction and working principle of excavator loader
- 8.6 Explain the construction and working principle of bucket wheel excavator
- 8.7 Explain the construction and working principle of trencher

## **UNDERSTAND SHOVELS**

- 9.1 Define the shovels

- 9.2 Enlist types of shovels
- 9.3 Explain each type of shovels
- 9.4 Explain the construction and working principle of dipper or power shovel
- 9.5 Explain the factors of selection of power shovel
- 9.6 Discuss the operation of power shovel
- 9.7 Describe the power shovels applications
- 9.8 Enlist the specification of power shovel
- 9.9 Explain the construction and working principle of hoe.
- 9.10 State the uses of hoe.
- 9.11 Explain the construction and working principle of dragline.
- 9.12 Describe the types of buckets of dragline.
- 9.13 State the uses of clamshell.
- 9.14 State classification of buckets of clamshell.
- 9.15 Explain the construction and working principle of clamshell.

## **UNDERSTAND CRANES**

- 10.1 State the uses of cranes
- 10.2 State the classes of cranes.
- 10.3 Explain the construction and working principle of each type of crane.
- 10.4 Discuss the categories of cranes available in the market
- 10.5 Explain the crane capacities

## **11 UNDERSTAND THE WORKING OF MOTOR GRADERS**

- 11.1 Describe the uses motor graders
- 11.2 Describe the construction motor graders
- 11.3 State the types of work for which motor graders are used
- 11.4 Explain the adjustment of blade of graders
- 11.5 Explain the operation of graders
- 11.6 Explain the operation of special attachments of motor graders such as:
  - Scarier
  - Bulldozing
  - Snow clearing
  - Ripper
  - Harrow operations

## **12 UNDERSTANDING THE WORKING OF HAULING EQUIPMENT**

- 12.1 State the purpose of hauling equipment
- 12.2 State the types of construction work of vehicles
- 12.3 Enlist the types of off-highway dump trucks
- 12.4 Explain the working and uses of each type of off- highway dump trucks
- 12.5 Discuss the construction of dump trucks

## **UNDERSTANDING THE WORKING OF MATERIAL HANDLING DEVICES**

- 13.1 State the need of material handling devices

- 13.2 State the uses of material handling devices
- 13.3 Describe the Types of mechanical material handling devices
- 13.4 Enlist the lifting and lowering devices
- 13.5 Describe the lifting and lowering devices

## **14 UNDERSTANDING THE PURPOSE AND WORKING OF CONVEYOR**

- 14.1 State the purpose of conveyor
- 14.2 Describe the types of conveyor
- 14.3 Explain the working belt conveyor
- 14.4 State the advantages of belt conveyor
- 14.5 Explain the components of belts conveyor
- 14.6 Describe the working of following types of conveyor:
  - Roller
  - Cable
  - Pipe line
  - Screw
  - Elevating conveyor

## **UNDERSTAND THE TRANSPORTING AND ROPEWAY**

- 15.1 Enlist the transporting devices
- 15.2 Describe the working principle of each transporting device
- 15.3 State the purpose of aerial transport
- 15.4 Explain the working of cable ways
- 15.5 State the uses of rope ways
- 15.6 Describe the types rope ways

## **16 Discuss international hydraulic, pneumatic, codes and symbols**

- 16.1 Define the international Hydraulic and Pneumatic Code And Symbols
- 16.2 Enlist the international Hydraulic Code And Symbols
- 16.3 Enlist the international Pneumatic Code And Symbols
- 16.4 State the Application of international Hydraulic Code And Symbols
- 16.5 State the international Pneumatic Code And Symbols



## **AF-322 EARTH MOVING MACHINERY**

### **LIST OF PRACTICALS**

Practice to Drain and service the reservoir.  
Practice to Cut and bend the tubes.  
Perform the Service of hoses.  
Practice to Service and reassemble the accumulators.  
Practice to Service, Reassemble and install oil cooler.  
Practice to Service actuators.  
Prepare periodic maintenance chart for earth moving machinery.  
Prepare the specification of dozer.  
Prepare the specification of scrapers.  
Enlist the factors influence the selection of cranes.  
Enlist the factors influence the output of motor graders  
Enlist the factors influence the selection of dump trucks  
Enlist the factors influence the selection of material handling devices  
Visit to local Agriculture Engineering Working.  
Visit to local different construction projects  
Visit to construction Machinery Training Institute Islamabad

**WORKSHOP PRACTICE -III****Total contact hours**

Theory:	64 hours	T	P	C
Practical:	192 hours	2	6	4

**Pre-requisite:** Workshop Practice II

- AIMS**
1. Understand the types of frames and bodies used in automobiles.  
Understand the tools, equipment and techniques of dent removing, shrinking, filling and painting  
Understand the tools, equipment and techniques of fiber glass bodies repairing, filling and painting
  - 4 understand tractor hydraulic system parts.  
understand the engine tune up, periodical maintenance and overhauling.  
understand the road safety management and emergency.  
understand workshop documentation.  
understand vehicle heating and air conditioning system.

**COURSE CONTENTS****On the completion of this course the student will be able to****FRAMES, BODY AND THEIR IMPORTANCE.(2 HOURS)**

- 1.1 Different types of frames.
- 1.2 Advantages and disadvantages of different types of frames.
- 1.3 Different types of bodies.
- 1.4 Advantages and disadvantages of different types of frames.

**2 TOOLS USED IN AUTO BODY SHOP (2 HOURS)**

- 2.1 Use of special tools such as 1.Hand tools 2.Electrical tools 3.Pneumatic tools  
4.Hydraulic tools.
- 2.2 Precautions during the use of these tools.
- 2.3 Different kinds of Spoons, Dollies, Hammers, Scrappers and prybars and their specific use .

**METHODS OF FITTING, ADJUSTMENT OF DIFFERENT BODY PARTS. (3 HOURS)**

- 3.1 Methods fitting ,adjustments of following body parts such as Doors, Deck , Lids.
- 3.2 Methods of Removing dents by using Pull rods and slide hammers.
- 3.3 Misalignment of body panels.
- 3.4 Methods of sheet metal repair.

**THE USE OF STATIONERY AND PORTABLE EQUIPMENT FOR FRAME REPAIR AND STRAIGHTENING. (3 HOURS)**

- 4.1 Four controlling in body and frame straightening.
- 4.2 Methods checking frame straightening.
- 4.3 Use of power straightening tools.

## **METHODS OF SHRINKING AND SURFACE FINISHING.**

### **(4 HOURS)**

- 5.1 Method of shrinking.
- 5.2 Use of different sanders such as disk sander, disk sander with vacuum attachment, feather edging with block type sander.
- 5.3 Different types of body fillers
- 5.4 Different methods of dent filling.
- 5.5 Method of using different Gauges for measurement and checking such as Center guage, Strut centering gauge.
- 5.6 Method of measuring the correct size and shape of panel.
- 5.7 Reasons for adjusting body panels.

## **6 FIBER GLASS BODY AND PLASTIC PARTS.**

**(4 HOURS)**

- 6.1 Fiber glass bodies charteristics, their repairs and materials.
- 6.2 Advantages and disadvantages of fiber glass bodies.
- 6.3 Precautions during fitting and repairing fiber glass body.
- 6.4 Calculate proper quantity of substance for preparing resin filler and putties.
- 6.5 Techniques use for forming fiber glass.
- 6.6 Procedure for repairing soft plastic parts

## **METHOD OF PREPARING OF SURFACE FOR PAINTING**

### **(4 HOURS)**

- 7.1 Safety in the paint shop, list the safety cautions.
- 7.2 Process for preparing surface for paintings.
- 7.3 Categorized different kinds of paints, lacquer and enamels.
- 7.4 Advantages and disadvantages of different paints ,lacquer and enemels.
- 7.5 Prepare a matching colour from combination of different colours.
- 7.6 Computerized method of accurate preparation of paint match scheme and its importance.
- 7.7 Computerized method of automotive body spray painting and its importance.

## **8 METHODS OF PAINTING.**

**(6 HOURS)**

- 8.1 Three basic ingradents in paints.
- 8.2 Under coat.
- 8.3 Equipment used in spray painting.
- 8.4 Use of spray equipment in proper order.
- 8.5 Use of spray gun and basic spray gun adjustment for batter finishing.
- 8.6 Different types of spray guns and advantages and disadvantages different spray guns.
- 8.7 Method of checking paint viscosity and setting the air pressure for proper spray painting.
- 8.8 Spray gun problems.
- 8.9 Types of spray booths and adjusting the temperature required for backing of paints
- 8.10 Method of using safety equipment according to the situation.
- 8.11 Painting problems and their remedies.

## **9 TRACTOR HYDRAULIC SYSTEM (4 HOURS)**

- 9.1 Parts of tractor hydraulic system.
- 9.2 Parts of tractor hydraulic system such as spool valve, safety valve, ram, actuator and pump.
- 9.3 Method of tracing out the faults in hydraulic system in tractor and suggest proper remedies.
- 9.4 Method of overhauling the tractor engine.

## **DEMONSTRATE THE ENGINE TUNE UP PROCEDURE. (4 HOURS) 10.1**

- Engine tune up procedure.
- 10.2 Importance of engine tune up procedure and car care.
- 10.3 Method of checking and adjusting engine tuning according to the specifications.
- 10.4 Use of proper tool in proper place.

## **WHAT TO DO BEFORE STARTING AND DRIVING TRACTOR AND CAR. (5 HOURS)**

- 11.1 Importance of daily inspection before starting tractor/car driving.
- 11.2 Method of checking the specified engine oil level, brake oil, power steering oil, electrolyte level in battery, coolant level in expansion tank and radiator
- 11.3 Method of checking fan belt tension, A.C. belt tension and power steering belt tension
- 11.4 Method of checking electrical system.
- 11.5 Method of checking clutch, brake and hand brake .
- 11.6 Method of applying brake and clutch in proper time and proper way .
- 11.7 Draw chart of speed and distance relationship.
- 11.8 Factor which effect the brake efficiency.

## **12 ROAD SAFETY MANAGEMENT. (2 HOURS)**

- 12.1 Interpret traffic symbols such as
  - a. Mandatory
  - b. Warning
  - c. Informative
- 12.2 Rules and Regulation of driving.
- 12.3 International traffic rules.

## **PROCEDURE OF VULCANIZING AND INFLATION TECHNIQUES. (1 HOUR)**

- 13.1 Procedure and method of vulcanizing.
- 13.2 Coating lock ring while inflation.
- 13.3 Tire pressure monitoring system.

## **14 THE DOOR SUCTION SYSTEM (1 HOUR)**

- 14.1 Purpose of door suction system.
- 14.2 Parts of door suction system.
- 14.3 Working of door suction system.

## **15 POWER SEATS, WINDOWS AND POWER SUN ROOF (2 HOURS)**

- 15.1 Purpose of power seats, windows and power sun roof.
- 15.2 Parts of power seats, windows and power sun roof.
- 15.3 Working power seats, windows and power sun roof.
- 15.4 Method of setting side and back view mirror manually and automatically

## **THE LAY-OUT AND USE OF WORKSHOP & GARAGE EQUIPMENT (3 HOURS)**

- 16.1 Differentiate between Auto Workshop and Garage.
- 16.2 Types of Garages (Small, Medium, Large, Service station).
- 16.3 Lay-out of the workshop and garage.
- 16.4 Prepare Lay-out of an Auto Workshop.
- 16.5 Prepare a comprehensive List of machines, equipment's and tools for Automotive Workshop and Garage.
- 16.6 Use of Battery Charger .

## **THE PREPARATION OF DOCUMENTATION OF AUTOMOTIVE WORKSHOP & GARAGE. (5 HOURS)**

- 17.1 Enlists Different kinds of record /documentation of auto workshop and garage.
  - 17.2 Principles of record maintenance.
  - 17.3 Workshop inventory stock register and consumption register.
  - 17.4 Procedure for reading of Vehicle Service Manual.
  - 17.5 Procedure for reading of Vehicle Parts Catalog Manual.
- 17.6 Job Card and Time Sheet..
- 17.7 Estimate and Compute repair cost of work from Job Card and time sheet.
- 17.8 Learn the following documents of auto workshop and garage.
  - Technical Report writing.
  - Customer handling skill.
  - Warranty terms & conditions (policies).
  - Work shop operation / Flow of workshop.
  - Complain Handling skills.
  - Assessment of Engine condition and report writing.
  - Assessment Sheet for engine condition and report writing.

## **MAINTENANCE OF SERVICE STATION EQUIPMENT. (3 HOURS)**

- 18.1 Purpose of maintenance.
- 18.2 Purpose of Jacks, Cranes, and Car Lifts.
- 18.3 Working and uses of different kinds of jacks.
- 18.4 Working and uses of different kinds Cranes.
- 18.5 Working and uses of different kinds Car Lifts.
- 18.6 Periodic lubrication of Jacks, Cranes, and Car Lifts

## **WORKING ENVIRONMENT OF AUTOMOTIVE FLEET ORGANIZATION. (2 HOURS)**

- 19.1 Organization chart relating to automotive fleet .
- 19.2 Functions of various sections of fleet.
- 19.3 Compare among Metro Bus corporation, Daewoo Corporation, and LTC

## **20 THE AUTOMOTIVE HEATING ,VENTILATING AND AIR CONDITIONING (5 HOURS)**

- 20.1 Purpose of heating, ventilation and air conditioning system.
- 20.2 Enlist heating, ventilation and air conditioning system components.
- 20.3 Principle of air conditioning.
- 20.4 Refrigeration cycle.
- 20.5 Enlist heating, ventilation and air conditioning system control methods.
- 20.6 Heating, ventilation and air conditioning system troubles

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## **INSTRUCTIONAL OBJECTIVES**

**On the completion of this course the student will able to**

### **1 UNDERSTAND THE TYPES OF FRAMES,BODY AND THEIR IMPORTANCE.**

- 1.1 Identify different types of frames.
- 1.2 Discuss the advantages and disadvantages of different types of frames.
- 1.3 Identify different types of bodies.
- 1.4 Discuss the advantages and disadvantages of different types of frames.

### **UNDERSTAND THE TOOLS USED IN AUTO BODY SHOP**

- 2.1 Describe the use of special toolssuch as 1.Hand tools 2.Electrical tools  
3.Pneumatic tools 4.Hydraulic tools.
- 2.2 State the precautions during the use of these tools.
- 2.3 Identify different kinds of Spoons, Dolleies, Hammers, Scrappers and plyiers and their specific use .

### **UNDERSTAND THE METHODS OF FITTING , ADJUSTMENT OF DIFFERENT BODY PARTS.**

- 3.1 Demonstrate the methods fitting ,adjustments of following body parts such as Doors, Deck , Lids.
- 3.2 State the methods of Removing dents by using Pullrods, and slide hammers.
- 3.3 State misalignment of Body parts
- 3.4 State the methods of sheet metal repair.

### **UNDERSTAND THE USE OF STATIONERYAND PORTABLE EQUIPMENT FOR FRAME REPAIR AND STRAIGHTENING.**

- 4.1 Describe the four controlling in body and frame straightening.
- 4.2 State the methods checking frame straightening.
- 4.3 Explain the use of power straightening tools.
- 4.4 Explain the computerized methods of frame allingment.

### **UNDERSTAND THE METHODS OF SHRINKING AND SURFACE FINISHING.**

- 5.1 Explain the method of shrinking.
- 5.2 Explain the use of different sanders such as disk sander,disk sander with vacuum attachment, fether edging with block type sander.
- 5.3 Explain different types of body fillers
- 5.4 Explain the different methods of dent filling.
- 5.5 explain the method of using different Guages for measurement and checking such as Center guage, Strut centering guage.
- 5.6 Explain the method of measuring the correct size and shape of panel.
- 5.7 discuss the reasons for adjusting body panels.

## **6 UNDERSTAND FIBER GLASS BODY AND PLASTIC PARTS.**

- 6.1 Discuss fiber glass bodies characteristics , their repairs and materials.
- 6.2 Explain the advantages and disadvantages of fiber glass bodies.
- 6.3 Explain the precautions during fitting and repairing fiber glass body.
- 6.4 Calculate proper quantity of substance for preparing resin filler and putties.
- 6.5 Explain the techniques use for forming fiber glass.
- 6.6 Describe the procedure for repairing soft plastic parts

## **UNDERSTAND THE METHOD OF PREPARING OF SURFACE FOR PAINTING**

- 7.1 Discuss the safety in the paint shop list the safety cautions.
- 7.2 Explain the process for preparing surface for paintings.
- 7.2 Categorized different kinds of paints, lacquer and enamels.
- 7.3 State the advantages and disadvantages of different paints ,lacquer and enamels.
- 7.4 Prepare a matching colour from combination of different colours.
- 7.5 Explain the computerized method of accurate preparation of paint match scheme and its importance.
- 7.6 Explain computerized method of automotive body spray painting and its importance.

## **8 UNDERSTAND THE METHODS OF PAINTING.**

- 8.1 Describe the three basic ingredients in paints.
- 8.2 Explain under coat.
- 8.3 Identify the equipment used in spray painting.
- 8.4 Explain the use of spray equipment in proper order.
- 8.5 state the use of spray gun and basic spray gun adjustment for better finishing.
- 8.6 Explain the different types of spray guns and advantages and disadvantages of different spray guns.
- 8.7 Explain the method of checking paint viscosity and setting the air pressure for proper spray painting.
- 8.8 Explain the spray gun problems.
- 8.9 Explain the types of spray booths and adjusting the temperature required for backing of paints
- 8.10 Explain the method of using safety equipment according to the situation.
- 8.11 Explain the painting problems and their remedies.

## **UNDERSTAND TRACTOR HYDRAULIC SYSTEM**

- 8.12 Identify the parts of tractor hydraulic system.
- 8.13 Explain the parts of tractor hydraulic system such as spool valve, safety valve, ram, actuator and pump.
- 8.14 Explain the method of tracing out the faults in hydraulic system in tractor and suggest proper remedies.



- 8.15 Explain the method of overhauling the tractor engine.

## **DEMONSTRATE THE ENGINE TUNE UP PROCEDURE**

- 10.7 Demonstrate the engine tune up procedure.
- 10.8 Explain the importance of engine tune up procedure and car care.
- 10.9 Explain the method of checking and adjusting engine tuning according to the specifications.
- 10.10 Explain the use of proper tool in proper place.

## **UNDERSTAND WHAT TO DO BEFORE STARTING AND DRIVING TRACTOR AND CAR.**

- 11.1 Explain the importance of daily inspection before starting tractor/car driving.
- 11.2 Explain the method of checking the specified engine oil level, brake oil, power steering oil, electrolyte level in battery, coolant level in expansion tank and radiator
- 11.3 Explain the method of checking fan belt tension, A.C. belt tension and power steering belt tension
- 11.4 Explain the method of checking electrical system.
- 11.5 Explain the method of checking clutch, brake and hand brake .
- 11.6 Explain the method of applying brake and clutch in proper time and proper way .
- 11.7 draw chart of speed and distance relationship.
- 12.4 Explain the factor which effect the brake efficiency.

## **UNDERSTANDING THE ROAD SAFETY MANAGEMENT.**

- 12.1 Discuss and Interpret traffic symbols such as
  - Mandatory
  - Warning
  - Informative
- 12.2 Explain the Rules and Regulation of diving.
- 12.3 Explain the International rules.
- 12.4 Discuss the causes of accidents.
- 12.5 Explain the method of providing first aid medical treatment in case of road accident.

## **UNDERSTAND THE PROCEDURE OF VOLCANIZING AND INFLATION TECHNIQUES.**

- 13.1 Explain the procedure and method of vulcanizing.
- 13.2 Explain the coating locking while inflation.
- 13.3 Explain the Tire pressure monitoring system.

### **UNDERSTAND THE DOOR SUCTION**

**SYSTEM** 14.1 Explain the purpose of door suction system.

14.2 Explain the parts of door suction system.

14.3 Explain the working of door suction system.

## **15 UNDERSTAND POWER SEATS, WINDOWS AND POWER SUN ROOF**

- 15.1 Explain the purpose of power seats ,windows and power sun roof .
- 15.2 Explain the parts of power seats, windows and power sun roof.
- 15.3 Explain the working power seats, windows and power sun roof.

15.4 Explain the method of setting side and back view mirror manually and automatically

### **UNDERSTAND THE LAY-OUT AND USE OF WORKSHOP & GARAGE EQUIPMENTS.**

Differentiate between Auto Workshop and Garage.

Describe the types of Garages(Small, Medium, Large, Service station).

Define Lay-out.

Prepare Lay-out of an Auto Workshop.

Prepare a comprehensive List of machines, equipments and tools for automotive Workshop and Garage.

f. Explain the Use of Battery Charger .

### **UNDERSTAND THE PREPARATION OF DOCUMENTATION OF AUTOMOTIVE WORKSHOP & GARAGE.**

17.1 Enlists Different kinds of record /documentation of auto workshop and garage.

17.2 State Principles of record maintenance.

17.3 Describe Workshop inventory stock register and consumption register.

17.4 Describe the procedure for reading of Vehicle Service Manual.

17.5 Describe the procedure for reading of Vehicle Parts Catalog Manual.

18.6 Describe Job Card and Time Sheet..

17.7 Estimate and Compute repair cost of work from Job Card and time sheet.

17.8 Learn the following documents of auto workshop and garage.

Technical Report writing.

Customer handling skill.

Warranty terms & conditions (policies).

Work shop operation / Flow of workshop.

Complain Handling skills.

Assessment of Engine condition and report writing.

Assessment Sheet for engine condition and report writing.

### **UNDERSTAND MAINTENANCE OF SERVICE STATION EQUIPMENT. 18.1**

Describe the purpose of maintenance.

18.2 State the purpose of Jacks, Cranes, and Car Lifts.

18.3 Describe the working and uses of different kinds of jacks.

18.4 Describe the working and uses of different kinds Cranes.

18.5 Describe the working and uses of different kinds Car Lifts.

18.6 Describe Periodic lubrication of Jacks, Cranes, and Car Lifts

### **UNDERSTAND WORKING ENVIRONMENT OF AUTOMOTIVE FLEET ORGANIZATION.**

19.1 Describe Organization chart relating to automotive fleet .

19.2 State functions of various sections of fleet.

19.3 Compare among Metro Bus corporation, Daewoo Corporation, and LTC

### **UNDERSTAND THE AUTOMOTIVE HEATING ,VENTILATING AND AIR CONDITIONING**

- 20.1 Purpose of heating, ventilation and air conditioning system.
- 20.2 Enlist heating, ventilation and air conditioning system components.
- 20.3 state the principal of air conditioning.
- 20.4 Explain refrigeration cycle.
- 20.5 Enlist heating, ventilation and air conditioning system control methods.
- 20.6 Discuss heating, ventilation and air conditioning system troubles

## **LIST OF PRACTICALS**

Identification of all body shop hand tools, electric power tools, pneumatic tools, hydraulic tools and their specific in denting.

Visual identification of defects in body of a vehicle, record and suggest denting repair method.

Pannel beating and finishing by hand tools.

Panel beating and finishing by use of welding (gas welding).

Practice to use Hydraulic jack in proper place and proper way for pulling, pushing door opening alignment, engine compartment and frame opening.

Straightening deformed frame and channel with the help of straightening hand , power tools and computerized power tools.

Checking body and frame by using different frame gauges.

Preparing fiber glass sheets, patching and filling in workshop.

Practice to spray painting on different body pannels.

Practice to adjust the door panels and lids.

Practice to service window glass winder mechanism and changing of window glass windscreen.

Practice to service the tractor by changing engine oil, Hydraulic oil, gear oil, oil filter, air cleaner and lubrication of other points .

Perform the tune up of tractor (diesel engine).

Perform the tune up of petrol engine.

Practice to identify the traffic symbols used in Pakistan and their meaning.

Practice to start petrol engine.

Practice to start diesel engine.

Vulcanizing of tube and tire.

Practice to change tire by using mechanical and hydraulic jack.

Practice to drive tractor and car in open field.

Prepare general and periodic maintenance chart for different vehicles like car, tractor and bus.

Perform the general overhauling of the tractor and car in the workshop.

Identify heating, ventilation and air conditioning system components.

Practice to charge an air-conditioning system of a car.

Visit to a modern automotive workshop.

Visit to tractor manufacturing plant (Millat tractor/Alghazi tractors).

Visit to car manufacturing plant.

**LIST OF AUTO & FARM TECHNOLOGY  
LABS/WORKSHOPS**

<b>S.NO</b>	<b>Name OF LAB/WORKSHOP</b>	<b>Quantity</b>
1.	ADVANCE ENGINE SHOP	1 NO
2.	DIESEL ENGINE LAB	1 NO
3.	AUTOMOTIVE ELECTRICITY & ELECTRONICS LAB	1 NO
4.	AUTOMOTIVE ELECTRONIC DIAGNOSTIC & TESTING LAB	1 NO
5.	SUSPENSION, STEERING & BRAKES LAB	1 NO
6.	AUTO MOTIVE DENTING & PAINTING LAB	1 NO
7.	MOTOCYCLE LAB	1 NO
8.	AUTO CAD LAB	1 NO
9.	SERVICE S TATION	1 NO
10.	FARM MACHINERY LAB	1 NO
11.	IMPLEMENT SHED	1 NO
12.	HYDRAULIC LAB	1 NO
13.	FIELD AREA FOR TUNNEL FARMING/PRESSURIZED IRRIGATION	1 Hector

**LIST OF BASIC HAND TOOLS  
(For DAE class of 40 students)**

<b>S.NO</b>	<b>Name of Tool</b>	<b>Quantity</b>
14.	Flat Screw driver ( 4", 6", 8", 12" ) & offset Screw driver ( 4", 6", 8", 12" )	10 each
15.	Philips Screw driver ( 4", 6", 8", 12" ) & clutch type, torx type, read type and prince type	10 each
16.	Impact Screw driver set	10 set
17.	Hammers ( Ball peen, Straight peen, cross peen) sledge, Brass or lead, plastic tipped, rubber mallet.	10 each
18.	Special screw drivers(stubby, scratch awl, Socket head driver, clip screw driver.	10 each
19.	Pliers(needle nose, High leverage cutter, vise grip, diagonal cutting, Battery Plier, tin snip ,snap ring, rib joint, slip joint,	10 each

	crimper)	
20.	Adjustable Wrench (6", 12")	10 each
21.	Pipe Wrench(8",10",12")	10 each
22.	strap wrenches(universal, Big range/Adjustable fuel filter and oil filter)	10 each
23.	Open end spanner set ( 8-32 mm )	10 set
24.	Ring Spanner set (off set) 8-32mm	10 set
25.	Box end spanner set ( 8-32 mm )	10 set
26.	Special wrenches( sludge wrench, ratchet wrench, flex combination, half moon).	10 each
27.	spark plug spanner.	10 No's
28.	Torque Wrench (flex bar, dial indicator, snap or click, digital)	10 each
29.	Allen Key set ( 1.5- 10 mm)	10 set
30.	Socket set complete( 8-32 mm with all accessories).	10 set
31.	wheel spanner cross type	10 No's
32.	Pullers ( Gears, Bearings, Pulleys, Steering, slide hammer)	10 each
33.	Oil Seal extractors and installers	10 No's
34.	Oil cane (pressure type).	10 No's
35.	Tube bender , Tube cutter and Flaring tools set	10 set
36.	Valve Spring Compressor	10 No's
37.	Piston Ring Compressor	10 No's
38.	Piston Ring Expander	10 No's
39.	Grease Gun (400cc capacity)	10 No's
40.	Pop Rivet Plier	5 No's
41.	Scraper (blade width 2",4",6")	15 No's each
42.	Scissor (10")	5 No's
43.	Centre Punch	10 No's
44.	Punches (Hollow punch set)	10 set
45.	Adjustable Hand Hacksaw frame ( 300 mm )	10 No's
46.	Bench vice (4", 6")	05 No's each
47.	Anvil (40 kg)	02 No's
48.	Surface Plate	1 No's
49.	Magnetic pickup tool(prob pick up tool set)	10 set
50.	Magnifying glass	10 No's
51.	Die & tap set (2,4,6,8,10mm)	05 set each
52.	Hand brushes (wire type)	10 No's
53.	Pry bars set (20", 25", 30")	10 set
54.	File (Flat, round, triangle, square)10"	05 No's each
55.	Chisels ( Flat, cross-cut, round nose)	25 No's each
56.	Calipers (Internal & external)2mm-100mm	10 set
57.	V-Blocks	10 No's
58.	S.S.T tools ( for carburetor)	2 set
59.	Stud extractor set	5 set
60.	Lettering Punch set	02 No's
61.	Numbers punch set	02 No's

**LIST OF MEASURING TOOLS/EQUIPEMENTS**  
**(For DAE class of 40 students)**

<b>S.NO</b>	<b>Name of Tool</b>	<b>Quantity</b>
1.	Steel Foot rule.	10 No's
2.	Steel tape (50 “)	10 No's
3.	Spring Scale (5 kg)	10 No's
4.	Venire Caliper. ( 250mm , Least count 0.05)	10 No's
5.	Micrometer (inside) 0-25mm, 0-50mm, 0-75mm, 0-100mm	10 No's
6.	Micrometer (out side) 0-25mm, 0-50mm, 0-75mm, 0-100mm	10 No's
7.	Dial Gauge ( Leas count 0.001” 0.01-10mm ))	05 No's
8.	Depth gauge	05 No's
9.	Feeler gauge	05 No's
10.	Thread pitch gauge	05 No's
11.	Wire gauge	05 No's
12.	Belt tension gauge	05 No's
13.	Telescoping gauge	05 No's
14.	Tire Pressure gauge	05 No's
15.	Angle measuring gauge (combination set)	05 No's
16.	Thermometer	10 No's
17.	Tri Square	

**LIST OF “WORKSHOP” MACHINERY / EQUIPMENTS**  
**(For DAE class of 40 students)**

<b>S.NO</b>	<b>Name of Machinery /Equipment</b>	<b>Quantity</b>
1.	Chain Pulley Block hoist ( 3-5 ton )	10 No's
2.	Hydraulic Car Lift ( Post Lift, Seizer Lift, Hydraulic lift)	1 No each
3.	Crane (hydraulic, pneumatic).	1 No each
4.	Spark Plug Cleaner & Tester Machine	1 No
5.	Automotive Tire changer	1 No
6.	Electronic Injector Testing Machine	1 No
7.	Heavy Duty Digital Tire inflator	1 No
8.	Tube vulcanizer	1 No
9.	Tire vulcanizer	1 No
10.	Tire tread depth measuring gauge	2 No
11.	Pneumatic Impact wrenches	5 No
12.	Pneumatic Impact sockets	5 No
13.	Waste Oil Receptacle with neck & funnel	1No's
14.	Hydraulic press with adopter ( 25 ton )	1 No
15.	Mechanical Arbor press ( 3 ton )	1 No
16.	Portable Electric Drill Machine	1 No
17.	Bench Electric Drill Machine	1 No each
18.	Buffer & Grinder (Bench & Portable) ( 6”)	1 No each
19.	Radiator Pressure Cap tester	1 No
20.	Hydraulic Jack ( 3-5 ton)	5 No each
21.	Mechanical Jack (3 ton )	5 No's
22.	Service Creeper trolleys with Led lights	5 No's
23.	Creeper stool type	5 No's
24.	Air Compressor ( 150- 200L, 5-8 hp)	1 No
25.	Engine oil dispenser	1 No
26.	Storage bin (Metallic make)	100 No's
27.	Tool trolley	10 No's
28.	Work bench	10 No's
29.	Lockers	10 No's
30.	Cabinets	10 No's
31.	Shelf rack	20 No's
32.	Gear box repairing stand	5 No's
33.	Platform truck	5 No's
34.	Oval shape Hydrometer	10 No's
35.	Battery Post terminal cleaner	5 No's
36.	Automotive Stethoscope	5 No's
37.	Soldering gun	5 No's
38.	Battery Charger (1 -50A)	1 No
39.	Battery tester	2 No's
40.	Gas welding Plant	1 No
41.	Arc welding Plant	1 No
42.	Cleaning tank	2 No's
43.	Cylinder boring machine	1 No



44.	Valve grinding & facing machine	1 No
45.	Mini compressor with tire inflator	2 No's
46.	Ramp & Pit .	2 No's
47.	Differential repair stands	2 No's
48.	Parts tray	20 No's
49.	V-blocks set	3 No's
50.	SST Board	5 No's
51.	Torch light	2 No's
52.	Test lamp	5 No's
53.	Circuit tester	5 No's
54.	Compressed air blow gun	3 No's

**LIST OF INSTRUMENTS / EQUIPEMENTS &  
AUTOMOTIVE DIAGNOSTIC TOOLS  
(For DAE class of 40 students)**

<b>S.NO</b>	<b>Name of Machinery /Equipments</b>	<b>Quantity</b>
1.	Digital tachometer and dwell tester	2 No's
2.	Compression Gauge ( for petrol engine )	5 No's
3.	Compression Gauge ( for diesel engine )	5 No's
4.	Vacuum Gauge	5 No's
5.	Cylinder Leakage Tester	5 No's
6.	Ignition Timing Gun( for petrol engine )	5 No's
7.	Ignition Timing Gun( for Diesel engine )	1 No's
8.	Digital Multimeter	20 No's
9.	Digital Clamp meter ( AC/DC up to- 400A)	5 No's
10.	Analogue Multimeter	5 No's
11.	Oscilloscope	1 No
12.	Growler Tester	1 No's
13.	Automotive Diagnostic Scanner (VIM)with Lap top & multimedia	2 No's
14.	Dynamometer ( Hydraulic type)	1 No
15.	Exhaust Gas Analyzer (5-Gases)	2 No's
16.	Computerized Wheel balancer machine(with all accessories)	1 No
17.	Computerized Wheel alignment apparatus 3D (with all accessories)	1 No
18.	Universal Injector Cleaner kit	2 No's
19.	Bench Mounted Injector Tester	1 No
20.	Universal diesel fuel Injection pump Phasing & Calibration machine.	1 No
21.	Dynamometer for testing engine power	1 No
22.	Self- Starter test bench	1 No

**LIST OF AUTO BODY REPAIR TOOLS & EQUIPEMENTS  
(For DAE class of 40 students)**

<b>S.NO</b>	<b>Name of Tools /Equipments</b>	<b>Quantity</b>
1.	<u>Hammers</u> (Heavy Duty roughing, combination or pick, light dinging, combination dinging, heavy	10 No's each type

	dinging, dinging hammer with short curved pick, offset dinging, Shrinking hammer, dinging hammer with long curved pick, Magnatic trim hammer,nylon mallet.	
2.	<u>Dollies</u> (High crown dollyblock, Low crown, heavy duty roughing, shrinking, rail type, All-purpose Heel dolly block.	10 No's each type
3.	<u>Spoons</u> (Double-end lower back panel,Double-end door and side apron spoon,Heavy-duty drivinbg spoon,Double-end heavy duty driving and fender-beading tool,Highcrown surfacing spoon,Low crown surfacing spoon, Edging tool.	10 No's each type
4.	<u>Pick Tools</u> (Short curved pick, Long curved pick, chisel bit pick, Deep throated pick, curved finishing punch, Hooked finishing punch,piercing punch.	10 No's each type
5.	<u>File's Holder</u> (Adjustable file holder)	10 No's each type
6.	<b>Files</b> (Long Blocking file, short blocking file,Special contour files, Bumping or Slapping file, Grater file Blades)	10 No's each type
7.	Screw drivers (Flate and philips standard screw, offset philips & flate, clutch head,	10 No's each type
8.	Door hinge wrenches	10 No's
9.	<u>Reamer</u> (hand operated)	10 No's
10.	Soldering Gun	10 No's
11.	Burr cutter	10 No's
12.	Buffing pad	10 No's
13.	Reveal molding	10 No's
14.	Door and window handle clip remover	10 No's
15.	Vacuum lifter (wind sheild)	10 No's
16.	Wind sheild lacing tools	10 No's
17.	Blind nut installation tools	10 No's
18.	Heavy duty blind rivet window regulator installation tool	10 No's
19.	Universal crease puller	10 No's
20.	pneumatic panel edge roll tool	10 No's
21.	Grease gun	10 No's
22.	Flange tool	10 No's
23.	Bumper Bracket tool	10 No's
24.	Body pull rod	10 No's
25.	Paint spraying equipment	05 No's
26.	Jigs for car frame straightening	1 No for recommended car
27.	Jigs for car straightening jacks	1 No for recommended car
28.	Safety Guard For working on machine	30 No's
29.	Axle Stand (Safety Stands)	10 No's
30.	Fire Blanket	05 No's
31.	Face shield	05 No's

**LIST OF AUTO CAD LAB**  
**(For DAE class of 40 students)**

<b>S.NO</b>	<b>Name of Machinery /Equipment's</b>	<b>Quantity</b>
1.	Computer	50-set
2.	Computer Table	50-set
3.	Computer Chair	1-set
4.	Multimedia Projector	1-set
5.	AutoCAD 2010	50-set
6.	Microsoft Windows 7	50-set

**LIST OF AUTOMOTIVE MODELS**  
**(For DAE class of 40 students)**

<b>S.NO</b>	<b>Name of Machinery /Equipment's</b>	<b>Quantity</b>
1.	Model of 4-stroke Petrol Engine	1 NO
2.	Model of 2-stroke Petrol Engine	1 NO
3.	Model of 4-stroke Diesel Engine	1 NO
4.	Small Chassis Model with Plexiglas EFI Petrol engine	1 NO
5.	Small Chassis Model with Plexiglas hybrid vehicle	1 NO
6.	Petrol engine complete cut-away model	1 NO
7.	Diesel engine complete cut-away model	1 NO
8.	EFI Engine Simulator	1 NO
9.	EFI cut-away parts.	1 NO
10.	Vehicle computer controlled on board diagnose simulator	1 NO
11.	ECT transaxle Gear box Sectional model	1 NO
12.	Manual transaxle Gear box Sectional model	1 NO
13.	4x4W transmission system Cristal model	1 NO
14.	Clutch assembly cut-away model	1 NO
15.	Free wheel hub model	1 NO
16.	Propeller shaft model	1 NO
17.	VVT-I Engine sectional model	1 NO
18.	V-Tech Engine sectional model	1 NO
19.	Wankle Engine model	1 NO
20.	Differential model (Non Slip)	1 NO
21.	Valve train model (V.V.T.I)	1 NO
22.	Cylinder head sectional model	1 NO
23.	Ignition System Model (Distributor less)	1 NO
24.	Starter motor assembly cut-away model	1 NO
25.	Alternator assembly cut-away model	1 NO
26.	Lead acid battery cut-away model	1 NO
27.	Electricity Master Board with all accessories	1 NO
28.	Electromagnetism Master Board with all accessories	1 NO
29.	Relay Cut-out Master Board	1 NO
30.	Vehicle Lighting system trainer	1 NO
31.	Vehicle all electrical/electronic accessories trainer	1 NO
32.	Instruments Panel Gauges Model	1 NO
33.	Power Steering Model	1 NO

34.	Tire construction model	1 NO
35.	Complete strut type suspension system model	1 NO
36.	Wheel balance simulator model	1 NO
37.	Shock absorber cut-away model	1 NO
38.	Rack & pinion type power steering cut-away model	1 NO
39.	Anti-lock Brake system simulator	1 NO
40.	Diesel Engine Instruction Model with Turbo Charges	1 NO
41.	Distributor type diesel fuel injection pump sectional model	1 NO
42.	Inline type diesel fuel injection pump sectional model	1 NO
43.	Driving Education charts	1 NO
44.	Driving trainer	1 NO
45.	Power window trainer	1 NO
46.	Power door lock trainer	1 NO
47.	Logic circuit & logic actual IC's	1 NO
48.	Air Bag Simulator ( SRS )	1 NO
49.	Electronic master Kit	1 NO
50.	Pneumatic Air Brake Simulator	1 NO

**LIST OF SAFETY & PROTECTION EQUIPEMENTS**  
(For DAE class of 40 students)

<b>S.NO</b>	<b>Name of Machinery /Equipment's</b>	<b>Quantity</b>
1.	Fire Extinguishers ( DCP 6-8kg, CO2 8kg)	3 No each
2.	Safety goggles	10 No's
3.	First Aid Box	10 No's
4.	Apron/ Proper uniform	55 No's
5.	Dust Mask	55 No's
6.	Safety shoes	55 No's
7.	Ear Muff	10 No's
8.	Safety Gloves set( Leather, rubber & Cotton)	55 No's
9.	Sand Storage buckets for fire fighting	10 No's
10.	Water Storage buckets for fire fighting	10 No's

**LIST OF ENGINES/TRANSXLES/VEHICLES**  
(For DAE class of 40 students)

<b>S.NO</b>	<b>Name of Machinery /Equipment's</b>	<b>Quantity</b>
1.	Petrol engine (4-cylinder VVT-I & i-VTech) (Used & in Good working condition with stand)	5 NO'S
2.	Petrol engine ( Multi cylinder with carburetor) (Used & in Good working condition with stand)	5 NO'S
3.	Manual transaxle(Synchromesh type)	5 NO'S
4.	ECT Automatic planetary gear transaxle	5 NO'S
5.	Generator (China make 7KVA)	2 No's
6.	Petrol engine ( 70-80 cc) (Used & in Good working condition with stand)	2 NO'S
7.	Petrol engine ( 100cc, 125cc)	3 NO'S

	(Used & in Good working condition with stand)	
8.	Diesel engine (multi cylinder with EFI) (Used & in Good working condition with stand)	5 NO'S
9.	Car equipped with manual transmission (Used in Good working condition model not old than 10 years )	1 NO
10.	Car l equipped with automatic transmission (Used in Good working condition model not old than 10 years )	1 NO
11.	Hybrid car with automatic transmission	1 NO
12.	Motorcycle (minimum 70cc) (Used in Good working condition model not old than 5 years )	1 NO
13.	Motorcycle ( minimum 125cc) (Used in Good working condition model not old than 5 years )	1 NO

**LIST OF CONSUMABLE MATERIALS**  
**(For DAE class of 40 students)**

<b>S.NO</b>	<b>Name of Consumable material</b>	<b>Quantity</b>
1.	Engine Oil (SAE-30-50)	50 L
2.	Grease	10 kg
3.	Petrol	1000 L
4.	Diesel	1000 L
5.	CNG	100 Kg
6.	LPG	100 kg
7.	Sulphuric Acid	10 L
8.	Kerosene Oil	100 L
9.	Brake Oil (350ml)	20 tin
10.	Distilled Water	60 L
11.	Battery terminals Clamp set	10 set
12.	Engine Over-hauling Kit	1 for each engine
13.	Emery Papers (0,1,2)	10 No's each
14.	Silicon Tube	10 No's
15.	Fan Belt(V-belts)	10 No's
16.	Oil Filter	20 No's
17.	Air Filter	20 No's
18.	Fuel Filter	30 No's
19.	Auto wire 3mm, 5mm	10 No's each coil
20.	Head Lights Beam	10 No's
21.	Auto Bulbs (different types)	24 No's each type
22.	Insulation Tape	30 No's
23.	Thimbles (male and female types) box	10 each
24.	Spark Plug High tension leads Set	5 set for each engine
25.	Cotton Waste (Towel and Cloth type)	100 kg of each type
26.	Malmal cloth	10kg
27.	Emery Past	5 tin
28.	Spark Plugs	50 No's
29.	C.B Point	10 No's
30.	Condenser	10 No's

31.	Thrust Bearing	10 No's
32.	Piston Rings (set)	10 set
33.	Shell Bearings set	5 for each engine
34.	Ignition Switch	10 No's
35.	Soldering wire	20 Roll's
36.	Fuses ( various range)	50 dozen
37.	Wire brush	5 No's
38.	Sand paper sheet ( 0, 1, 2,3 no)	2 dozen each type
39.	Grinder disk	5 No's
40.	Gasket material(cork sheet)	10 No's
41.	Washers (aluminum/copper/fiber) (Box)	1 box each type
42.	Assorted size of nuts & bolts	25 No's each size
43.	Screws deferent size (Box)	1 box each size
44.	Bearings ( Ball type, Needle type, Bush type)	2 No's each type
45.	Engine timing belts	10 No's
46.	Hose pipe (set)	10 set
47.	Jubilee hose clips (different size)	2 dozen
48.	Tube vulcanize solution (tin)	1 2 tin
49.	Jumper leads	6 No's
50.	Drill bit set	4 No's
51.	Oil drain Plugs(different types)	5 No's
52.	Cup type core plugs	1 dozen
53.	Internal & External circlips	20 No's each
54.	Splint pins ( different size ( box)	1 box each size
55.	Coil springs(different types)	1dozen each type
56.	Dust boot & seals (different types)	10 No's each
57.	Wiper blades (set)	2 set
58.	Engine flush chemical (450ml)	10 Pack
59.	Wind Screen wash fluid (1000ml)	10 L
60.	Pop Rivets (different sizes) Box	1 box each
61.	Cable ties	4 dozen
62.	Fire extinguisher filling powder (packet)	5 Packets
63.	Tire puncture kit	10 No's
64.	Tire valve	1 dozen
65.	Mechanics mat	6 No's
66.	Lead acid Battery ( 85 AH)	05 No's
67.	Horn Relay	12 No's
68.	Horn (set)	10 set
69.	Horn Button	10 No's
70.	Dimmer Switch	10 No's
71.	Wheel Balancing weights ( 5gm -100gm)	25 No's each size
72.	Diode	2 dozen
73.	Capacitor	2 dozen
74.	Resistances (different range)	2 dozen
75.	Step down transformer ( 5A, 10A)	5 each type
76.	Transistor	2 dozen
77.	Battery post Cleaner	6 No's
78.	Carburetor service kit	6 No's
79.	Sand for Spark plug Cleaner machine	10 packets
80.	Wooden powder	20kg
81.	Fertilizer (Urea, DAP, NPK)	50 Kg each

82.	Herbicide, Insecticide, Pesticide sprays	5 litter each
83.	Cultivator tines	24 No.
84.	Thresher cutters	50 No.
85.	Cultivator springs	24 No.
86.	Rotavator Blades	24 No.
87.	Lock pins	24 No.
88.	Hitching pins	24 No.
89.	PTO pulley PTO Transmission shaft	1 No. Each
90.	Belts different sizes	5 Sets
91.	Tractor fuel & oil filter	12 No. Each
92.	Hydraulic oil	60 liter
93.	Seeds of different crops	As per field
94.	Plastic sheet	As per field

**List of Tools & Equipment/ Machinery “especially for Farm Machinery”**

<b>Sr. No.</b>	<b>Nomenclature of Equipment / Tools</b>	<b>Quantity</b>
1.	Tractor min 50 Hp and min 80 Hp	1 No Each
2.	Tractor 4wd min 85 Hp (optional)	1 No.
3.	Excavator (optional)	1 No.
4.	Self-propelled vibrating Road compactor (optional)	1 No.
5.	Motor grader (Optional)	1 No.
6.	Bulldozer (Optional)	1 No.
7.	Power shovel (optional)	1 No.
8.	Combine harvester (optional)	1 No.
9.	Sugar cane planter (optional)	1 No.
10.	Sugar cane harvester (Optional)	1 No.
11.	M.B plough	1 No
12.	Disc plough	1 No
13.	Sub soiler	1 No
14.	Chisel plough	1 No
15.	Tine Cultivator 11 tines	1 No
16.	Rotavator min 48 Blade	1 No
17.	Multi crop thresher	1 No.
18.	Soil Augur Sampler	10 No.
19.	Soil texture tester	01 No.
20.	Oven for soil moisture testing	01 No.
21.	Disc harrow	1 No
22.	Boom sprayer machine	1 No
23.	Knap Sack Spray Machine	5 No's
24.	Seed drill & Planter	1 No each
25.	Potato digger	1 No
26.	Wheat thresher	1 No
27.	Rigger	1 No
28.	Border disc	1 No
29.	Centrifugal pumps of tube well	1 No
30.	Wheat Reaper	1 No
31.	Farm tripping trolley Hydraulic	1 No
32.	Peter engine 16-18 Hp	1 No
33.	Lawn Mover	1 No
34.	Land leveler	1 No.

35.	Planker	1 No.
36.	Front bucket	1 No.
37.	Fertilize Broad caster	1 No.
38.	Kurpa, Kassi, Kasola,	50 Each
39.	Wheel barrow	2 No.
40.	Post hole digger	1 No.
41.	Portable mechanical reaper	2 No.
42.	Potato digger	1 No.
43.	Fork lift truck 3 ton	1 No.
44.	Mold board plough	1 No.
45.	Front blade	1 No.
46.	Rear blade	1 No.
47.	Lase land leveler	1 No.
48.	Adjustable pintle hook	1 No.
49.	Jib Crane	1 No.
50.	Walk in tunnel min 20' x 60'	1 No.
51.	Trickle irrigation unit ½ Cusec	1 No.
52.	Water Sprinkler min 8 unit set	1 No.
53.	Straw Chopper	1 No.
54.	Hay Bailer	1 No.
55.	Bar Harrow	1 No.



**List of Useful reference books  
AUTO & FARM Technology**

<b>S.No</b>	<b>Book Name</b>	<b>Author Name</b>
1.	Automotive Technology A System Approach	Jack Erjavec
2.	Automotive Excellence ( Volume 1 & 2 )	McGRAW Hill International
3.	Modern Automotive Mechanics	James E. Duffy
4.	Automotive Electrical and Electronic systems	Frank C. Derato
5.	Automotive Electricity & Electronics	Barry Hollembeak
6.	Automotive Chassis Systems	James D. Helderman
7.	Suspension & Steering Systems	Clifton Owen
8.	Automotive Brake Systems	Clifton Owen
9.	Automotive Diagnostic fault codes manual	Haynes Techbook
10.	Automotive Tools manual	Haynes Techbook
11.	Automotive Mechanics	William H. Crouse
12.	Auto fundamentals	Martin W. Stockal
13.	Automotive Engine Management System	Jeff Hartmen
14.	Automotive Diagnostic Scanner	Martin
15.	AutoCAD -2007	Alf Yarwood
16.	Performance Automotive Math	John
17.	A Practical Approach to Motor Vehicle Engineering & maintenance	Allan Bonnick
18.	Advance automotive Electronics Systems	Barry Hollembeak
19.	Automotive Control Systems	A. Galip Ulsoy
20.	Automotive Body Work and Rust Repair	M. Joseph
21.	Auto Repair & Service	Martin W. Stockal
22.	Automobile Engineering	K K Jain
23.	Automotive Engine Theory & Servicing	James D. Helderman
24.	Automobile Technology	Dr. N.K. Giri
25.	Automotive Mechanics ( Volume 1 & 2 )	Ed May
26.	A Text Book of Automobile Engineering	R.K. Rajput
27.	Automotive Electricity, Electronics & Computer Controls	Barry Hollembeak
28.	Internal Combustion Engine	V Ganesan
29.	Automobile Engineering	Er. A.K. Babu
30.	Book of Driving	Automobile association
31.	Team Training Manuals (Step-1,2,& 3)	Toyota Motor Japan
32.	Farm Tractor	S.C. Rai
33.	Fundamentals of Tractor & Energy conservation	Dr. Gulam Sarwar
34.	A text Book of Irrigation & Drainage	Dr. Muhammad Rafiq
35.	Farm Machinery and Equipment	Harris P. Smith
36.	Agricultural Power and Machinery	Jacob Harrel
37.	A Textbook of Agriculture	M. Ibrahim Bajwa
38.	Fundamentals of soil Science	Henry D. Forth,
39.	A Text Book of Agriculture Vol. I&II	- By: Muhammad Ibrahim Bajwa

## **Minimum Qualification of Teacher/ Instructor**

**M.Sc. in Mechanical Engg.**

**B.Sc. in Mechanical Engg. with 2-Years' relevant experience in  
teaching/ industry**

**B-Tech. / B.Sc. Tech. with 4-Years' relevant experience in teaching/  
industry**

**DAE in Mechanical Technology OR DAE Auto & Farm Technology, with  
6-Years' relevant experience in teaching/ industry**

## **Employability of the pass-outs /Graduates**

The pass outs of this course may find job / employment opportunities in the following areas  
/ sectors:-

Manufacturing Industry

Automobile Industry

Tractor manufacturing units Packages.

Service technician in private / government organization as a:-

petrol mechanics

diesel mechanics

engine overhauling mechanic

wheel alignment and wheel balancing mechanic

store man auto

Mechanic / foreman in government organization

Auto mobile assembler in assembly plants

Agriculture engineering workshop at distt. Levels.

Center of agriculture machinery industries (CAMI), mian channu.

Agriculture mechanization research institute (AMRI), Multan.

Farm machinery manufacturing organization as MILLAT tractors, Al-Ghazi (FAIT Tractor)  
etc.

Honda Atlas Cars, Manga Mindi, Lahore.

Pak Suzuki Motors, Karachi.

Dewan Motors, Karachi.

Toyo Crolla Cars, Karachi.

Own farm machinery workshop.

## **CURRICULUM REVISION COMMITTEE**

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<b>Mr. Bashir Hussain Arshad,</b> Sr. Instructor, Govt. College of Technology Sahiwal. 0334-7900895	Member
<b>6. Mr. Shafaat ullah Khan</b> Manager Tech. (Ali Brothers Engg.) Toll Tax Chowk, Satiana Road, Faisalabad 0310-1338055	Member