PUNJAB BOARD OF TECHNICAL EDUCATION

21-A, Kashmir Block Allama Iqbal Town, Lahore

www.pbte.edu.pk Tel # 042-99260273 email: rnd.pbte@gmail.com

SAY NO TO CORRUPTION

No: PBTE/R&D/2026/22 Dated: 28-01-2026

NOTIFICATION

In pursuance of the NAVTTC Notification No. (D.G) (SS&C)/2021-QD-1 dated 26.11.2025, it is notified that the existing DAE Mechanical Technology (power) with specialization in Auto & Diesel (3 years) has been repealed and replaced with DAE Mechanical Technology (power) with specialization in Automotive Technology.

The implementation of said technology shall apply on the students who shall be registered for academic session 2026-27 and onward. Punjab Board of Technical Education shall conduct the examination of the said technology w.e.f. 1st Annual Examination 2027. However, the candidates who were registered in the old course of DAE Mechanical Technology (power) with specialization in Auto & Diesel (3 years) will avail the prescribed chances. Soft copy of the curriculum of the said technology may be downloaded from the website of PBTE i.e. www.pbte.edu.pk/textbooks.html.

SECRETARY

CC to:

1- PS to Chairperson PBTE, Lahore.
2- PA to Secretary PBTE, Lahore.
3- PA to Controller of Examinations PBTE, Lahore.
4- PA to DG Academics TEVTA, Lahore.
5- PA to DG Operations TEVTA, Lahore.
6- The Principals concerned.
7- Deputy Controller of Examinations (Conduct) PBTE, Lahore
8- Deputy Controller of Examinations (Secrecy) PBTE, Lahore.
9- System Analyst PBTE, Lahore.
10-Assistant Controller of Examinations (Technical) PBTE, Lahore.
11-Assistant Controller of Examinations (Conduct) PBTE, Lahore.
12-Assistant Controller of Examinations (Secrecy) PBTE, Lahore.
13-Assistant Controller of Examinations (P&P-I) PBTE, Lahore.
14-Assistant Controller of Examinations (P&P-II) PBTE, Lahore.
15-Assistant Secretary (Recognition) PBTE, Lahore.
16-IPS PBTE, Lahore.
17-IOW PBTE, Lahore.
18-Web Administrator PBTE, Lahore to upload on website of PBTE.
19-Notification File.

Training Objectives:-

This three-year Diploma in Mechanical Technology (Power) with specialization in Automotive aims to develop skilled technicians equipped with modern knowledge of automotive systems, tools, and technologies. In the first year, students are introduced to the fundamentals of science, mathematics, and engineering drawing alongside core subjects such as internal combustion engines, automotive electricity, and occupational health and safety. Emphasis is placed on practical training through workshop practice and computer applications to build essential technical and analytical skills, while subjects like Islamiat, Pakistan Studies, and English nurture moral, civic, and communication competencies essential for professional growth.

In the second and third years, the program advances into specialized areas including thermodynamics, suspension and braking systems, electric vehicles, and automotive transmission systems. Students gain hands-on experience in vehicle inspection, diagnostics, and repair through progressive workshop practices. They are also introduced to modern tools such as CAD and robotics, along with entrepreneurship and freelancing, to prepare them for self-employment and industry demands. By the end of the diploma, graduates will possess the technical expertise, safety awareness, and entrepreneurial mindset required for successful careers in the automotive industry or for pursuing higher education in related engineering disciplines.

CURRICULUM SALIENT

Qualification Title	3-Year Diploma of Associate Engineer (DAE) in Automotive Technology
Qualification Stream	Technical
Duration of Course	3 Years (Annual System)
Total Training Credit Hours	70
Entry Level	Entry Level Matric with Science.
Annual Intake	As approved by the respective TEVTA
Methodology	Theory 40% ; Practical 60%
Instructional Medium	Urdu / English

SCHEME OF STUDIES

REVISED CURRICULUM OF

Mechanical Technology (Power) with Specialization in Automotive (3-Years)

1st Year

Code		Subject	T	P	C
Gen	111	Islamiat& Pak Studies	1	0	1
TTQ / Civic	111	Tarjuma-tul-Quran / Civics-I	1	0	1
ENG	112	English	2	0	2
Math	113	Applied Mathematics-I	3	0	3
Phy	122	Applied Physics	1	3	2
Comp	152	Computer Application	1	3	2
AM	112	Basic Engineering Drawing	1	3	2
AM	123	I.C Engines	2	3	3
AM	134	Automotive Electricity & Electronics	2	6	4
AM	141	Occupational Health & Safety Environment (OHSE)	1	0	1
AM	153	Workshop Practice-I	1	6	3
TOTAL			**16**	**24**	**24**

2nd Year

Code		Subject	T	P	C
Gen	201	Islamiat& Pak Studies	1	0	1
TTQ / Civic	211	Tarjuma- tul-Quran / Civics-II	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	211	Business Communication	1	0	1
AFM	242	Applied Thermodynamics	1	3	2
AM	213	Electric Vehicles (E.V)	2	3	3
AM	223	Problems in I.C Engines	2	3	3
AM	233	Suspension, Steering & Brakes	2	3	3
AM	244	Workshop Practice-II	2	6	4
TOTAL			**17**	**24**	**25**

3rd Year

Code		Subject	T	P	C
Gen	301	Islamiat& Pak Studies	1	0	1
Mgm	332	Entrepreneurship and Freelancing	1	3	2
AM	313	CAD & Robotics	2	3	3
AD	302	Motor Vehicle Driving	1	3	2
AFM	312	Motor Vehicle Inspection	1	3	2
AM	323	Fuel Injection & Carburetion	2	3	3
AM	334	Automotive Transmission	3	3	4
AM	343	Auto Body Building & Finishing	2	3	3
AM	354	Workshop Practice-III	2	6	4
TOTAL			**15**	**27**	**24**

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 کل وقت:20 گھنٹے

قرآن مجید

1- تعارف قرآن مجید 2- نزول قرآن 3- مکی و مدنی سورتوں کی خصوصیات 4- وحی کی اقسام 3

5- پندرہ منتخب آیات معہ ترجمہ

1- لن تنالوا البر حتی تنفقوا مما تحبون

2- واعتصموا بحبل الله جمیعا ولا تفرقوا

3- ولا یجرمنکم شنان قوم علی ان لا تعدلوا

4- ان الله یامرکم ان تودوا 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- ومآ اتاکم الرسول فخذوه ومانهاکم عنه فانتهو

10- واوفوبالعهد

11- وعاشروهن بالمعروف

12- یمحق الله الربوٰ ویربی الصدقات

13- واصبر علی ما اصابک

14- وقولوا قولا سدیدا

15- ان الدین عند الله الاسلام

(ب) **سنت**

1- **سنت کی اہمیت**

1- انما الاعمال بالنیات

2- انما بعث لاتمم مکارم الاخلاق

3- لایومن احدکم حتی یحب الا خیہ ما یحب لنفسہ

4- المسلم من سلم المسلمون من لسانہ ویدہ

5- قل امنت باللہ ثم استقم

6- خیرکم خیرکم لا ھلہ

7- سباب المسلم فسوق وقتالہ کفر

8- المومن اخوالمومن

9- کل المسلم علی المسلم حرام دمہ وما لہ وعرضہ

10- آیۃ المنافق ثلاثۃ اذا حدث کذب واذا اوتمن خان واذا وعد اخلف

2- **دین اسلام** (5)

2.1 اسلام کے بنیادی عقائد کی وضاحت اور انسان کی انفرادی واجتماعی زندگی پران کے اثرات

1- توحید

2- رسالت

3- آخرت

4- ملائکہ

5- آسمانی کتب

2.2 **عبادات** (5)

1- نماز 2- روزہ 3- حج 4- زکوۃ

مندرجہ بالا عبادات کی اہمیت وفضیلت، حکمتیں اور انسان کی انفرادی ومعاشرتی 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 ڈھال کر ایک اچھا مسلمان بن سکے۔

نصاب اخلاقیات سال اول (غیر مسلم طلباء کیلئے)

حصہ اول اخلاقیات	Gen III	ٹی	پی	سی
		1	0	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 وضبط
- راست گوئی
- صبر واستقلال
- 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۔
- وفاداری کی اہمیت بیان کر سکے۔
- نظم وضبط 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۔
- ذہنی 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 قائداعظم 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۔

نصاب سال اول Gen III

حصہ دوم مطالعہ پاکستان کل وقت:12 گھنٹے

موضوعات

- حریت فکر

مسلمان قوم میں آزادی فکر کی تاریخ۔ مسلمانوں میں سیاسی آزادی کی اہمیت اور ضرورت۔ ذہنی وجسمانی 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 قائداعظم 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 تحریکوں 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۔

Tarjumat-ul-Quran / Civics-II

TTQ-111 / Civic-111;

T	P	C
1	0	1

Total Contact Hours:

Theory: **32**

Practical: **0**

Note: Syllabi for this subject would be as per BISEs/General education, developed by Punjab Curriculum TextBook Board (PCTB)/ PECTA

Eng-112 ENGLISH

Total Contact Hours	**T**	**P**	**C**
Theory 64	**2**	**0**	**2**

LEARNING OUTCOMES:

At the end of the course, the students will be equipped with cognitive skills 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

1 prose/text **16 hours**

1.1 First eight essays of Intermediate English Book-II

2 close test **4 hours**

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

3 Grammar **26 hours**

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

4. Composition **12 hours**

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.

5. Translation 6 hours

5.1 Translation from Urdu into English.
For Foreign Students: A paragraph or a dialogue.

Recommended Textbooks:

1. 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

0Eng-112 ENGLISH

Instructional Objectives:

PAPER-A

1. 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

2. 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

3. 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.

4. 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.

5. 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.

MATH-113 APPLIED MATHEMATICS-I

Total Contact Hours	T	P	C
Theory 96	3	0	3

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

LEARNING OUTCOMES:

After completing the course the students will be able to

1. Solve problems of Algebra, Trigonometry, vectors, Mensuration, Matrices and Determinants.
2. Develop skill, mathematical attitudes and logical perception in the use of mathematical instruments as required in the technological fields.
3. Acquire mathematical clarity and insight in the solution of technical problems.

Detail of Contents:

1. Quadratic equations **6 Hours**

- 1.1 Standard Form
- 1.2 Solution
- 1.3 Nature of roots
- 1.4 Sum & Product of roots
- 1.5 Formation
- 1.6 Problems

2. Arithmetic progression and series. **3 Hours**

- 2.1 Sequence
- 2.2 Series
- 2.3 nth term
- 2.4 Sum of the first n terms
- 2.5 Means
- 2.6 Problems

3. Geometric progression and series. **3 Hours**

- 3.1 nth term
- 3.2 Sum of the first n terms
- 3.3 Means
- 3.4 Infinite Geometric progression
- 3.5 Problems

4. Binomial theorem **6 Hours**

- 4.1 Factorials
- 4.2 Binomial Expression
- 4.3 Binomial Co-efficient
- 4.4 Statement
- 4.5 The General Term
- 4.6 The Binomial Series
- 4.7 Problems.

5. Partial fractions **6 Hours**

5.1 Introduction
5.2 Linear Distinct Factors Case I
5.3 Linear Repeated Factors Case II
5.4 Quadratic Distinct Factors Case III
5.5 Quadratic Repeated Factors Case IV
5.6 Problems

6. Fundamentals of trigonometry **6 Hours**

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

7. Trigonometric functions and ratios **6 Hours**

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

8. General identities **6 Hours**

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

9. Solution of triangles **6 Hours**

9.1 The law of Sines
9.2 The law of Cosines
9.3 Measurement of Heights & Distances
9.4 Problems

10. Mensuration of solids **30 Hours**

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

11. Vectors **9 Hours**

- 11.1 Scalers & Vectors
- 11.2 Addition & Subtraction
- 11.3 The unit Vectors i, j, k
- 11.4 Direction Cosines
- 11.5 Scaler 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 x b.
- 11.11 Problems

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

MATH-113 APPLIED MATHEMATICS-I

Instructional Objectives:

1. 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.

2. Understand apply concept of arithmetic progression and series.

2.1 Define an Arithmetic sequence and a series.
2.2 Derive formula for the nth 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.

3. Understand geometric progression and series.

3.1 Define a geometric sequence and a series.
3.2 Derive formula for nth 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.

4. 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) .....,(n,r)....., (n,n)
4.3 Derive expression for the general term.
4.4 Calculate the specified terms.
4.5 Expand the 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.

5. 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.

6. 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.

7. 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.

8. 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.

9. 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.

10. 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 the weight of solids.
10.8 Solve problems of these solids.

11. 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

12. 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.

PHY-122 APPLIED PHYSICS

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

Pre-requisite: None.

LEARNING OUTCOMES:

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. 3 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 3 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 center 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

6 Sound. 5 Hours

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.

7 Light. 5 Hours

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

8 Optical fiber. 2 Hours

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.

9 Lasers. 3 Hours

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:

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

PHY-122 APPLIED PHYSICS

Instructional Objectives:

1 Use concepts of measurement to practical situations and technological problems.

1.1 Write dimensional formula 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.

2 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.

3 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.

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

4.1 Explain Torque
4.2 Distinguish between Centre of gravity and center 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.

5 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.

6 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.

7 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 the working of optical instruments, e.g. microscopes, telescopes, camera and sextant.

8 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.

9 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 the use of optical fiber in industry and medicine.

PHY-122 APPLIED PHYSICS

List of Practicals:

1. Draw graphs representing the functions:
   a) y=mx for m=0, 0.5, 1, 2
   b) $y=x^2$
   c) y=1/x
2. Find the volume of a given solid cylinder using Vernier calipers.
3. Find the area of cross-section of the given wire using micrometer screw gauge.
4. Prove that force is directly proportional to (a) mass, (b) acceleration, using fletchers' trolley.
5. Verify law of parallelogram of forces using Grave-sands apparatus.
6. Verify law of triangle of forces and Lami's theorem
7. Determine the weight of a given body using
   a) Law of parallelogram of forces
   b) Law of triangle of forces
   c) Lami's theorem
8. Verify law of polygon of forces using Grave-sands apparatus.
9. Locate the position and magnitude of resultant of like parallel forces.
10. Determine the resultant of two unlike parallel forces.
11. Find the weight of a given body using principle of moments.
12. Locate the center of gravity of regular and irregular shaped bodies.
13. Find Young's Modules of Elasticity of a metallic wire.
14. Verify Hooke's Law using helical spring.
15. Study of frequency of stretched string with length.
16. Study of variation of frequency of stretched string with tension.
17. Study resonance of air column in resonance tube and find velocity of sound.
18. Find the frequency of the given tuning fork using resonance tube.
19. Find the velocity of sound in rod by Kundt's tube.
20. Verify rectilinear propagation of light and study shadow formation.
21. Study effect of rotation of plane mirror on reflection.
22. Compare the refractive indices of given glass slabs.
23. Find focal length of concave mirror by locating center of curvature.
24. Find focal length of concave mirror by object and image method
25. Find focal length of concave mirror with converging lens.
26. Find refractive index of glass by apparent depth.
27. Find refractive index of glass by spectrometer.
28. Find focal length of converging lens by plane mirror.
29. Find focal length of converging lens by displacement method.
30. Find focal length of diverging lens using converging lens.
31. Find focal length of diverging lens using concave mirror.
32. Find angular magnification of an astronomical telescope.
33. Find angular magnification of a simple microscope (magnifying glass)
34. Find angular magnification of a compound microscope.
35. Study working and structure of camera.
36. Study working and structure of sextant.
37. Compare the different scales of temperature and verify the conversion formula.
38. Determine the specific heat of lead shots.

39 Find the coefficient of linear expansion of a metallic rod.
40 Find the heat of fusion of ice.
41 Find the heat of vaporization.
42 Determine relative humidity using hygrometer.

COMP-152 **COMPUTER APPLICATIONS**

Total Contact Hours

		T	P	C
Theory:	**32 Hours**	**1**	**3**	**2**
Practical:	**96 Hours**			

Pre-requisites: None

LEARNING OUTCOMES:

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.

Course 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 Generations of Computers
1.4 Block diagram of a computer system
1.5 BIT, Byte, RAM & ROM
1.6 Input & Output devices
1.7 Secondary storage devices
1.8 Types of Software
1.9 Programming Languages
1.10 Applications of computer in different fields
1.11 Application in Engineering, Education & Business

2. MS-WINDOWS 10 2 Hours

2.1 Introduction to Windows
2.2 How to install Drivers in Windows
2.3 Loading & shut down process
2.4 Introduction to Desktop items (Creation of Icons, Shortcut, Folder & modify Taskbar)
2.5 Desktop properties
2.6 Use of Control Panel
2.7 Searching a document

3. MS-OFFICE (MS-WORD -2016) 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 its Editing
3.12 Printing the document
3.13 Saving a document file as PDF format

4. MS-OFFICE (MS-EXCEL -2016) 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- 2016) 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 3 Hours

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 Drop Box / Online/ Sky drive/ Cloud data etc.
6.5 File attachment.
6.6 Uploading and downloading file(s) and software(s)
6.7 Explain some advance features over the internet and search engines
6.8 Difference between Internet, Intranet and Extranet

Recommended Textbooks:

1. Bible Microsoft Office 2016 by John Walkenbach
2. Bible Microsoft Excel 2016 by John Walkenbach
3. Bible Microsoft PowerPoint 2016 by John Walkenbach

COMP-152 **COMPUTER APPLICATIONS**

Instructional Objectives:

1. **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. Generations of Computers
   - 1.4. Explain Block diagram of a computer system
   - 1.5. State the terms such as BIT, Byte, RAM & ROM
   - 1.6. Identify Input & Output devices
   - 1.7. Describe Secondary Storage devices
   - 1.8. Explain types of Software
   - 1.9. Introduction to Programming Language
   - 1.10. Explain Applications of computer in different fields
   - 1.11. Application in Engineering, Education & Business
2. **UNDERSTAND MS-WINDOWS 10**
   - 2.1 Explain Introduction to Windows
   - 2.2 How to install Drivers in Windows
   - 2.3 Describe Loading & Shut down process
   - 2.4 Explain Introduction to Desktop items (Creation of Icons, Shortcut, Folder & modify Taskbar)
   - 2.5 Explain Desktop properties
   - 2.6 Describe use of Control Panel (add/remove program, time & date, mouse and create user account)
   - 2.7 Explain the method of searching for a document
3. **UNDERSTAND MS-OFFICE (MS-WORD – 2016)**
   - 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
4. **UNDERSTAND MS-OFFICE (MS-EXCEL- 2016)**
   - 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 detail the types of charts e.g. pie chart, bar chart

5. UNDERSTAND MS-OFFICE (MS-POWER POINT-2016)

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

6. 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
6.4 Interpret Drop Box / Online/ Sky drive/ Cloud data etc.
6.5 File attachment.
6.6 Uploading and downloading file(s) and software(s)
6.7 Explain some advanced features over the internet and how to search topics on different search engines
6.8 Enlist the Difference between Internet, Intranet and Extranet

COMP-152 COMPUTER APPLICATIONS

List of Practicals:

1. **Identify keyboard, mouse, CPU, disk drives, disks, monitor, and printer**
2. **MS WINDOWS 10**
   - 2.1 Practice of loading and shutdown of operating system
   - 2.2 How to install Drivers in Windows
   - 2.3 Creating items (icons, shortcuts, folders etc.) and modifying taskbar
   - 2.4 Changing wallpaper, screensaver, and resolution
   - 2.5 Practice of control panel items (add/remove, time and date, mouse, and create user account)
3. **MS OFFICE (MS-WORD 2016)**
   - 3.1 Identifying the MS Word Screen and its menu
   - 3.2 Practice creating 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 2016)**
   - 4.1 Identifying the MS EXCEL Screen and its menu
   - 4.2 Practice creating 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 number04
   - 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 2016)**
   - 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**
   - 6.1 Identifying internet explorer
   - 6.2 Practice searching data from any search engine
   - 6.3 Practice of create an E-Mail account and how to send and receive mails, download attachments
   - 6.4 File attachment.
   - 6.5 Uploading and downloading file(s) and software(s)

AM-112 BASIC ENGINEERING DRAWING

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

Pre-requisite: N/A

LEARNING OUTCOMES:

At the end of this course the students will be able to understand:

1. Fundamentals of Engineering Drawing used in the various fields of industry, especially in the Auto and Farm Machinery.
2. Familiarize with the use of conventional drawing equipment as well as the modern techniques used for this subject.

Detail of Contents:

1 Application of Technical Drawing 2 Hours

1.1 Importance of Technical Drawing
1.2 Language of Engineering Terminology
1.3 Uses of Technical Drawing
1.4 Types of Drawing
1.5 Application of Technical Drawing.

2 Drafting Equipment 3 Hours

2.1 Introduction and importance of drafting equipment
2.2 List of drawing equipment
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 2 Hours

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 3 Hours

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 2 Hours

5.1 Geometry, plane and solid type
5.2 Definition of terms (Check Saad and Tahir)
5.3 Different conventional shapes, surfaces and objects
5.4 Basic geometrical construction

6 Engineering Curves 3 Hours

6.1 Introduction to the curve
6.2 Application of engineering curves
6.3 Cone and conic section
6.4 Spiral and Involutes
6.5 Cycloid, Epicycloids, Hypocycloid

7 Introduction to multi-view drawings 6 Hours

7.1 plane and its types
7.2 Dihedral and Trihedral angles
7.3 Projection of point, lines, plane and solids
7.4 multi-view drawings
7.5 Perceptual views of plan of projections
7.6 Orthographic projections
7.7 1st angle and 3rd angle projection
7.8 Principal views and its arrangements
7.9 Multi-view drawings and missing lines

8 Pictorial drawing 5 Hours

8.1 Uses of pictorial/3D
8.2 Three types of pictorial views
8.3 Isometric sketching of rectangular block with Arcs and circles
8.4 Oblique sketching of rectangular block
8.5 One-point perspective sketching of rectangular block
8.6 Two points perspective sketching of rectangular block
8.7 Preparation of pictorial drawings of simple objects

9 Basic Dimensioning 3 Hours

9.1 Definition of dimensioning
9.2 Types of dimensioning
9.3 Elements of dimensioning
9.4 System of measurements
9.5 Dimensioning of multi view drawing
9.6 Dimensioning pictorial views
9.7 Dimensioning rules and practices
9.8 Note & specification.

10 Development of Orthographic Projections 3 Hours

10.1 Introduction to surface development
10.2 Methods to develop the surfaces
10.3 Application of Orthographic Projections in Packaging Industry
10.4 Geometrical solids and development

Recommended Textbooks:

1. Mechanical Drawing (12th Addition) by French. Svensen, Helsel and Urbanick
2. Drafting Fundamentals by scot. Foy, Schwendan
3. Engineering Drawing and Design 2nd addition by Cecil Jenson / Jay Helsel
4. Engineer Drawing by M.B. Shah (B.C. Rana)

AM-112 BASIC ENGINEERING DRAWING

Instructional Objectives:

1 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
1.5 Recognize the different applications of technical drawing

2 Know and use the common Drafting equipment and accessories

2.1 Explain the introduction and importance of drafting equipment
2.2 Identify the different instruments used in drafting
2.3 Describe the construction, use and care of all equipment
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

3 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 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

4 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

5 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

6 Know and draw the different Engineering Curves used in various mechanisms

6.1 Describe the different engineering curves
6.2 Describe the application of different Engineering curves
6.3 Define cone and conic sections
6.3.1 Describe the Ellipse, Parabola & Hyperbola by different methods
6.4 Define the Archimedean Spiral and Involutes
6.4.1 Define the Involutes curves of square, Triangle, Circle and Hexagon
6.5 Describe the Cycloid curves
6.5.1 Define Cycloid, Epicycloids and Hypocycloid curves

7 Understand the multi-view projections of specific object

7.1 Describe the plane and its types
7.2 Define Dihedral and Trihedral angles
7.3 Explain the projection of point, lines, plane and solids in different shapes
7.4 Define the concept of multi-view drawings
7.5 Know the Plane of projections
7.6 Know the orthographic method of projection
7.7 Explain the 1st and 3rd angle projections
7.8 State six principal views
7.9 Practice of multi-view projections and missing lines

8 Apply the use, types and methods of pictorial views

8.1 Describe the importance of pictorial views
8.2 State three types of pictorial drawings
8.3 Describe isometric view of rectangular blocks, arcs, circles
8.4 Describe oblique sketching of a rectangular block
8.5 Describe one-point perceptive view of rectangular block
8.6 Describe two-point perspective view of a rectangular block
8.7 Prepare/draw pictorial drawings of simple objects

9 Apply good dimensioning on multi-view and pictorial drawings

9.1 Define dimensioning

9.2 Identify the types of dimensioning
9.3 Enlist the elements of dimensioning
9.4 Identify the system of measurements
9.5 Indicate complete dimension on multi-view drawings
9.6 Indicate complete dimension on pictorial drawings
9.7 Follow the general rules of dimensioning
9.8 Indicate notes and specifications or multi-view drawings

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

10.1 Define the surface development
10.2 Describe the methods to draw the development
  10.2.1 Parallel line or Rectangle method
  10.2.2 Radial line or Triangle method
  10.2.3 Triangulation method
10.3 Explain the role of development in Packaging Industry
10.4 Define and draw the different Geometrical solids and their development

AM-112 BASIC ENGINEERING DRAWING

List of Practical:

1. Practice of single stroke capital vertical & inclined lettering
2. Practice of double stroke lettering
3. Use of tee-square and set squares for drawing horizontal, vertical and inclined lines
4. Use of compass, circles, half circles, radius
5. Draw different types of drawing lines
6. Construction of angles and triangles
7. Construction of quadrilaterals and circles elements
8. Draw of inscribe and circumscribe figures (square, triangle and hexagon)
9. Construction of pentagon by different methods
10. Draw of hexagon, Octagon by general and different methods
11. Construction of ellipse by four different methods
12. Construction of parabola curve by four different methods
13. Draw of hyperbola curve
14. Construction of Archimedean Spiral curve
15. Draw of involutes curve of square rectangle hexagon and circle
16. Construction of cycloid, epicycloids, and hypocycloid
17. Practice orthographic projection 1st and 3rd angle wooden block-1
18. Practice orthographic projection 1st and 3rd angle wooden block-2
19. Practice orthographic projection 1st and 3rd angle wooden block-3
20. Practice orthographic projection and Isometric Drawing
21. Practice orthographic projection and Oblique Drawing
22. Construct perspective drawings (One point, Two Point, Three Point)
23. Construct multi view drawing of Gland
24. Construct multi view drawing of Simple Bearing
25. Construct multi view drawing of Open Bearing
26. Missing lines and portions on given views
27. Development of prism
28. Development of cylinder
29. Development of cone
30. Development of pyramid
31. Reading of various complex Drawings
32. Replicate Industrial Drawings

AM-123 INTERNAL COMBUSTION (I.C) ENGINE

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

Pre-requisite: None

LEARNING OUTCOMES:

1. Understand the working principles of petrol and diesel engines.
2. Understand the construction and working of engine systems.
3. Understand the systems based upon pressure and volume
4. Recognize the importance of proper relationship between different parts and components.
6. Identify main parts of petrol and diesel engine
7. Know different types of IC engines
9. Compare between petrol and diesel engine

Detail of Contents:

ENGINE HISTRORY/CONSTRUCTION AND FUNDAMENTALS.

1. History and development of automobile. **2 Hours**

1.1 History & development of Automobile (Conventional, Hybrid & Electric Vehicle).

1.2 History & development of an engine (Petrol Engine, Diesel Engine & Hydrogen 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, advance materials, construction and working of following engine parts.

3.1.1. Piston, Piston rings, Piston pin, piston pin locks.

3.1.2. Connecting rod.

3.1.3. Crankshaft.

3.1.4. Vibration Damper

3.1.5. Fly Wheel

3.1.6. Cylinder Block, Cylinder, Cylinder Liner and its characteristics.

3.1.7. Camshaft.

3.1.8. Engine Valve
3.1.9. Rocker arm
3.1.10. Cylinder Head.
3.1.11. Combustion chamber.
3.1.12. Gaskets.
3.1.13. Timing Gears
3.1.14. Timing belt.

4. IC engine fundamentals and operations. 6 Hours

4.1 Terminology of IC Engine.
- 4.1.1 Bore & Stroke.
- 4.1.2 TDC & BDC.
- 4.1.3 Clearance Volume.
- 4.1.4 Swept /Displacement Volume.
- 4.1.5 Cylinder total Volume.

4.2 Working Principle of
- 4.2.1 4-Stroke Petrol Engine.
- 4.2.2 2-Stroke Petrol Engine.
- 4.2.3 4-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).

5.9 CVVT-I continuous variable valve timing intelligent system

5.10 i.VTech intelligent variable valve timing system.

5.11 CVVD continuous variable valve duration

6. Classifications of engines. **6 Hours**

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

6.1.1 Fuel
6.1.2 Strokes.
6.1.3 Ignition.
6.1.4 Cylinder arrangements.
6.1.5 No of Cylinders.
6.1.6 Valve arrangements.
6.1.7 Camshaft arrangements.
6.1.8 Cooling systems.
6.1.9 Lubrication systems.
6.1.10 Engine capacity.
6.1.11 Combustion chambers.
6.1.12 Introduction and lay-out of main components Electric Vehicle.
6.1.13 Introduction of Hydrogen power engine.

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.

ENGINE SYSTEMS.

8. Engine intake system. **2 Hours**

8.1 Function, and modern features of intake system.
8.2 Function of air cleaner.
8.3 Parts of intake system.
8.4 Introduction of sensors installed in intake system.

9. Engine exhaust system. **2 Hours**

9.1 Purpose Describe the construction of exhaust system.
9.2 Parts of engine exhaust system.
9.3 Introduction of electronic type muffler.

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, ECU controlled 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 filter types, 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.

11.8 Introduction about oil changing intervals.

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.

12.7 Introduction of EFI System.

13. Working of petrol engine ignition system. 4 Hours

13.1 Introduction, construction & working of electronic type ignition system.

13.2 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.

14.6 Working principle of carburetor system.

14.7 Main components of Carburetor.

14.8 Procedure & steps involved for disassemble & assembled of Motorcycle carburetor

14.9 Introduction of E.Bike.

Recommended Textbooks:

1. Auto fundamentals by Martin W. Stockal
2. Modern Automotive Technology (10th edition) by James E. Duffy.
3. Automotive Technology A System Approach by Jack Erjavec

AM-123 INTERNAL COMBUSTION (I.C) ENGINES

Instructional Objectives:

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

ENGINE HISTRORY/CONSTRUCTION AND FUNDAMENTALS.

1. Know the history and development of automobile.

1.1 Describe the History & development of Automobile (Conventional, Hybrid & Electric Vehicle).

1.2 History & development of an engine (Petrol Engine, Diesel Engine & Hydrogen engine).

2. 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).

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

3.1 Function, types, advance materials, construction and working of following engine parts.

3.1.1 Piston, Piston rings, Piston pin, piston pin locks.
3.1.2 Connecting rod.
3.1.3 Crankshaft.
3.1.4 Vibration Damper
3.1.5 Fly Wheel
3.1.6 Cylinder Block, Cylinder, Cylinder Liner and its characteristics.
3.1.7 Camshaft.
3.1.8 Engine Valve
3.1.9 Rocker arm
3.1.10 Cylinder Head.
3.1.11 Combustion chamber.
3.1.12 Gaskets.
3.1.13 Timing Gears
3.1.14 Timing belt.

4. Understand the IC engine fundamentals and operations.

4.1 Define the following terminology of IC Engine.

4.1.1 Bore & Stroke.
4.1.2 TDC & BDC.
4.1.3 Clearance Volume.
4.1.4 Swept /Displacement Volume.
4.1.5 Cylinder total Volume.

4.2 Explain the working Principle of

4.2.1 4-Stroke Petrol Engine.
4.2.2 2-Stroke Petrol Engine.
4.2.3 4-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.

5. 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).

5.9 Describe CVVT-I continuous variable valve timing intelligent system

5.10 Describe i.VTech intelligent variable valve timing system.

5.11 Describe CVVD continuous variable valve duration

6. Understand the classifications of engines.

6.1 Describe the Classifications/types of IC engines w.r.t.

6.1.1 Fuel
6.1.2 Strokes.
6.1.3 Ignition.
6.1.4 Cylinder arrangements.
6.1.5 No of Cylinders.
6.1.6 Valve arrangements.
6.1.7 Camshaft arrangements.
6.1.8 Cooling systems.
6.1.9 Lubrication systems.
6.1.10 Engine capacity.
6.1.11 Combustion chambers.
6.1.12 Introduction and lay-out of main components Electric Vehicle.
6.1.13 Introduction of Hydrogen power engine.

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.

7. Understand the engine bearings.

7.1 State the purpose of bearings.

7.2 Enlist the types of bearing and their use in vehicles.

ENGINE SYSTEMS.

8. Understand the working of an engine intake system.

8.1 State the function, and modern features of intake system.

8.2 State the function of Air Cleaner.

8.3 Enlist the parts of the intake system.

8.4 Explain the working of each part of the inlet system.

8.5 Introduction of sensors installed in intake system.

9. Understand the working of engine exhaust system.

9.1 State the purpose and describe the construction & working of each component of engine exhaust system.

9.2 Enlist the parts of the engine exhaust system.

9.3 Introduction of electronic type muffler.

10. 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, ECU controlled 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).

10.5 Describe Causes and remedies of Engine Cooling System Faults.

11. 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 filter types, 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.

11.8 Introduction about oil changing intervals.

12. 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 & adjustment of Carburetor.

12.5 Procedure and steps involved for disassemble and assemble motorcycle engine carburetor

12.6 Describe the steps for the adjustment of carburetor float level.

12.7 Introduction of EFI System

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

13.1 Introduction, construction & working of electronic type ignition system.

13.2 Describe Causes and remedies of Engine Ignition System Faults.

14. 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.

14.6 Working principle of carburetor system.

14.7 Main components of Carburetor.

14.8 Procedure & steps involved for disassemble & assembled of Motorcycle carburetor.

14.9 Introduction of E.Bike

AM-123 INTERNAL COMBUSTION ENGINES

List of Practical's:

1. Identify the main components of vehicle and sketch them.
2. Identify the main components of engine and sketch them.
3. Measure the size of piston, piston pin, crank shaft main journal by using Vernier caliper and Micrometer.
4. Identify the parts of crankshaft & camshaft and sketch them.
5. Disassemble & assemble the cam shaft and crankshaft on engine block.
6. Measure the Swept Volume of given engine cylinder.
7. Disassemble and inspect the valves face and valve seat.
8. Perform the engine valve lapping and reassemble it.
9. Identity the components of VVT-I, I-Vtech, CVVD systems.
10. Check and adjust the engine valve clearance.
11. Practice to change the engine Oil.
12. Identify the location of different bearings in engine.
13. Identify the engine cylinder liners.
14. Identify the intake and exhaust system parts and their location.
15. Identify the main components of engine cooling system and sketch them.
16. Identify the main components of engine lubricating system and sketch them.
17. Identify the main components of the engine ignition system and sketch them.
18. Carry out the complete overhauling of a 4-stroke Motorcycle engine.
19. Carry out the service/tune-up of E-bike.
20. Visit at Modern Automotive workshop to familiarize with the working environment of Auto workshop and prepare a report.

AM-134 AUTOMOTIVE ELECTRICITY & ELECTRONICS

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

Pre-requisite: Applied Physics

LEARNING OUTCOMES:

1. Know the basic principles of electricity and electronics
2. Recognize the different electrical units of an automobile
3. Repair and maintain the electrical and electronics units fitted on an automobile
4. Service, repair and maintain all types of batteries
5. Trace and rectify faults in the electrical system of an automobile
6. Understand wiring diagrams of various makes of automobiles
7. Understand electronics devices, transistors, rectifiers, amplifiers, S.C.R; S.C.O; sensors and microprocessors.
8. Know the purpose of modern types of 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, OHM's law, Capacitance.
- 1.5 Series and Parallel circuits and their characteristics.
- 1.6 Faults of series and parallel circuits using OHM's Law
- 1.7 Use of Multi meter.
- 1.8 Value of resistance with the help of Color code.
- 1.9 Electrical and 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 semiconductor materials.
- 2.7 Working of different types of diode & transistor.

3. Storage battery its working and testing. **5 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 Construction & working principal of Lithium-ion battery

4. Troubleshooting of batteries. **4 Hours**

4.1 Factors affecting battery life.
4.2 Discharging, sulphation, internal short circuiting.
4.3 Overcharging, causes of loss of water, discoloring of Electrolyte and specific gravity variation.
4.4 Charging system of battery in vehicle.
4.5 Battery charging methods (series & parallel).

5. Charging system AC & DC. **5 Hours**

5.1 Charging system
5.2 Construction & working of DC Generator
5.3 Construction and working of Alternator
5.4 Charging circuit of Alternator.
5.5 Half-wave and full-wave Rectifier.
5.6 DC and AC Generator
5.7 Construction &working principle of cut out Relay.
5.8 Voltage and current Regulator.
5.9 Trouble shooting of DC & AC Generator

6. CB Point and Magneto ignition system. **4 Hours**

6.1 Purpose, function of ignition system.
6.2 Construction, types, heat ranges of spark plug.
6.3 Magneto ignition system.
6.4 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:
7.4.1 Pick -up Coil type.

7.4.2 Hall Effect ignition system.
7.4.3 Distributer less ignition system (DIS)
7.4.4 Coil on Plug ignition system (i-DSI)
7.4.5 CDl system
7.4.6 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 type of starting motors.
8.6 Construction and working of modern modes of starting system i.e. push button starting, electronic remote starting.
8.7 Gear reduction Drive
8.8 Construction and working of Solenoid switch
8.9 Starting circuit diagram.
8.10 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.

10. Construction & working of horn, windshield wiper & washer. 4 Hours

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.

11. Working of instrument panel gauges, meters, & warning lights. 3 Hours

11.1 Circuit and working of fuel gauge.
11.2 Circuit and Working of Engine temperature gauge.
11.3 Circuit and Working of Engine Cooling system Electric Fan.
11.4 Circuit and Working of Engine oil pressure Light and Gauge.
11.5 Different warning lights.
- 11.5.1 Low oil pressure light.
- 11.5.2 Charging system light.
- 11.5.3 Engine Malfunction Light (MIL)
- 11.5.4 Gear Selected indicator Light

11.6 Purpose of following dash board meters.
- 11.6.1 Digital Speedo meter.
- 11.6.2 Odometer
- 11.6.3 Tachometer.

BASIC ELECTRONICS

12 Transistor, thermistors, thyristors and their applications. 4 Hours

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.

13 Logic gates / integrated circuit. 3 Hours

13.1 Electronic Logic Gates. (AND, OR, NOT, NAND, NOR)
13.2 Printed circuit and integrated circuit (IC).

14 Different types of sensors in automotive. 3 Hours

14.1 Sensor and its importance in automotive
14.2 Types of sensors.

- 14.2.1 Voltage generating sensor
- 14.2.2 Zirconium dioxide sensors
- 14.2.3 Piezoelectric sensors
- 14.2.4 Magnetic sensors.
- 14.2.5 Reference voltage sensor
  - 14.2.5.1 Potentiometers.
  - 14.2.5.2 Switches.
  - 14.2.5.3 Thermistors

15 Microcomputers. 3 Hours

15.1 Micro Computers.

15.2 Components of Microcomputers.

- 15.2.1 Microprocessor
- 15.2.2 Programmable Read Only Memory (PROM)
- 15.2.3 Keep alive memory
- 15.2.4 Electronically Erasable PROMES (EEPROMS)
- 15.2.5 Input Device.
- 15.2.6 Output Device.

15.3 Operation of a Microcomputer

16 Automotive accessories. 4 Hours

Circuit and function of Vehicle accessories:

16.1 Vehicle immobilizer system.
16.2 Vehicle navigation system.
16.3 Vehicle communication system.
16.4 Vehicle tracking system.
16.5 Power window system.
16.6 Night vision mode.
16.7 Climate control system.
16.8 Key less entry system
16.9 Cigarette lighter.
16.10 Central locking door system.
16.11 Power side mirror.
16.12 Vehicle rear camera.
16.13 Child door lock system.
16.14 Rear screen defogger.
16.15 Glass embedded point antenna
16.16 Door suction system.
16.17 Supplementary restrain system (SRS).
16.18 Heated rear window system.
16.19 Auto light control system (Head lights turn on automatically according to the level of darkness)
16.20 Vehicle 360-degree view camera system.
16.21 Vehicle side view mirror camera.
16.22 Dash-cam

Recommended Textbooks:

1. Automotive Electrical and Electronic systems by Frank C. Derato,1986
2. Automotive Electricity & Electronics by Barry Hollembeak, 2002
3. Automotive Electricity, Electronics & Computer Controls by Barry Hollembeak, 1999
4. Automotive Electricity & Electronics by James E. Duffy.

AM-134 AUTOMOTIVE ELECTRICITY & ELECTRONICS

Instructional Objectives:

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

BASIC ELECTRICITY

1. 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 faults of series and parallel circuits using OHM's Law
1.7 Describe the use of multimeters.
1.8 Describe the value of resistance with the help of Color code.
1.9 Enlist all electrical and electronic symbols used in vehicle electrical circuits.

2. 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 semiconductor materials.
2.7 Describe the construction and working of different types of diode & transistor.

3. 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 working and construction of lithium-ion batteries.

4. Understand the troubleshooting of batteries

4.1 Describe the Factors affecting battery life.
4.2 Define self-discharging, sulphation, internal short circuiting.
4.3 Discuss the overcharging, causes of loss of water, discoloring of Electrolyte, plates and specific gravity variation.

4.4 Describe the charging system of battery in vehicle.
4.5 State the battery charging methods. (Series & parallel).

5. Understand charging system AC & DC.

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

6. Understand CB Point and Magneto ignition system.

6.1 Explain the purpose, function of ignition system.
6.2 Describe the construction, types, and heat ranges of spark plug.
6.3 Explain the construction & working of magneto ignition system.
6.4 Discuss the trouble shooting of ignition system.

7. 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
- 7.4.1 Pick -up Coil type.
- 7.4.2 Hall Effect ignition system.
- 7.4.3 Distributer less ignition system (DIS)
- 7.4.4 Coil on plug (Cop) ignition system
- 7.4.5 Capacitor discharge ignition (CDl) system
- 7.4.6 Intelligent dual sequential ignition system.

8. Understand the starting system.

8.1 Define starting system.
8.2 Explain the construction and working of the 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 type of starting motors.
8.6 Describe the construction and working of modern modes of starting system i.e. push button starting, electronic remote starting.
8.7 Describe the working gear reduction drive.
8.8 Explain the construction and working of Solenoid switch
8.9 Draw the starting circuit diagram.
8.10 Identify the faults of Starting system.

9. 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.

10. 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.

11. **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.
  - 11.5.1 Low oil pressure light.
  - 11.5.2 Charging system light.
  - 11.5.3 Engine Malfunction Light (MIL)
  - 11.5.4 Gear Selected indicator Light
- 11.6 State the Purpose of following dash board meters.
  - 11.6.1 Digital Speedo meter.
  - 11.6.2 Odometer
  - 11.6.3 Tachometer.

BASIC ELECTRONICS

12 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.

13 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.

14.2.1 Voltage generating sensors

14.2.2 Zirconium dioxide sensors

14.2.3 Piezoelectric sensors

14.2.4 Magnetic sensors.

14.2.5 Reference voltage sensor

14.2.5.1 Potentiometers

14.2.5.2 Switches.

14.2.5.3 Thermistors

15 Understand microcomputers.

15.1 Define Micro Computers.

15.2 State the function of following components of Miro computer.

15.2.1 Microprocessor

15.2.2 Programmable Read Only Memory (PROM)

15.2.3 Keep alive memory

15.2.4 Electronically Erasable PROMES (EEPROMS)

15.2.5 Input Device.

15.2.6 Output Device.

15.3 Describe briefly the operation of a Microcomputer.

16 Understand Automotive Accessories.

Describe the working with circuit diagram of the following vehicle accessories:

16.1 Vehicle immobilizer system.

16.2 Vehicle navigation system.

16.3 Vehicle communication system.

16.4 Vehicle tracking system.

16.5 Power window system.

16.6 Night vision mode.

16.7 Climate control system.

16.8 Key less entry system

16.9 Cigarette lighter.

16.10 Central locking door system.
16.11 Power side mirror.
16.12 Vehicle rear camera.
16.13 Child door lock system.
16.14 Rear screen defogger.
16.15 Glass embedded point antenna
16.16 Door suction system.
16.17 Supplementary restrain system (SRS).
16.18 Heated rear window system.
16.19 Auto light control system (Head lights turn on automatically according to the level of darkness)
16.20 Vehicle 360-degree view camera system.
16.21 Vehicle side view mirror camera.
16.22 Dash-cam

AM-134 AUTOMOTIVE ELECTRICITY AND ELECTRONICS

List of Practicals:

1. Identify the complete electrical units on a vehicle.
2. Make an electromagnet (Solenoid).
3. Verify OHM'S Law using a multimeter.
4. Make series, parallel and combination circuits on bench board and verify the properties of circuits using a multimeter.
5. Disassemble unserviceable lead acid battery and identify its parts.
6. Prepare an electrolyte for lead acid battery and check its specific gravity using a hydrometer.
7. Charge the batteries in a series and parallel using a battery charger.
8. Service the lead acid battery.
9. Identify the problems of ignition system.
10. Check the ignition coil (i) Resistance (ii) Ground Test
11. Check the Pick-up coil (i) Resistance (ii) Ground Test
12. Identify the Problems of Charging System.
13. Disassemble, assemble and diagnose the faults of vehicle starting motor assembly (i) Open circuit (ii) Short Circuit (iii) Ground circuit
14. Disassemble and assemble of DC Generator.
15. Disassemble, assemble and diagnose the faults of vehicle alternator assembly (i) Open circuit (ii) Short Circuit (iii) Ground circuit
16. Adjust the Head Light aiming.
17. Make the Horn Circuit on a Bench board.
18. Make the Head Light Circuit on a Bench board.
19. Identify the sensors, actuators and Microcomputer on Vehicle
20. Visit to a modern automotive workshop to familiarize on how modern electronic
21. Diagnostic equipment is being used to find out the faults of vehicle electronic systems.
22. Program the ignition key of vehicle immobilizer system using automotive scanner.
23. Operate the vehicle navigation system live on vehicle.
24. Identify the parts of the vehicle communication system.
25. Operate the vehicle tracking system live on vehicle.
26. Diagnose and rectify the malfunction of vehicle power window system.

27. Operate the vehicle night vision mode live on vehicle.
28. Diagnose and rectify the faults of vehicle climate control system.
29. Diagnose and rectify the faults of Key less entry system of a vehicle.
30. Diagnose and rectify the faults of cigarette lighter on a vehicle.
31. Diagnose and rectify the faults of the Central locking door system.
32. Diagnose and rectify the faults of the power side mirror.
33. Diagnose and rectify the faults of vehicle rear camera.
34. Diagnose and rectify the faults of vehicle dash camera and side mirror cameras.
35. Indicate and resolve the faults of child door lock system.
36. Diagnose and rectify the faults of Rear screen defogger.
37. Diagnose and rectify the faults of glass embedded point antenna.
38. Diagnose and rectify the faults of door suction system.
39. Diagnose and rectify the faults of Supplementary restrain system (SRS)
40. Diagnose and rectify the faults of the heated rear window system.
41. Diagnose and rectify the faults of auto light control system.

AM-141 OCCUPATIONAL HEALTH & SAFETY ENVIRONMENT

Total Contact Hours		**T**	**P**	**C**
Theory	**32**	**1**	**0**	**1**
Practical	**0**			

Pre-requisite: None

LEARNING OUTCOMES:

1. Describe the importance of safety.
2. State safety rules.
3. Explain safety procedures in the workshop.
4. Explain safety procedures in Industries.
5. Identify hazards in shops / industries.
6. State the cost of accidents.
7. State the rules in maintaining cleanliness and order lines of working area.

Details of Contents:

1 **Introduction and importance of safety.** 2 Hours

- 1.1 Introduction
- 1.2 Importance of institute shops
- 1.3 Importance in Industry
- 1.4 Accident cost

2 **Personal protective equipment** 3 Hours

- 2.1 What is PPE
- 2.2 Types of PPEs
- 2.3 Description and detail of PPEs usage
- 2.4 Safety Equipment at Plant Site
- 2.5 Safety Suit Purpose & Usage
- 2.6 Fire Suppression System

3 **Application and importance of personal protective equipment** 3 Hours

- 3.1 Protective equipment
- 3.2 List of personal protective equipment
- 3.3 Importance of personal protective equipment
- 3.4 Protective equipment for protecting hands and faces
- 3.5 Protective equipment for protecting the human body
- 3.6 Protective equipment for protection from chemical gases

4 **Employees training and certifications** 4 Hours

- 4.1 Training of employees
- 4.2 Importance of training.
- 4.3 Introduction to international safety courses and certifications

4.3.1 OSHA 10-Hour (for entry-level workers)
4.3.2 OSHA 30-Hour (for supervisors and engineers)
4.3.3 IOSH (Institution of Occupational Safety and Health)
4.3.4 ISO 45001:2018 – Occupational Health and Safety Management Systems
4.3.5 Certified Industrial Hygienist (CIH)
4.3.6 Certified Safety Professional (CSP)
4.3.7 NEBOSH (National Examination Board in Occupational Safety and Health)

4.4 What is Permit to work?

5 **Accident investigation record and report** 2 Hours

5.1 Accident Investigation terminology and record keeping.
5.2 Sample of Incident Report
5.3 Six Significant Disasters

6 **Industrial noise and control** 1 Hour

6.1 Introduction to industrial noise and control.

7 **Accidents in the mechanical industry.** 2 Hours

7.1 Material handling and transportation.
7.2 Accidents due to hand tools.
7.3 Accidents in machines shop.
7.4 Accidents in Metal work shop.
7.5 Accidents in wood working shop.
7.6 Accident in Foundry, welding, and forging shop.
7.7 Preventive measures

8 **Accidents in production industry**. 2 Hours

8.1 Accidents in the automotive industry
8.2 Accidents in Fast Moving Consumable Goods (FMCG) industry.

9 **Accidents in the chemical industry** 1 Hour

9.1 Accidents in petroleum industry
9.2 Accidents in paint shop/industry
9.3 Explosive vapors and gases
9.4 Accidents in other chemical industry

10 **Accidents in other industries.** 1 Hours

10.1 Accidents in mines.
10.2 Accidents in power plant.

11 **Analyzing causes of accidents.** 2 Hours

11.1 Accident prevention fundamentals.
11.2 Plan inspections.
11.3 Safety inventory.
11.4 Accidents investigation.
11.5 Records and reports.

12 **Environmental effect on accidents.** 1 Hour

12.1 Industrial ventilation.
12.2 Exhaust systems.
12.3 Illumination for safety and comfort.
12.4 Industrial hygiene and plant sanitation.

13 **Safety on plant.** 1 Hour

13.1 Plant lay out for safety.
13.2 Housekeeping for safety

14 **Fire incidents** 2 Hours

14.1 Fire hazard.
14.2 Types of fires and their respective fire extinguishers
14.3 Causes.
14.4 Firefighting equipment.
14.5 Plant lay out for fire safety.

15 **First aid**. 2 Hours

15.1 Importance.
15.2 Procedure.
15.3 Extended medical services and CPR training.

16 **Promoting safety.** 2 Hours

16.1 Employees training.
16.2 Display of safety signs.
16.3 Guidance.

17 **Safety laws.** 1 Hour

17.1 Pakistan factory act (laws concerning to safety).
17.2 Workman compensation act.
17.3 Industrial insurance.

Recommended Textbooks:

1. Heinrich, H. W. (Herbert William), 1886-1962. Industrial Accident Prevention; a Scientific Approach. New York ; London :McGraw-Hill book company, inc., 2007.

2. The Occupational Environment Its Evaluation and Control. 2nd Ed. Dinardi, Salvatore. Fairfax, VA: American Industrial Hygiene Association, 2003.
3. Fundamentals of Industrial Hygiene. 5th Ed. Plog, Barbara and Patricia Quinlain. Chicago, IL: National Safety Council, 2001.

AM-141 Occupational Health & Safety Environment (OHSE)

Instructional Objectives:

1 Know the 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

2 Personal protective equipment

2.1 What is PPE
2.2 Explain the types of PPEs
2.3 Explain the description and detail of PPEs usage
2.4 Explain the Safety Equipment at Plant Site
2.5 Explain the Safety Suit Purpose & Usage
2.6 Explain the Fire Suppression System

3 Application and importance of personal protective equipment

3.1 Define Protective equipment
3.2 Explain the List personal protective equipment
3.3 Explain Importance of personal protective equipment
3.4 Describe Protective equipment for protecting hands and faces
3.5 Describe Protective equipment for protecting the human body
3.6 Protective equipment for protection from chemical gases

4 Employees training and certifications

4.1 Define Training of employees
4.2 Explain the Importance of training
4.3 Describe the Introduction to International Safety courses and certifications
- 4.3.1 OSHA 10-Hour (for entry-level workers)
- 4.3.2 OSHA 30-Hour (for supervisors and engineers)
- 4.3.3 IOSH (Institution of Occupational Safety and Health)
- 4.3.4 ISO 45001:2018 – Occupational Health and Safety Management Systems
- 4.3.5 Certified Industrial Hygienist (CIH)
- 4.3.6 Certified Safety Professional (CSP)
- 4.3.7 NEBOSH (National Examination Board in Occupational Safety and Health)

4.4 Explain what is Permit to work?

5 Accident investigation record and report

5.1 Describe the Accident Investigation terminology and record keeping.
5.2 Explain the Sample of Incident Report
5.3 Explain the Six Significant Disasters

6 Industrial noise and control

6.1 Describe the Industrial noise and control.

7 Accidents in mechanical industry

7.1 State Material handling and transportation.
7.2 Explain the Accidents due to hand tools.
7.3 Explain the Accidents in machines shop.
7.4 Explain the Accidents in Metal work shop.
7.5 Explain the Accidents in wood working shop.
7.6 Explain the Accident in Foundry, welding, and forging shop.
7.7 Explain the Preventive measures

8 Accidents in flow production industry

8.1 Explain the Accidents in the automotive industry.
8.2 Explain the Accidents in Fast Moving Consumable Goods (FMCG) industry

9 Accidents in the chemical industry

9.1 Explain the Accidents in petroleum industry
9.2 Explain the Accidents in paint shop/industry
9.3 Explain the Explosive vapors and gases
9.4 Explain the Accidents in other chemical industry

10 Accidents in other industries

10.1 Explain the Accidents in mines.
10.2 Explain the Accidents in power plant.

11 Analyzing causes of accidents.

11.1 Explain the Accident prevention fundamentals.
11.2 Explain Plan inspections.
11.3 Explain Safety inventory.
11.4 Explain Accidents investigation.
11.5 Explain Records and reports.

12 Environmental effects on accidents

12.1 Explain the Industrial ventilation.
12.2 Explain the Exhaust systems.
12.3 Explain the Illumination for safety and comfort.
12.4 Explain the Industrial hygiene and plant sanitation

13 Safety on plant

13.1 Explain the Plant lay out for safety.
13.2 Explain the Housekeeping for safety.

14 Fire incidents

14.1 Explain the Fire hazard.
14.2 Describe the types of fires and their respective fire extinguishers
14.3 Explain the Causes of Fire.
14.4 State the purpose of firefighting equipment.
14.5 Describe the Plant lay out for fire safety.

15 First aid.

15.1 Explain the Importance of first aid.
15.2 Explain the procedure of first aid.
15.3 State the purpose of extended medical services and CPR training.

16 Promoting safety

16.1 Explain the Employees training.
16.2 Explain Displays of safety related text/ banners.
16.3 Explain the Guidance.

17 Safety laws

17.1 Explain the Pakistan factory act (laws concerning to safety).
17.2 Explain the Workman compensation act.
17.3 Explain the Industrial insurance.

AM-153 WORKSHOP PRACTICE-I

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

Pre-requisite: None

LEARNING OUTCOMES:

1. Know different basic machines like Drill machine, Grinder, Lathe, and Shaper
2. Understand methods of producing simple jobs on Lathe and Shaper.
3. Explain the shop setting of Metal work, wood work, welding and foundry.
4. State shop rules and regulations of individual shops
5. Explain the use of tools involved in these shops.
6. Identify the main parts of each tool and machine of all these shops.
7. Exercise proper care and maintenance of each tool and machine of Metal work, welding and Foundry.
8. Prepare jobs/projects in all the aforesaid shops

MACHINE SHOP

Details of Contents:

1 Lathe construction **2 Hours**

1.1 Parts of lathe
1.2 Description of each part of lathe
1.3 Types of lathe
1.4 Description of each type of lathe
1.5 Size of lathe
1.6 Accessories, attachments, work holding devices with uses
1.7 Introduction of CNC Lathe machine

2 Lathe cutting tools **1 Hour**

2.1 Types of lathe cutting tools
2.2 Description of each and their angles

3 Cutting speed, feed, and cut **2 Hours**

3.1 Speed and feed
3.2 Method of speed and feed calculation
3.3 Relationship between speed and feed
3.4 Depth of cut

4 Lathe operation and drilling **5 Hours**

4.1 Importance of centering job
4.2 Shoulder turning/ step turning
4.3 Taper Turning
4.4 Knurling
4.5 Purpose of knurling
4.6 Knurling Methods

4.7 Threading
4.8 Pitch and lead
4.9 Thread cutting calculation
4.10 Thread cutting calculation based on system
4.11 Facing and its operation
4.12 Method of drilling and boring on lathe machine

5 Drill press/drilling. 2 Hours

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 and their explanation

6 Tool grinder. 2 Hours

6.1 Parts of grinder
6.2 Grinding operation
6.3 Portable Grinders

7 Shaper work. 2 Hours

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
7.8 Difference between shaper & Planner

METAL SHOP, WELDING PRACTICE AND FOUNDRY

Details of Contents:

8 Metal work tools and machines. 8 Hours

- 8.1 Hand Tools
- 8.2 Measuring tools
- 8.3 Layout tools.
- 8.4 Cutting tools
- 8.5 Chisels
- 8.6 Files
- 8.7 Hacksaw
- 8.8 Drill
- 8.9 Miscellaneous tools
- 8.10 Drilling Machine.
- 8.11 Power Hacksaw
- 8.12 Bending Machine
- 8.13 Rolling Machine
- 8.14 Shearing Machine.

9 Welding. 4 Hours

- 9.1 Gas welding Tools.
- 9.2 Welding processes
- 9.3 Welding tests and equipment
- 9.4 Different types of Arc, Gas, resistance, thermal, solid state, newer Welding.
- 9.5 Welding materials and electrodes

10 Hand forging operations. 2 Hours

- 10.1 Drawing
- 10.2 Swaging
- 10.3 Up-setting
- 10.4 Punching
- 10.5 Cutting.
- 10.6 Forge welding

11 Foundry shop tools and machines 2 Hours

- 11.1 Hand Moulding Tools.
- 11.2 Moulding boxes.
- 11.3 Pit furnace.
- 11.4 Core baking furnace.
- 11.5 Grinding and brushing machines.

Recommended Textbooks:

Chapman Vol-I - Workshop Technology

AM-153 WORKSHOP PRACTICE-I

Instructional Objectives:

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

MACHINE SHOP

1. **Know the 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
   - 1.7. Introduction of CNC Lathe machine

2. **Understand lathe cutting tools.**
   - 2.1. List types of lathe cutting tools
   - 2.2. Explain each type of lathe cutting tool and their angles

3. **Know cutting speed, feed, and cut.**
   - 3.1 Define speed and feed
   - 3.2 Describe method of speed and feed calculation
   - 3.3 Describe the relationship between speed and feed
   - 3.4 Describe depth of cut

4. **Understand lathe operation and drilling.**
   - 4.1. List methods of centering the job
   - 4.2. Explain the 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 of 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

5. 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 and explain parts of a drill

6. Understand tool grinder.

6.1. List parts of grinder
6.2. Explain grinding operation
6.3. Explain portable Grinders

7. 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 of different clamping devices for job and tool
7.8. Explain operations of shaper and planner
7.9.

METAL SHOP, WELDING PRACTICE AND FOUNDRY

Instructional Objectives:

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

8. Understand kinds of tools and machines

8.1. Describe Hand Tools
8.2. Describe the Measuring tools
8.3. Define the Layout tools.
8.4. Explain the Cutting tools
8.5. Explain the Chisels
8.6. Explain the Files

8.7. Explain the Hacksaw
8.8. State the purpose of Drill
8.9. State the Miscellaneous tools
8.10. Explain Drilling Machine.
8.11. Explain Power Hacksaw
8.12. Explain Bending Machine
8.13. Explain Rolling Machine
8.14. Explain Shearing machine.

9. Understand welding shop tools and machines.

9.1. Describe Gas welding Tools.
9.2. Describe welding processes
9.3. Explain Welding tests and equipment
9.4. Describe Welding processes Arc, Gas, resistance, thermal, solid state and newer Welding
9.5. State Welding materials and electrodes

10. Understand forging operations.

10.1. Explain Drawing,
10.2. Describe Swaging
10.3. State Up-setting
10.4. Describe Punching
10.5. State Cutting.
10.6. Explain Forge welding

11. Know kinds of foundry shop tools and machines.

11.1. Describe Hand Moulding Tools.,
11.2. Describe Moulding boxes, moulding sands and moulding methods.
11.3. Describe Pit furnace and types of cores.
11.4. Describe Core baking furnace.
11.5. Describe grinding and brushing machines.

AM-153 WORKSHOP PRACTICE-I

List of Practicals:

A) Machine shop

1. Practice of facing
2. Practice of plain turning
3. Practice of Drilling & Boring
4. Practice of Threading (Internal & External)
5. Practice of Taper Turning

B) Metal shop

1. Practice of hacksaw cutting
2. Practice of filing
3. Practice of drilling on flat piece (Bench & Portable)
4. Practice of threading on flat piece

C) Welding

1. Shielded Metal Arc Welding (SMAW)
2. Gas Metal Arc Welding (GMAW / MIG)
3. Gas Tungsten Arc Welding (GTAW / TIG)
4. Laser Beam Welding (LBW)
5. Electron Beam Welding (EBW)
6. Practice of making Butt Joint
7. Practice of making Lap Joint
8. Practice of making Tee Joint

D) Forging

1. Practice of Drawing
2. Practice of Swaging

GEN-201

اسلامیات/مطالعہ پاکستان

نصاب سال دوئم

حصہ اول اسلامیات

حصہ دوئم مطالعہ پاکستان

ٹی	پی	سی
1	0	1

کل وقت 20 گھنٹے:

موضوعات:

1۔ سورۃ المومنون ایک تا گیارہ آیات کا ترجمہ مع تشریح

2۔ دس منتخب احادیث مع ترجمہ وتشریح

() خیر کم من تعلم القرآن و علمه

() لا ایمان لمن لا امانته له ولا دین لا من لا اعهد له

() و یاکم و الظن ان الظن اکرب الحدیث

() من احدث فی امرنا هذا ما لیس منه فهورد

() من حمل علینا السلاح فلیس منا

() انا و کافل الیتیم فی الجنه

() لا ضرور ولا ضرار فی السلام

() کلکم راع و کلکم راع و کلکم مسول عن رعیته

3۔ سیرۃ طیبہ

() مکی زندگی۔ولادت۔بعثت۔ہجرت

() مدنی زندگی۔مواخات۔میثاق مدینہ۔فتح مکہ(اسباب ونتائج)

4۔ حضورﷺ بحیثیت

() خطبہ حجۃ الوداع۔انسانی حقوق کا اعلامیہ/حقوق انسانی پالیسی 2018

() معلم کامل۔سربراہ خاندان

5۔ اسلامی معاشرہ

نظام تعلیم اوراس کے مقاصد۔عدل وانصاف۔امر بالمعروف۔نہی عن المنکر۔انسانی حقوق کا معاشرتی اور معاشی ترقی میں کردار

جہاد۔کسب حلال۔مسجد(اہمیت وفضیلت)

6۔ اسلامی ریاست کی تعریف۔اسلامی ریاست کی خصوصیات۔اسلامی حکومت کے فرائض۔اسلامی طرز حکومت۔

( ) حضورﷺ کی بطور سربراہ بیان کر سکے

حضورﷺ بحیثیت

( ) خطبہ حجۃ الوداع ۔انسانی حقوق کا اعلامیہ رحقوق انسانی پالیسی 2018 کے بارے جان سکے

اسلامی معاشرہ:

عمومی مقاصد: اسلامی معاشرہ کی خصوصیات سے آگاہی حاصل کر سکے

خصوصی مقاصد:

( ) اسلامی معاشرہ کا معنی ومفہوم کر سکے

( ) اسلامی معاشرہ کی امتیازی خصوصیات بیان کر سکے

( ) اسلامی معاشرہ میں عدل واحسان کی اہمیت بیان کر سکے

( ) تبلیغ کے لغوی معنی بیان کر سکے

( ) تبلیغ کی اہمیت اور ضرورت بیان کر سکے

( ) جہاد کے لفظی واصطلاحی معنی بیان کر سکے

( ) جہاد کی اہمیت بیان کر سکے

( ) جہاد اور قتل میں فرق بیان کر سکے

( ) جہاد کی مختلف اقسام بیان کر سکے

( ) لفظ مسجد کی تعریف بیان کر سکے

( ) مسجد کی سابقہ حیثیت کو بحال کرنے کے بارے میں اقدامات کو مان سکے

( ) انسانی حقوق کی معاشی اور معاشرتی ترقی میں اہمیت اور کردار بیان کر 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 ومقاصد بیان کر سکے

() اسلامی ریاست کے قیام کی لیے جدوجہد کر سکے

() حقوق آگاہی رمعلومات تک رسائی کا قانون جان سکے

() ملازمت پیشہ خواتین کے حقوق کا تحفظ جان سکے اور

() معاشرے میں خواتین کے حقوق کا تحفظ یقینی بنائے

نصاب مطالعہ پاکستان

سال دوئم	ٹی	پی	سی
حصہ دوم	1	0	1

کل وقت 12 گھنٹے

موضوعات:

() دوقومی نظریہ

() تحریک پاکستان

() انڈین کانگریس

() مسلم لیگ

() تقسیم بنگال

() میثاق لکھنو

() تحریک خلافت

() سندھو تحریک

() تجاویز دہلی

() نہرو رپورٹ

() قائداعظم کے چودہ نکات

() خطبہ آلہ آباد

() انتخابات 1938 اور انتقال اقتدار

() قرارداد پاکستان

حصہ دوم

مطالعہ پاکستان

تدریس مقاصد:

تحریک پاکستان:

عمومی مقاصد:

() قیام پاکستان کے اسباب وتحریک کو بیان کر سکے

خصوصی مقاصد:

() قومیت کے مفہوم کو بیان کر سکے

() دو قومی نظریہ کی تعریف وتوضیح کر سکے

() دوقومی نظریہ کی اہمیت بیان کر سکے

() ہندوستانی مسلمانوں کی محرومیوں کو بیان کر سکے

() قومی تشخص کو بحال رکھنے کے لیے مسلمانان ہند کی مساعی بیان کر سکے

() آزادی ہند اور قیام پاکستان علامہ اقبال اور قائداعظم کی مساعی بیان کریں

() قیام پاکستان سے مستقبل اسلامی مملکت کے قیام کے لیے مسلم عوام کی کوششوں کو بیان کر سکے

() مسلم لیگ کے قیام پاکستان کے لیے جدو جہد بیان کر سکے

(غیر مسلم طلباء کے لیے)

نصاب اخلاقیات

ٹی	پی	سی
1	0	1

سال دوم

کل وقت 20 گھنٹے

موضوعات:

معاشرتی اقدار بلحاظ ہمسایہ۔قوم۔قومی سطح۔شہری سطح۔صنعتی اداروں کی سطح۔ضروریات۔ورثہ

() حقوق وفرائض

() قوت برداشت

() قوت ارادی

() لگن وجذبہ

() وسیع النظری

() بے غرضی

() انسانی دوستی

() حفاظتی شعور

() پاس آزادی

() کامل آگاہی

() تغیرات کو قبول کرنا

() خودشناسی

() انسانی حقوق کا اعلامیہ/حقوق انسانی پالیسی 2018

() انسانی حقوق کا معاشرتی اور معاشی ترقی میں کردار

() حقوق آگاہی/معلومات تک رسائی۔ملازم پیشہ خواتین کا تحفظ

نصاب اخلاقیات

سال دوم

تدریس مقاصد:

طالب علم اخلاقیات کی اہمیت وضرورت سے آگاہ ہوسکے اور بیان کر سکے

خصوصی مقاصد: طالب علم اس قابل ہو کہ

() موضوعات کا مطلب بیان کر سکے

() عملی زندگی سے مثالوں کی نشاندہی کر سکے

() اپنی شخصیت اور معاشرے پر موضوعات کے مطابق اثرات پیدا کرنے کے طریقے بیان کر سکے

() اعلیٰ اخلاقی اقدار میں سے قوت برداشت۔قوت ارادی۔لگن وجذبہ۔وسیع النظری۔بے غرض۔انسانی دوستی شعور۔پاس آزادی۔کامل آگاہی اور خود شناسی کی اہمیت

() اخلاقیات سے متصف ہوکر قومی خدمت بہتر طور پر انجام دے سکے

() انسانی حقوق کا اعلامیہ/حقوق انسانی کی پالیسی 2018 کے بارے میں جان سکے

() انسانی حقوق کا معاشرتی اور معاشی ترقی میں اہمیت اور کردار بیان کر سکے

() حقوق اگاہی/معلومات تک رسائی کے قانون کو جان سکے

() ملازم پیشہ خواتین کا تحفظ کو اخلاقیات کا حصہ تصور کرے

Tarjumat-ul-Quran / Civics-II

TTQ-211 / Civic-211;

T	P	C
1	0	1

Total Contact Hours:

Theory: **32**
Practical: **0**

Note: Syllabi for this subject would be as per BISEs/General education, developed by Punjab Curriculum TextBook Board (PCTB)/ PECTA

CH-213 APPLIED CHEMISTRY

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

LEARNING OUTCOMES:

After studying this course, a student will be able to:

1. Understand the significance and role of chemistry in the development of modern technology.
2. Become acquainted with the basic principles of chemistry as applied in the study of relevant technology.
3. Know scientific methods for production, properties and use of materials of industrial & technological significance.
4. Gain skill for the efficient conduct of practical in a chemistry lab.

Detail of Contents:

1. Introduction. **4 Hours**

1.1 Scope and significance of the subject.
1.2 Orientation with reference to this technology.
1.3 Terms used & units of measurements in the study of chemistry.

2. Fundamental concepts of chemistry. **4 Hours**

2.1 Symbols, Valency, Radicals, formulas.
2.2 Chemical Reactions & their types.
2.3 Balancing of equations by ionic method.

3. Atomic structure. **4 Hours**

3.1 Sub-atomic particles.
3.2 Architecture of atoms of elements, Atomic No. and Atomic weight.
3.3 Periodic classification of elements, periodic law.

4. Chemical bond. **4 Hours**

4.1 Nature of Chemical Bond.
4.2 Electrovalent bond with examples.
4.3 Covalent Bond (Polar and Non-polar) sigma & Pi Bonds with examples.
4.4 Co-ordinate Bond with examples.

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, Charlee'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, and 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:

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

CH-213 APPLIED CHEMISTRY

Instructional Objectives:

1. 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.

2. 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.

3. 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.

4. 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.

5. 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, Charlee’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.

6. 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.

7. 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.

8. 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.

9. 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.

10. 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.

11. 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.

12. 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.

13. 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 aluminum 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.

14. 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.

15. 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.

16. 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.

CH-213 APPLIED CHEMISTRY

List of Practicals:

1. To introduce the common apparatus, glassware and chemical reagents used in the chemistry lab.
2. To purify a chemical substance by crystallization.
3. To separate a mixture of sand and salt.
4. To find the melting point of substance.
5. To find the pH of a solution with pH paper.
6. To separate a mixture of inks by chromatography.
7. To determine the co-efficient of viscosity of benzene with the help of Ostwald vasomotor.
8. To find the surface tension of a liquid with a stalagmometer.
9. To perform electrolysis of water to produce Hydrogen and Oxygen.
10. To determine the chemical equivalent of copper by electrolysis of Cu SO.
11. To get introduction with the scheme of analysis of salts for basic radicals.
12. To analyze 1st group radicals (Ag^{+} - Pb^{++} - Hg^{+}).
13. To make practice for detection 1st group radicals.
14. To get introduction with the scheme of II group radicals.
15. To detect and confirm II-A radicals (hg^{++}, Pb^{++++}, Cu^{+}, Cd^{++}, Bi^{+++}).
16. To detect and confirm II-B radicals Sn^{+++}, Sb^{+++}, As^{+++}).
17. To get introduction with the scheme of III group radicals (Fe^{+++} - Al^{+++}, Cr^{+++})
18. To detect and confirm Fe^{+++}, Al^{+++} and Cr^{+++}.
19. To get introduction with the scheme of IV group radicals.
20. To detect and confirm An^{++} and Mn^{++} radicals of IV group.
21. To detect and conform Co^{++} and Ni^{++} radicals of IV group.
22. To get introduction with the Acid Radical Scheme.
23. To detect dilute acid group.
24. To detect and confirm CO''_3 and HCO'_3 radicals.
25. To get introduction with the methods/apparatus of conducting volumetric estimations.
26. To prepare standard solution of a substance.
27. To find the strength of a given alkali solution.
28. To estimate HCO'_3 contents in water.
29. To find out the %age composition of a mixture solution of KNO_3 and KOH volumetrically.
30. To find the amount of chloride ions (Cl') in water volumetrically.

MATH-212 APPLIED MATHEMATICS-II

Total Contact Hours		T	P	C
Theory	64	2	0	2

Pre-requisite: Must have completed Mathematics I.

LEARNING OUTCOMES:

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

1. Solve problems of Calculus and Analytic Geometry.
2. Develop mathematical skill, attitudes and logical perception in the use of mathematical instruments.
3. Apply principles of Differential Calculus to work out rate measures, velocity, acceleration, maxima & minima values
4. Use Principles of Integral Calculus to compute areas and volumes.
5. Acquire proficiency in solving technological problems with mathematical clarity and insight.

Detail of Contents:

1. Functions & limits. **4 Hours**

- 1.1 Constant & Variable Quantities
- 1.2 Functions & their classification
- 1.3 The concept of Limit
- 1.4 Limit of a Function
- 1.5 Fundamental Theorems on Limit
- 1.6 Some important Limits
- 1.7 Problems

2. Differentiation **4 Hours**

- 2.1 Increments
- 2.2 Differential Coefficient or Derivative
- 2.3 Differentiation ab-initio or by first Principle
- 2.4 Geometrical Interpretation of Differential Coefficient
- 2.5 Differential Coefficient of X^n, $(ax + b)^n$
- 2.6 Three important rules
- 2.7 Problems

3. Differentiation of algebraic functions **4 Hours**

- 3.1 Explicit Functions
- 3.2 Implicit Functions
- 3.3 Parametric forms
- 3.4 Problems

4. Differentiation of trigonometric functions **4 Hours**

- 4.1 Differential Coefficient of Sin x, Cos x, Tan x from first principle.

4.2 Differential Coefficient of Cosec x, Sec x, Cot x
4.3 Differentiation of inverse Trigonometric functions.
4.4 Problems.

5. Differentiation of logarithmic & exponential functions **4 Hours**

5.1 Differentiation of ln x
5.2 Differentiation of Log a^x
5.3 Differentiation of a^x
5.4 Differentiation of e^x
5.5 Problems

6. Rate of change of variable. **4 Hours**

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

7. Integration **8 Hours**

7.1 Concept
7.2 Fundamental Formulas
7.3 Important Rules
7.4 Problems

8. Methods of integration **6 Hours**

8.1 Integration by substitution
8.2 Integration by parts
8.3 Problems

9. Definite integrals **6 Hours**

9.1 Properties
9.2 Application to area
9.3 Problems

10. Plane analytic geometry & straight line **6 Hours**

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

11. Equations of the straight line **6 Hours**

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 center
12.5 Problems

REFERENCE BOOKS

1. 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

MATH-212 APPLIED MATHEMATICS-II

Instructional Objectives:

1. 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.

2. 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.

3. 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.

4. 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, Cosec x, Cot x.
4.3 Find differential coefficients of inverse trigonometric functions.

5. 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.

6. 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.

7. 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.

8. 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.

9. 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.

10. 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.

11. 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.

12. 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.

PHY-212 APPLIED MECHANICS

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

Pre-requisite:

LEARNING OUTCOMES:

1. Apply the concepts of Applied Physics to understand Mechanics
2. Apply laws and principles of Mechanics in solving technological problems
3. Use the knowledge of App. Mechanics in learning advance technical courses.
4. 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 Equilibrium.
- 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

6. Friction: 2 Hours

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

7. Work, energy and power 3 Hours

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.

8. Transmission of power: 3 Hours

8.1 Belts, Ropes.
8.2 Chains.
8.3 Gears.
8.4 Clutches, functions and types with application

9. Machines: 3 Hours

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

10. Vibratory motion: 2 Hours

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

11. Elasticity: 3 Hours

11.1 Three Moduli of Elasticity
11.2 Loaded Beams, Types of Beam & Loads

11.3 Bending Stress
11.4 S.F & B.M diagram
11.5 Torsion and Torsional Stresses

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 center.
13.3 Instantaneous velocity.
13.4 Velocity of a link by instantaneous center method.
13.5 Relative velocity of two bodies in the straight line
13.6 Velocity of a link by relative velocity method.

Recommended Textbooks:

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

PHY-212 APPLIED MECHANICS

Instructional Objectives:

1. 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

2. 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.

3. 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.

4. 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.

5. 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.

6. 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.

7. 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

8. 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

9. 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:
  i. Single purchase crab.
  ii. Double purchase crab.
  iii. Worm and worm wheel.
  iv. 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.

10. 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.

11. 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

12. 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.

13. 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:
13.4.1. Relative velocity method.
13.4.2. Instantaneous center method.

PHY-212 APPLIED MECHANICS

List of Practicals:

1. Find the weight of the given body using Law of Polygon of forces.
2. Find unknown forces in a given set of concurrent forces in equilibrium using Grave-sands apparatus
3. Set a jib crane and analyses forces in its members
4. Set a Derrick Crane and analyses forces in its members
5. Study forces shared by each member of a Toggle Joint
6. Set a Roof Truss and find forces in its members
7. Verify Principle of Moments in a compound lever
8. Calibrate a steelyard
9. Find the Reactions at the ends of a loaded beam
10. Use Reaction of Beams apparatus to study resultant of Parallel forces
11. Find the Moment of Inertia of a Flywheel
12. Find the angle of reaction for a wooden block placed on an inclined plane
13. Find the B.H.P. of a motor
14. Study the transmission of Power through friction gears
15. Study the transmission of power through belts
16. Study the transmission of Power through toothed wheels
17. Study the function of clutches
18. Find M.A. and Efficiency of worm and worm wheel
19. Find M.A. and efficiency of differential wheel and axle
20. Find the efficiency of a screw
21. Find the efficiency of a differential pulley
22. Study conversion of rotatory motion to S.H.M. using S.H.M. Model/Apparatus
23. Study conversation of rotatory motion to vibratory motion of the piston in a cylinder
24. Study the reciprocating motion
25. Study the working of cams
26. Study the quick return motion
27. Compare the Elastic constants of the given wires
28. Verify Hooke's Law using Helical Spring
29. Find the coefficient of Rigidity of a wire using Maxewell's needle
30. Find the coefficient of Rigidity of a round bar using torsion apparatus
31. Find the coefficient of Rigidity of a rectangular bar using Deflection of Beam Apparatus
32. Determine S.F. and B.M. in a loaded canti-lever (Point Loads)
33. Determine S.F. and B.M. in a simply supported Beam (Point Loads)
34. Determine S.F. and B.M. in a simply supported Beam (Point loads and uniformly distributed load)
35. Determine S.F. and B.M. in a simply supported Beam (Point loads and uniformly distributed)
36. Study working and function of link mechanism of different types.

MGM- 211 BUSINESS COMUNICATION

Total Contact Hours		T	P	C
Theory	32	1	0	1

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

LEARNING OUTCOMES:

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.
8.8 Decision-making and consensus-building strategies

RECOMMENDED BOOKS

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

MGM-211 BUSINESS COMMUNICATION

Instructional Objectives:

1. **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.

2. **Understand the process of oral.**
   - 2.1 Identify speaking situations with other people.
   - 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.

3. **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.

4. **Demonstrate the use of active listening skills 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 feedback.

5. **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 an instrument for a structured interview.

6. **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.

7. 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.

8. 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 meetings 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.
8.6 How to handle conflicts and difficult participants
8.7 State decision-making and consensus-building strategies
8.8 How to follow up and documentation after meetings

AFM-242 APPLIED THERMODYNAMICS

Total Contact Hours		T	P	C
Theory	32	1	3	2
Practical	96			
Pre-Requisite	N/A			

LEARNING OUTCOMES:

To transfer the knowledge of

1. Fundamentals of thermodynamics,
2. Laws and properties of gases,
3. Thermodynamic processes and cycles,
4. Formation and properties of steam,
5. Steam boilers and their performance,
6. Steam and gas turbines,
7. I.C. engines,
8. Air compressors and their performance engines,
9. Air compressors and their performance, etc.

Details of Contents:

1 Fundamentals of thermodynamics. 3 Hours

1.1 Fundamentals of thermodynamics.
1.2 Units and Systems of Units.
1.3 Thermodynamic systems and its types.
1.4 Heat.
1.5 Mass & Weight.
1.6 Force.
1.7 Work done.
1.8 Power
1.9 Describe the following.
1.10 Temperature.
1.11 Absolute temperature.
1.12 Temperature Scales.
1.13 Normal temperature & Pressure.
1.14 Describe the following.
1.15 Pressure & Absolute pressure.
1.16 Gauge pressure & Vacuum pressure.
1.17 State the following.
1.18 Energy, Potential energy, Kinetic energy,
1.19 Chemical energy, Thermal/Heat energy.
1.20 Internal energy of the Gas.
1.21 The working Fluid.

1.22 Liquid, Vapor & Gas.
1.23 Laws of thermodynamics
1.24 Zeroth Law of Thermodynamics
1.25 1st law of Thermodynamics
1.26 2nd Law of Thermodynamics.
1.27 3rd Law of Thermodynamics.
1.28 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.
  2.2.1 Boyle's law.
  2.2.2 Charles's law
  2.2.3 Joule's law
  2.2.4 Gay Loussac Law
2.3 Mathematical relations.
2.4 General gas equation
2.5 Characteristic Gas equation
2.6 Universal Gas equation
2.7 The two specific heats of a gas and derive its mathematical relations.
2.8 Enthalpy of a Gas

3 Thermodynamics Processes 4 Hours

3.1 Thermodynamic process.
3.2 Classification\Types of thermodynamic processes
3.3 The Non-Flow-Reversible & Irreversible processes with the help of P-V diagram.
3.4 The constant volume process with the help of P-V diagram; also derive its mathematical relations for work done during expansion.
3.5 The constant pressure process with the help of P-V diagram; also derive its mathematical relations for work done during expansion.
3.6 The constant temperature process with the help of P-V diagram, also derive its mathematical relation for work done during expansion.
3.7 The adiabatic process with the help of P-V diagram also derive its mathematical relations for work done during expansion.
3.8 The polytrophic process with the help of P-V diagram also derive its mathematical relations for work done during expansion.

4 Thermodynamic Cycles 4 Hours

4.1 Describe the following.

4.1.1 Thermodynamic cycle with the help of P-V diagram.
4.1.2 Types of thermodynamic cycles.
4.1.3 Reversible & Irreversible cycles with help of PV diagram

4.2 Explain the following.

4.2.1 CARNOT CYCLE with the help of P-V diagram; also derive mathematical relations for Air Standard Efficiency during the cycle of operation.
4.2.2 OTTO CYCLE with the help of P-V diagram also derive its mathematical relations for Air Standard Efficiency during the cycle of operation.
4.2.3 DIESEL CYCLE with the help of P-V diagram; also derive its mathematical relations for Air Standard Efficiency during the cycle of operation.
4.2.4 Joule's Cycle with the help of P-V diagram, also derive its mathematical relations for air standard efficiency during cycle of operation.
4.2.5 DUAL COMBUSTION CYCLE with the help of P-V diagram; also derive its mathematical relations for Air Standard Efficiency during the cycle of operation.

5 Formation and properties of Steam. 2 Hours

5.1 Steam formation and its properties
5.2 Important terms used for steam

6 Steam Boilers & its performance. 4 Hours

6.1 Working and general construction of a boiler
6.2 Classification of boilers
6.3 Important terms used for steam boilers
6.4 The construction and working of Simple Vertical Boiler with the help of neat sketch
6.5 The construction and working of COCHRAN Boiler (Multi tubular boiler) with the help of neat sketch.
6.6 The construction and working of Babcock and Wilcox Boiler with the help of neat sketch
6.7 Describe The Boiler Mountings & accessories.
6.8 Comparison between Water tube and Fire tube boilers
6.9 Efficiency of boilers

7 Steam and Gas Turbines. 3 Hours

7.1 Classification of turbines
7.2 De-Level Impulse turbine with the help of neat sketch.
7.3 PARSON'S Reaction turbine with the helping neat sketch.
7.4 Gas Turbines.

8 Internal Combustion Engines 4 Hours

8.1 Torque, and its unit in SI system.
8.2 Mean effective pressure.
8.3 Indicated power and its formula.
8.4 Brake Horsepower and its formula.
8.5 Measurement of Brake Horsepower.
8.6 Friction Horsepower.
8.7 Mechanical efficiency.
8.8 Thermal efficiency.
8.9 Volumetric efficiency.

9 Air Compressors and their performance (Reciprocating & Rotary) 5 Hours

9.1 Introduction of Air Compressors
9.2 Types of Air Compressors (Reciprocating & Rotary)
9.3 Terms used for Air Compressors
9.4 Single stage reciprocating Air Compressor with the help of PV diagram and sketch.
9.5 Uses of Air Compressors
9.6 Multistage compression and its advantages.
9.7 Reciprocating and rotary air compressors

Recommended Textbooks:

1. Applied Thermodynamics T.D Eastop, A. Mcconkey
2. Mechanical Technology (Thermal Engineering) By R.S Khurmi
3. Text Book of Applied Thermodynamics Developed By Academics wing Technical Education & Vocational Training Authority, (Punjab) Pakistan.

AFM-242 APPLIED THERMODYNAMICS

Instructional Objectives:

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

1 Understand the fundamentals of thermodynamics.

1.1 State the following
1.2 Fundamentals of thermodynamics.
1.3 Units and Systems of Units.
1.4 Describe the thermodynamic systems and its types.
1.5 State the following.

- 1.5.1 Heat.
- 1.5.2 Mass & Weight.
- 1.5.3 Force.
- 1.5.4 Work done.
- 1.5.5 Power

1.6 Describe the following.

- 1.6.1 Temperature.
- 1.6.2 Absolute temperature.
- 1.6.3 Temperature Scales.
- 1.6.4 Normal temperature & Pressure.

1.7 Describe the following.

- 1.7.1 Pressure & Absolute pressure.
- 1.7.2 Gauge pressure & Vacuum pressure.

1.8 State the following.

1.8.1 Energy
1.8.2 Potential energy
1.8.3 Kinetic energy,
1.8.4 Chemical energy
1.8.5 Thermal/Heat energy.
1.8.6 Internal energy of the Gas.
1.8.7 The working Fluid.
1.8.8 Liquid, Vapor & Gas.

1.9 Describe the following Laws of thermodynamics.

1.9.1 Zeroth Law of Thermodynamics.
1.9.2 1st Law of thermodynamics.
1.9.3 2nd Law of Thermodynamics.
1.9.4 3rd Law of Thermodynamics.
1.9.5 Law of conservation of energy.

2 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.

2.2.1 Boyle's law.
2.2.2Charles's law
2.2.3Joule's law
2.2.4Gay Lussac Law

2.3 Describe the following; also derive its mathematical relations.
2.4 General gas equation
2.5 Characteristic Gas equation
2.6 Universal Gas equation
2.7 Describe the following.

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

2.8 State the following.

2.8.1 Enthalpy of a Gas

3 Understand the Thermodynamics Processes.

3.1 State the thermodynamic process.
3.2 State Classification /Types of thermodynamic processes
3.3 Describe the following.

3.3.1 The Non-Flow-Reversible & Irreversible processes with the help of P-V diagram.
3.3.2 The constant volume process with the help of P-V diagram; also derive its mathematical relations for work done during expansion.
3.3.3 The constant pressure process with the help of P-V diagram; also derive its mathematical relations for work done during expansion.
3.3.4 The constant temperature process with the help of P-V diagram, also derive its mathematical relation for work done during expansion.
3.3.5 The adiabatic process with the help of P-V diagram; also derive its mathematical relations for work done during expansion
3.3.6 The polytrophic process with the help of P-V diagram also derive its mathematical relations for work done during expansion

4 Thermodynamics Cycles

4.1 Describe the following.

4.1.1 Thermodynamic cycle with the help of P-V diagram.
4.1.2 Types of thermodynamic cycles.

4.2 Describe the Reversible & Irreversible cycles with help of PV diagram
4.3 Explain the following.

4.3.1 CARNOT CYCLE with the help of P-V diagram; also derive its mathematical relations for Air Standard Efficiency during the cycle of operation.
4.3.2 OTTO CYCLE with the help of P-V diagram; also derive its mathematical relations for Air Standard Efficiency during the cycle of operation.
4.3.3 DIESEL CYCLE with the help of P-V diagram; also derive its mathematical relations for Air Standard Efficiency during the cycle of operation.
4.3.4 Joule's Cycle with the help of P-V diagram, also derive its mathematical relations for air standard efficiency during cycle of operation
4.3.5 DUAL COMBUSTION CYCLE with the help of P-V diagram; also derive its mathematical relations for Air Standard Efficiency during the cycle of operation.

5 Understand the Formation and properties of Steam.

5.1 Describe the steam formation and its properties
5.2 State the important terms used for steam

6 Understand the Steam Boilers& its performance.

6.1 Describe the working and general construction of a boiler
6.2 Describe the classification of boilers
6.3 Describe the important terms used for steam boilers
6.4 Explain the Following:

6.4.1 The construction and working of Simple Vertical Boiler with the help of neat sketch

6.4.2 The construction and working of COCHRAN Boiler (Multi tubular boiler) with the help of neat sketch

6.4.3 The construction and working of Babcock and Wilcox Boiler with the help of neat sketch

6.5 Describe the Boiler Mounting & accessories.

6.6 Make a Comparison between Water tube and Fire tube boilers

6.7 Efficiency of boiler

7 Understand the Steam and Gas Turbines.

7.1 State the introduction and classification of turbines

7.2 Explain construction and working of De-Level Impulse turbine with the help of neat sketch .

7.3 Explain the construction and working of PARSON'S Reaction turbine with the helping neat sketch.

7.4 Describe the introduction of Gas Turbines.

8 Understand the Internal Combustion Engines.

8.1 State the following.

8.1.1 Torque, and its unit in SI system.

8.1.2 Mean effective pressure.

8.1.3 Indicated power and its formula.

8.1.4 Brake Horse power and its formula.

8.1.5 Measurement of Brake Horse power.

8.1.6 Friction Horse power.

8.1.7 Mechanical efficiency.

8.1.8 Thermal efficiency.

8.1.9 Volumetric efficiency.

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

9.1 State the introduction of Air Compressors

9.2 Describe the types of Air Compressors (Reciprocating & Rotary)

9.3 State the terms used for Air Compressors

9.4 State the Use of compressed Air

9.5 Describe the construction and working of single stage reciprocating Air Compressor with the help of PV diagram and sketch.

9.6 Describe the multistage compression and its advantages.

9.7 Describe the Reciprocating and rotary Air Compressor.

AFM-242 APPLIED THERMODYNAMICS

List of Practicals:

1. Pressure measurement by barometer.
2. Solve problems based on laws of perfect gases.
3. Solve problems Based on heating and expansion of gases.
4. Solve problems based on air cycles.
5. Measurement of Efficiency of a Boiler.
6. Measurement of Indicated Horse power of I.C Engine.
7. Calculate Work done by a Rotary Air Compressor.
8. Performance test of reciprocating air compressor.
9. To determine the area of an irregularly shaped figure using a planimeter and verify the accuracy of the results by comparing them with the calculated area using graph paper.
10. Visit the thermal power plant and compile report regarding
    - 10.1 Thermal efficiency
    - 10.2 Draw the process flow diagram
    - 10.3 Safety precaution on site.

AM-213 Electric Vehicles (E.Vs)

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

Pre-requisite: AD-143 Automotive Electricity & Electronics

LEARNING OUTCOMES:

Students will be able to:

1. Explore the transition of automotive domain from Internal Combustion Engine to electric vehicles
2. Explain the basic of Electric vehicles and its major parts.
3. Illustrate the working of motors and conversions.
4. Identify and illustrate the various hybrid electric power trains and their different modes of operations.
5. Demonstrate standardized safety handling practices of high voltage systems.
6. Locate and describe hybrid vehicle components (on-vehicle).
7. Distinguish between a cranking and running hybrid gasoline engine.
8. Identify plug-in hybrid EVAP system operation.
9. Diagnose various plug-in hybrid concerns and DTC.
10. Accurately repair various conditions of hybrid and EV systems.
11. Comply with environmental health and safety regulations.
12. Familiarize with Inter Connected Vehicles (ICVs).

Detail of Contents:

1 Introduction of E.Vs **4 Hours**

1.1 Electric Vehicles History.
1.2 EV Comparison with IC Engine
1.3 EV Benefits and Challenges
1.4 Structures of EV and HEV
1.5 EV types/classification
1.6 BEV, HEV, and FCEV
1.7 EV Terminology.
1.8 MPGe of an electric vehicle.
1.9 EV accessories with the highest range impact
1.10 Series hybrid and parallel hybrid
1.11 Instant torque
1.12 Advantages of electric motors over IC engines
1.13 ECU and VCU
1.14 EV frames

2 Direct Current Circuit **4 Hours**

2.1 Voltages in a series circuit
2.2 Kirchhoff's Voltage Law and Current Law
2.3 Voltage divider and current divider rule
2.4 Effect of connecting voltage sources in parallel
2.5 Positive ground and negative ground
2.6 Resistance in a series-parallel circuit
2.7 Troubleshoot DC circuits

3 Alternating Current Circuit 2 Hour

3.1 Sine waves
3.2 Impedance
3.3 Phase relationships between alternating current and voltage
3.4 Operating principle of transformers
3.5 Define harmonics
3.6 Effects of inductive and capacitive reactance on AC circuits
3.7 Power in AC circuits

4 Power Electronics 4 Hours

4.1 Introduction to Power electronics
4.2 Difference between a FET, BJT, Mosfet & IGBT
4.3 Enhancement and depletion mode
4.4 Operation of an SCR
4.5 Inverters and converters
4.6 Types of rectifiers
4.7 Difference between a coupling and bypass capacitor
4.8 Purpose of filters in power electronic circuits
4.9 Troubleshoot diodes, rectifiers, and transistors
4.10 DC-DC converters, DC-AC Converters and AC-DC Converters used in EV applications

5 Battery and Fuel Cells 4 Hours

5.1 Battery basics.
5.2 Battery working principle.
5.3 Battery selection criteria.
5.4 Battery management system
5.5 Calendar life, charge cycle, and cycle life
5.6 Battery capacity
5.7 Approximate range depending upon battery capacity
5.8 Difference between SoH and SoC
5.9 Internal resistance of a battery
5.10 Types of batteries used in EVs
5.11 Types of cathode materials in a lithium-ion battery

5.12 Types of fuel cells

6 Battery Charging System **4 Hours**

6.1 Charging station
6.2 Sizing of charging station
6.3 Components of charging station
6.4 Diagram of charging station
6.5 Differentiate Level 1, 2, 3 chargers
6.6 Principle of bi-directional charging
6.7 Types of EV connectors
6.8 Charging time and charging cost
6.9 Safety hazards associated with EVSEs
6.10 Safe charging of an EV

7 DC Motors & control **6 Hours**

7.1 EV Motors and Characteristics
7.2 Main components of a DC motor
7.3 Purpose of commutation between a stator and an armature
7.4 Torque of a DC motor
7.5 Operating principle of BLDC motors
7.6 Speed regulation of a DC motor
7.7 Types of stepper motors
7.8 Dynamic and regenerative braking
7.9 Types of Motors
7.10 Selection and sizing of Motor
7.11 RPM and Torque calculation of motor
7.12 Motor Controllers
7.13 Mechanical connection of motor
7.14 Electrical connection of motor

8 AC Motors & control **6 Hours**

8.1 Principle of induction motors
8.2 Synchronous and asynchronous motors
8.3 Torque developed in a 3-phase induction motor
8.4 Types of synchronous motors
8.5 Permanent magnet synchronous motor
8.6 Advantages of a PMSM over an induction motor
8.7 Main components of speed control in AC motor

9 Power train **8 Hours**

9.1 DC motor drives.
9.2 Power train, drive train and driveline
9.3 EV transmission
9.4 Differentials used in EVs
9.5 Difference between 4WD and AWD
9.6 Components in a motor controller
9.7 Main components in an EDU
9.8 Reduction gearbox
9.9 Un-sprung weight affects in wheel motors (add specific term)
9.10 Semi-hybrid and fully-hybrid

10 Sensors & actuators **4 Hours**

10.1 Sensors in EVs
10.2 NTC and PTC thermistor
10.3 Applications for pressure sensors in EVs
10.4 Digital cameras in driver assist systems
10.5 Operation of solenoid valves in EV applications
10.6 Temperature sensors in EV power trains
10.7 Steps for troubleshooting sensors and actuators

11 Communication & Control System **4 Hours**

11.1 Communication control system of a bus
11.2 Gateway in a communication system
11.3 Types of communication protocols used in EVs
11.4 Main difference between CAN and CAN FD
11.5 Benefits of automotive Ethernet (review)
11.6 Communication conductors in EVs
11.7 Operating principles of MCUs
11.8 VCU and ECU

12 Safety, Maintenance and Repair **4 Hours**

12.1 Active safety and passive safety
12.2 Safety features found in EVs
12.3 Main safety risks associated with ADAS
12.4 Arc flash and an arc blast
12.5 Active and passive discharge system
12.6 Battery protection unit and battery management system
12.7 Maintenance procedures for high voltage vehicles
12.8 Types of sensors in an EV charging station
12.9 Typical EV maintenance schedule
12.10 PIDs and DTCs
12.11 Types of essential PPE for troubleshooting HV systems
12.12 Troubleshooting practices to HV systems

13 Inter Connected Vehicles **10 Hours**

13.1 Introduction of inter connected vehicles (ICVs).
13.2 Advance Driver Assistance Systems (ADAS)
13.3 Networking & Protocol
13.4 Security & Privacy (Cyber security)
13.5 Intelligent Transportation system (ITS)
13.6 Smart traffic management

Recommended Textbooks:

1. Hand Book of Automotive Power Electronics and power drive By Tailor & Francis
2. Automotive Mechatronics by Konred Reif
3. Electric Vehicle Engineering by Per Enge 2021

AM-213 Electric Vehicles (E.Vs)

Instructional Objectives:

1 Introduction of EVs

1.1 Electric Vehicles History.
1.2 Comparison with Internal combustion Engine: Technology
1.3 Comparison with Internal combustion Engine: Benefits and Challenges
1.4 Structures of EV and HEV (Components of Electric Vehicle)
1.5 EV types/classification and their electrification levels
1.6 Differentiate between a BEV, HEV, and FCEV
1.7 Battery Electric vehicle (BEV)
1.8 Hybrid electric vehicle (HEV)
1.9 Plug-in hybrid vehicle (PHEV
1.10 Fuel cell electric vehicle (FCEV)
1.11 Solar Power operated Electric vehicles
1.12 Comparison of fuel vs Electric and solar power
1.13 Photovoltaic solar based EV design.
1.14 EV terminology.
1.15 Calculate the MPGe of an electric vehicle.
1.16 Describe two EV accessories with the highest range impact
1.17 Differentiate between series hybrid and parallel hybrid
1.18 Define the term instant torque
1.19 Name four advantages of electric motors over internal combustion engines (ICEs)
1.20 Describe the main difference between an ECU and VCU
1.21 List three types of EV frames

2 Direct Current Circuit

2.1 Describe how voltages are distributed in a series circuit
2.2 Define Kirchhoff's Voltage Law and Current Law
2.3 Use the voltage divider and current divider rule
2.4 Describe the effect of connecting voltage sources in parallel
2.5 Define positive ground and negative ground
2.6 Determine the total resistance in a series-parallel circuit
2.7 Troubleshoot DC circuits

3 Alternating Current Circuit

3.1 Identify sine waves
3.2 Define impedance
3.3 Describe the phase relationships between alternating current and voltage

3.4 Explain the basic operating principle of transformers
3.5 Define harmonics
3.6 Explain the effects of inductive and capacitive reactance on AC circuits
3.7 Discuss power in AC circuits

4 Power Electronics

4.1 Define power electronics
4.2 Explain the difference between a FET, BJT, Mosfet & IGBT
4.3 Differentiate between enhancement and depletion mode
4.4 Describe the operation of an SCR
4.5 Compare inverters and converters
4.6 List three types of rectifiers
4.7 Explain the difference between a coupling and bypass capacitor
4.8 Describe the purpose of filters in power electronics circuits
4.9 Troubleshoot diodes, rectifiers, and transistors
4.10 Power Conversion – DC-DC converters, DC-AC Converters and AC-DC Converters used in EV applications

5 Battery and Fuel Cells

5.1 Battery basics, battery pack configuration, construction
5.2 Internal chemical reactions & working principal.
5.3 Battery selection criteria.
5.4 Battery management system
5.5 Differentiate between calendar life, charge cycle, and cycle life
5.6 Define the term “battery capacity”
5.7 Discuss the approximate range depending upon battery capacity
5.8 Explain the difference between SoH and SoC
5.9 Calculate the internal resistance of a battery
5.10 List the three main types of batteries used in EVs
5.11 Name three types of cathode materials in a lithium-ion battery
5.12 List five types of fuel cells

6 Battery Charging System

6.1 Type of charging station
6.2 Selection and Sizing of charging station
6.3 Components of charging station
6.4 Single line diagram of charging station
6.5 Differentiate between Level 1, Level 2 and Level 3 chargers
6.6 Describe the principle of bidirectional charging
6.7 List the five basic types of EV connectors
6.8 Calculate charging time and charging cost

6.9 Discuss the two main safety hazards associated with EVSEs
6.10 List seven steps that ensure safe charging of an EV

7 DC Motors & control

7.1 EV Motors and Characteristics
7.2 Name the main components of a DC motor
7.3 Explain the purpose of commutation
7.4 Differentiate between a stator and an armature
7.5 Define torque and counter EMF
7.6 Explain the operating principle of BLDC motors
7.7 Determine the % speed regulation of a DC motor
7.8 List five types of stepper motors
7.9 Define the terms dynamic and regenerative braking
7.10 Types of Motors
7.11 Selection and sizing of Motor
7.12 RPM and Torque calculation of motor
7.13 Motor Controllers
7.14 Mechanical connection of motor
7.15 Electrical connection of motor

8 AC Motors & control

8.1 Explain the basic operating principles of induction motors
8.2 Differentiate between synchronous and asynchronous motors
8.3 Describe how torque is developed in a 3-phase induction motor
8.4 Name three types of synchronous motors
8.5 Describe operation of a permanent magnet synchronous motor
8.6 List three advantages of a PMSM over an induction motor
8.7 Name the main components in AC motor speed control

9 Power train

9.1 Power Converters for DC motor drives
9.2 Describe power train, drive train and driveline.
9.3 Describe the operation of an EV transmission
9.4 List the three types of differentials used in EVs
9.5 Explain the difference between 4WD and AWD
9.6 Name the main components in a motor controller
9.7 Name the three main components in an EDU
9.8 Explain the purpose of a reduction gearbox
9.9 Describe how unsprung weight affects in-wheel motors
9.10 Differentiate between a mild hybrid and full hybrid

10 Sensors & actuators

10.1 List the four main quantities measured by sensors in EVs
10.2 Describe the difference between and NTC and PTC thermistor
10.3 Name three applications for pressure sensors in EVs
10.4 List four applications of digital cameras in driver assist systems
10.5 Describe the operation of solenoid valves in EV applications
10.6 List four applications of temperature sensors in EV power trains
10.7 List the three basic steps for troubleshooting sensors and actuators

11 Communication & Control System

11.1 Explain the purpose of a communications bus
11.2 Describe the purpose of a gateway in a communication system
11.3 List five types of communication protocols used in EVs
11.4 Explain the main difference between CAN and CAN FD
11.5 Name four benefits of automotive Ethernet
11.6 Compare three of the most common communication conductors in EVs
11.7 Describe the basic operating principles of MCUs
11.8 Explain the difference between a VCU and ECU

12 Safety, Maintenance and Repair

12.1 Differentiate between active safety and passive safety
12.2 List seven safety features found in EVs
12.3 Describe the two main safety risks associated with ADAS
12.4 Distinguish between an arc flash and an arc blast
12.5 Differentiate between an active and passive discharge system
12.6 Compare a battery protection unit and battery management system
12.7 Distinguish the maintenance procedures for high voltage vehicles
12.8 Name five types of sensors in an EV charging station
12.9 Describe a typical EV maintenance schedule
12.10 Differentiate between PIDs and DTCs
12.11 List five types of essential PPE for troubleshooting HV systems
12.12 Apply safe troubleshooting practices to HV systems

13 Inter Connected Vehicles

13.1 Introduction of inter connected vehicles (ICVs).
13.2 Introduction of Advance Driver Assistance Systems (ADAS)
13.3 Introduction of Networking & Protocol
13.4 Introduction of Security & Privacy (Cyber security)
13.5 Introduction of Intelligent Transportation system (ITS)
13.6 Introduction of Smart traffic management

AM-213 Electric Vehicles (E.Vs)

Total Hours: 96

List of Practical's:

1. Identify the electric vehicles major parts (on-vehicle) and prepare a layout.
2. Identify the location of motors
3. Identify and sketch hybrid electric power trains and their different modes of operations.
4. Identify hybrid vehicle components & systems (on-vehicle) and prepare a layout.
5. Identify plug-in hybrid EVAP system (on-vehicle) and prepare a layout.
6. Analyze the Device Characteristics, linear and switching operations.
7. Study and analyze the Protection circuits for E.Vs.
8. Make Step up and step down converter for low voltage E.Vs loops
9. Make half and full bridge converter and find role of control signals for DC motor.
10. Study of Motor Control system for Current/Voltage loop control of a DC motor.
11. Study and demonstration of Induction motor Control system
12. Study and demonstration of BLDC /PMSM /SRM motor system
13. Demonstration of control signals for three phase induction motor
14. Inspection and condition monitoring of Electric Vehicle batteries.
15. Diagnose and repair traction motor speed control systems in Electric Vehicles.
16. Diagnose and repair high voltage traction motors in Electric Vehicles.
17. Diagnose and repair DC to DC converters in Electric Vehicles.
18. Invite a guest speaker from Automotive Hi-Tech industry for the introduction of ICVs
19. Visit a dealership workshop and demonstrate service and maintenance of Electric & Hybrid Vehicles and submit the findings.

AM-223 PROBLEMS IN I.C. ENGINES

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

Pre-requisite: I.C. Engine

LEARNING OUTCOMES:

1. Understand power and its implications in transfer
2. Understand causes of I.C. engine faults and suggest their remedies
3. Recognize the engine problem by hearing engine noise and symptoms
4. Understand combustion problems and suggest remedies

Detail of Contents:

1. Engine problems, symptoms and leakages **2 Hours**

1.1 General problems of an engine and their symptoms.

1.2 Symptoms and remedies of following leakages.

- 1.2.1 Engine oil Leakage (Internal & External).
- 1.2.2 Engine Coolant Leakage (Internal & External).
- 1.2.3 Intake vacuum leakage.
- 1.2.4 Exhaust gas leakage.

1.3 Colors of engine exhaust smokes.

- 1.3.1 Black color of exhaust smoke.
- 1.3.2 Blue color of exhaust smoke.
- 1.3.3 White color of exhaust smoke.

2. Factors affecting the engine power/performance **2 Hours**

2.1 Factors affecting the engine power/performance.

- 2.1.1 Turbo charging /Super-charging.
- 2.1.2 Scavenging.
- 2.1.3 Venturi effect.
- 2.1.4 Exhaust gasses back pressure
- 2.1.5 Intake manifold.
- 2.1.6 Atmospheric pressure & temperature.

3. Faults, causes and remedies of piston, piston rings & piston pin. **4 Hours**

3.1 Heat stresses and their effects on Piston, piston rings, piston pin.
3.2 Scuffing and scoring of pistons.
3.3 Causes of Piston expansion.
3.4 Purpose and types of piston rings.
3.5 Causes and remedies of scuffing, sticking and breaking of piston rings.
3.6 Causes and remedies of engine Blow-by.
3.7 Specifications of piston Rings.
3.8 Procedure and steps involved for inspection, dismantling and installation of piston rings.
3.9 Methods of Piston pin fitting.
3.10 Effects of contraction and expansion on piston pin.

3.11 Causes of piston pin knocking.
3.12 Procedure of piston installation in an engine cylinder.

4. Problems, their causes and remedies of engine cylinders. 2 Hours

4.1 Causes and remedies of cylinder ovality & tapperness
4.2 Effects of heat stresses on cylinder wear & tear.
4.3 Causes and remedies of cylinder Scuffing, scoring and distortion.
4.4 Procedure and steps involved for measuring the Ovality and tapperness of cylinder.

5. Problems, their causes and remedies of connecting rod. 2 Hours

5.1 Purpose and types of Connecting Rod with respect to its sections.
5.2 Causes and remedies of bending and twisting of connecting rod.

6. Problems, their causes and remedies of crankshaft. 2 Hours

6.1 Factors causing effects on crankshaft performance.
6.2 Causes and remedies of deflection, bending, cracking, rapid wear & twisting of crankshaft.
6.3 Factors involved in crankshaft damages.
6.4 Describe dynamic Balancing of crankshaft.

7. Problems, their causes and remedies of valve train mechanism. 4 Hours

7.1 Causes and remedies of Sticking, bending, breakage and burning of engine valves.
7.2 Causes and remedies of broken engine timing belt/timing chain and its effects on the operation of engine valves.
7.3 Camshaft lobe lift, and shapes of different types of cam lobes.
7.4 Steps involved for setting of engine valve clearance adjustment.
7.5 Procedure and steps involved for the setting of engine timing belt/chain.
7.6 Procedure and steps involved for the setting of engine timing gears.
7.7 Working principle of VVT-I and i-Vtech.
7.8 Causes and remedies of problems (VVT-i and i-Vtech.

Problems, their causes and remedies of engine combustion chamber. 2 Hours

7.9 Types of combustion chamber and their features.
7.10 Direct combustion chamber and indirect combustion chamber.
7.11 Delay period and its effects.
7.12 Controlled and uncontrolled combustion.
7.13 Procedure for Decarburizing of combustion chamber.

8. Problems, their causes and remedies of engine cylinder head. 2 Hours

8.1 Causes and remedies of cracking and leakages of cylinder head.
8.2 Cylinder Head Wrapage.
8.3 Causes and remedies of blown gasket of cylinder head.

9. Problems, their causes and remedies of engine bearings. 1 Hours

9.1 Function, types and working of engine Bearings & bushes.
9.2 Causes and remedies of failure of engine bearings & bushes.

10. Problems, their causes and remedies of engine knocking. 2 Hours

10.1 Causes and remedies of engine following faults.
10.1.1 Pre-ignition.
10.1.2 Detonation.
10.1.3 Back Firing.
10.1.4 Engine Missing
10.2 Causes and remedies of Diesel engine Knocking
(Delay Period, Low Quality of Fuel, Compression ratio, Engine speed).
10.3 Causes and remedies of following engine noises.
10.3.1 Hisses.
10.3.2 Rattles.
10.3.3 Popping.
10.3.4 Knocking.

11. Faults, causes and remedies of engine cooling system. 2 Hours

11.1 Describe the causes and remedies of following problems of engine cooling system.
11.1.1 Engine Overheating.
11.1.2 Leakage of coolant.
11.1.3 Faulty Thermostat Valve.
11.1.4 Scale in water Jackets.
11.1.5 Faulty Water Pump.
11.1.6 Faulty Radiator Pressure Cap.
11.1.7 Faulty Electric Fan.
11.1.8 Faulty Fan Belt.
11.2 Causes and remedies of under cooling of an engine.
11.3 Effects of dirt, scale, oil leakage in cooling water, and cavitation on engine cooling system.
11.4 Procedure for straight and reverse flushing of engine cooling system.

12. Problems, their causes and remedies of engine lubricating system. 2 Hours

12.1 Causes and remedies of following problems of engine Lubricating system.

12.1.1 Engine Oil Contamination.

12.1.2 Oil Sludge formation.

12.1.3 Under Lubrication

12.1.4 Over Lubrication

12.1.5 Faulty Oil Filter.

12.1.6 Faulty Oil Pump.

12.1.7 Faulty Oil Pressure gauge sending unit.

12.1.8 Blown Oil Seals.

12.2 Oil Rating and Viscosity index No's.

12.3 Procedure and steps involved for Change of engine oil and oil filter.

13. Problems, their causes and remedies of ignition system. 2 Hours

13.1 Firing order for 3, 4, 6, 8 & 12 Cylinder engines.

13.2 Procedure and steps involved for checking and testing of ignition systems.

14. Problems, their causes and remedies of engine fuel system. 2 Hour

14.1 Causes and remedies of following problems of engine fuel systems.

14.1.1 Excessive Fuel Consumption.

14.1.2 Engine Dieseling.

14.1.3 Engine Missing.

14.1.4 Fuel Blockage.

14.1.5 Electrical fuel pump assembly

14.1.6 Fuel Lines

14.1.7 Fuel pressure regulator

14.1.8 Purge control valve

14.1.9 Fuel injector

15. Automotive diagnostic scanner for fault finding of IC engine problems. 2 Hours

15.1 Procedure for the use of automotive diagnostic Scanner for following engine problems.

15.1.1 Faulty Ignition System.

15.1.2 Faulty EFI system.

15.1.3 Faulty VVT-I System & electronic mechanism

16. Engine/Vehicle emissions control systems. 4 Hours

16.1 Engine emissions and vehicle emissions.

16.2 Function and working of positive crankcase ventilation system (PCV system).

16.3 Function and working of electronically controlled exhaust gas recirculating system (E.G.R System).

16.4 Function and working of catalytic convertor.

16.5 Function and working of Air-Injection System.

16.6 Function and working of Fuel evaporative emission control system

17. Steps & procedure for engine overhauling. 15 Hours

17.1 Purpose & types of engine overhauling.
17.2 Procedure involved for dismounting engine from the Vehicle.
17.3 Procedure for top overhauling of petrol/diesel engine.
17.4 Procedure involved for the complete overhauling of
17.4.1 Petrol engine.
17.4.2 Diesel engine.
17.4.3 Motorcycle engine.

18. Engine break-in. **2 Hours**

18.1 Importance of engine break-in.
18.2 Various methods of Engine break-in.
18.3 Motoring the engine.
18.4 Causes of Engine motoring.

19. Engine output testing. **4 Hours**

19.1 Engine testing.
19.2 Parameters of engine testing.
19.3 Engine power rating.
19.4 Procedure for testing of engine output with dynamometer.
19.5 Types of engine efficiency.
19.5.1 Mechanical efficiency.
19.5.2 Thermal efficiency.
19.5.3 Volumetric efficiency.

20. Power plant / Generator (types, operating, testing, troubleshooting). **4 Hours**

20.1 Purpose of Diesel Engine Power Plant / Generator.
20.2 Main Components of Diesel Engine Power Plant / Generator.
20.3 Working principle of Diesel Engine Power Plant / Generator.

BOOK RECOMMENDED:

1. Modern Automotive Mechanics by James E. Duffy.
2. Automotive Technology A System Approach by Jack Erjavec

AM-223 PROBLEMS IN I. C. ENGINES

Instructional Objectives:

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

1 Understand the engine problems, symptoms and leakages.

1.1 Identify the General problems of an engine and their symptoms.
1.2 Describe causes their symptoms and remedies of following leakages.

- 1.2.1 Engine oil Leakage (Internal & External).
- 1.2.2 Engine Coolant Leakage (Internal & External).
- 1.2.3 Intake vacuum leakage.
- 1.2.4 Exhaust gas leakage.

1.3 Explain the causes and remedies of following different colors of engine exhaust smokes.

- 1.3.1 Black color of exhaust smoke.
- 1.3.2 Blue color of exhaust smoke.
- 1.3.3 White color of exhaust smoke.

2 Understand the factors effecting on the engine power/performance.

2.1 Describe the effects of following factors on the engine power/performance.

- 2.1.1 Turbo charging/Super charging.
- 2.1.2 Scavenging.
- 2.1.3 Venturi effect.
- 2.1.4 Exhaust gasses back pressure
- 2.1.5 Intake manifold.
- 2.1.6 Atmospheric pressure & temperature.

3 Understand the problems, their causes and remedies of piston, piston rings & piston pin.

3.1 Describe Heat stresses and their effects on Piston, piston rings, piston pin.
3.2 Describe scuffing and scoring of piston.
3.3 Describe causes of Piston expansion.
3.4 Describe purpose and types of piston rings.
3.5 Describe the causes and remedies of scuffing, sticking and breaking of piston rings.
3.6 Describe the causes and remedies of engine Blow-by.
3.7 Describe Specifications of piston Rings.
3.8 Explain the procedure and steps involved for inspection, dismantling and installation of piston rings.
3.9 Explain the methods of Piston pin fitting.

3.10 Describe the effects of contraction and expansion of piston pin.
3.11 Enlist the causes of piston pin knocking.
3.12 Explain the procedure and steps involved for piston installation in engine cylinder.

4 Understand the problems, their causes and remedies of engine cylinders.

4.1 Describe the causes and remedies of cylinder ovality & tapperness.
4.2 Describe the causes and remedies of cylinder tapperness.
4.3 Explain the effects of heat stresses on cylinder wear & tear.
4.4 Describe the causes and remedies of cylinder Scuffing, scoring and distortion.
4.5 Describe the procedure and steps involved for measuring the Ovality and tapperness of the cylinder.

5 Understand the problems, their causes and remedies of connecting rod.

5.1 Describe the purpose and types of Connecting Rod with respect to its sections.
5.2 Describe the causes and remedies of bending and twisting of connecting rod.

6 Understand the problems, their causes and remedies of crankshaft.

6.1 Describe the factors causing effects on crankshaft performance.
6.2 Describe the causes and remedies of deflection, bending cracking, rapid wear & Twisting of crankshaft.
6.3 Identify the factors involved in crankshaft damages.
6.4 Describe the procedure for dynamic balancing of crankshaft.

7 Understand the problems, their causes and remedies of valve train mechanism.

7.1 Describe the causes and remedies of Sticking, bending, breakage and burning of engine valves.
7.2 Describe the causes and remedies of broken engine timing belt /timing chain and its effects on the operation of engine valves.
7.3 Describe the Camshaft lobe lift, and shapes of different types of cam lobes and their effects.
7.4 Describe the procedure and steps involved for setting of engine valve clearance adjustment.
7.5 Describe the procedure and steps involved for the setting of engine timing belt/chain.
7.6 Explain the procedure and steps involved for the setting of engine timing gears.
7.7 Describe the working principle of Variable Valve timing-intelligent system (VVT-i).
7.8 Describe the causes and remedies of problems of Variable Valve timing-intelligent system (VVT-I, i-Vtech).

8 Understand the problems, their causes and remedies of engine combustion chamber.

8.1 Explain the types of combustion chamber and their features.
8.2 Compare the Direct combustion chamber and indirect combustion chamber.
8.3 Explain the delay period and its effects.
8.4 Describe the Controlled and uncontrolled combustion.

8.5 Describe the procedure for Decarburizing of combustion chamber.

9 Understand the problems, their causes and remedies of engine cylinder head.

9.1 Explain the causes and remedies of cracking and leakages of cylinder head.
9.2 Explain Cylinder Head Warpage.
9.3 Explain causes and remedies of blown gasket of cylinder head.

10 Understand the problems, their causes and remedies of engine bearings.

10.1 Describe the function, types and working of engine Bearings & bushes.
10.2 Describe the causes and remedies of failure of engine bearings & bushes.

11 Understand the problems, their causes and remedies of engine knocking.

11.1 Describe the causes and remedies of engine following faults.

- 11.1.1 Pre-ignition.
- 11.1.2 Detonation.
- 11.1.3 Back Firing.
- 11.1.4 Engine Missing

11.2 Describe the causes and remedies of Diesel engine Knocking (Delay Period, Low Quality of Fuel, Compression ratio, Engine speed).
11.3 Describe the causes and remedies of following engine noises.

- 11.3.1 Hisses.
- 11.3.2 Rattles.
- 11.3.3 Popping.
- 11.3.4 Knocking.

12 Understand the problems, their causes and remedies of engine cooling system.

12.1 Describe the causes and remedies of following problems of engine cooling system.

- 12.1.1 Engine Overheating.
- 12.1.2 Leakage of coolant.
- 12.1.3 Faulty Thermostat Valve.
- 12.1.4 Scale in water Jackets.
- 12.1.5 Faulty Water Pump.
- 12.1.6 Faulty Radiator Pressure Cap.
- 12.1.7 Faulty Electric Fan.
- 12.1.8 Faulty Fan Belt.

12.2 Describe the causes and remedies of under cooling of an engine.
12.3 Explain the effects of dirt, scale, oil leakage in cooling water, and cavitations on engine cooling

system.

12.4 Describe the procedure for straight and reverse flushing of engine cooling system.

13 Understand the problems, their causes and remedies of engine lubricating system.

13.1 Describe the causes and remedies of following problems of the engine Lubricating system.

13.1.1 Engine Oil Contamination.
13.1.2 Oil Sludge formation.
13.1.3 Under Lubrication
13.1.4 Over Lubrication
13.1.5 Faulty Oil Filter.
13.1.6 Faulty Oil Pump.
13.1.7 Faulty oil Pressure gauge sending unit.
13.1.8 Blown Oil seals

13.2 Describe Oil Rating and Viscosity index No's.

13.3 Discuss the Procedure and steps involved for Change of engine oil and oil filter.

14 Understand the problems, their causes and remedies of ignition system.

14.1 Describe the Firing order for 3, 4, 6, 8 & 12 Cylinder engines.

14.2 Describe the procedure and steps involved for checking for modern electronic types of ignition system.

15 Understand the problems, their causes and remedies of engine fuel system.

15.1 Describe the causes and remedies of following problems of engine fuel systems.

15.1.1 Excessive Fuel Consumption.
15.1.2 Engine Dieseling.
15.1.3 Engine Missing.
15.1.4 Fuel Blockage.
15.1.5 Electrical fuel pump assembly
15.1.6 Fuel Lines
15.1.7 Fuel pressure regulator
15.1.8 Purge control valve
15.1.9 Fuel injector

16 Understand the use of automotive diagnostic scanner for fault finding of IC engine problems.

16.1 Describe the procedure for the use of automotive diagnostic Scanner for following engine problems.

16.1.1 Faulty Ignition System.
16.1.2 Faulty EFI system.
16.1.3 Faulty VVT-i System & electronic mechanism.

17 Understand engine/vehicle emissions control systems.

17.1 Describe the engine emissions and vehicle emissions.
17.2 Describe the function and working of positive crankcase ventilation system (PCV system).
17.3 Describe the function and working of electronically controlled exhaust gas recirculating system (E.G.R System).
17.4 Describe the function and working of catalytic convertor.
17.5 Describe the function and working of Air Injection System
17.6 Function and working of Fuel evaporative emission control system

18 Understand steps & procedure for engine overhauling.

18.1 Describe the purpose & types of engine overhauling.
18.2 Describe in detail the steps and procedure involved for dismounting engine from the Vehicle.
18.3 Describe in detail the steps and procedure for top overhauling of petrol/diesel engine.
18.4 Describe in detail the steps and procedure involved for the complete overhauling of :

18.4.1 Petrol engine.
18.4.2 Diesel engine.
18.4.3 4-stroke Motorcycle engine

19 Understand engine break-in.

19.1 Describe importance of engine break-in.
19.2 Explain various methods of Engine break-in.
19.3 Describe motoring the engine.
19.4 Explain Causes of Engine motoring.

20 Understand engine out-put testing.

20.1 Describe Engine testing.
20.2 Explain Parameters of engine testing.
20.3 Explain engine power rating.
20.4 Describe the Procedure for testing of engine output with dynamometer.
20.5 Describe types of engine efficiency.

20.5.1 Mechanical efficiency.
20.5.2 Thermal efficiency.
20.5.3 Volumetric efficiency.

21 Understand the Power plant / Generator (types, operating, testing, and troubleshooting).

21.1 Understand the Purpose of Diesel Engine Power Plant / Generator.
21.2 Enlist the main Components of Diesel Engine Power Plant / Generator.
21.3 Describe the Working principle of Diesel Engine Power Plant / Generator

AM-223 PROBLEMS IN I. C. ENGINES

List of Practical:

1. Inspect and identify the various engine leakages.
2. Diagnose faults after study of color of engine exhaust smoke.
3. Using inside Micrometer find out the tapperness and ovality of an engine cylinder.
4. Identify the scuffing and scoring of piston and engine cylinder.
5. Locate the faults of engine overheating and rectify them.
6. Perform the straight and reverse flushing of engine cooling system.
7. Change the engine oil with oil filter.
8. Check the working of thermostat valve using thermometer in boiling water.
9. Practice to locate the excessive blow-by problem of an engine.
10. Practice to replace engine timing belt.
11. Practice to adjust the valve clearance of an engine.
12. Locate the cylinder head cracks and Wrapage by different methods.
13. Dismantle the engine and identify the engine bearings failure.
14. Decarbonize the cylinder head.
15. Identify the noise of piston pin knocking.
16. Identify different types of combustion chambers.
17. Identify the noise of pre-ignition and detonation of an engine.
18. Identify the causes and remedies of engine missing.
19. Practice to measure the compression pressure of a petrol and diesel engine.
20. Measure the engine speed by using a digital tachometer.
21. Practice to find out the effects of wrong firing order.
22. Using Micrometer measure the cam lobe lift of camshaft.
23. Identify the difference between petrol and diesel engines.
24. Practice using automotive diagnostic scanner to find out different faults of engine systems.
25. Perform Petrol/Diesel engine cylinder leakage test.
26. Perform complete overhauling of a petrol engine.
27. Perform Complete overhauling of diesel engine
28. Visit at diesel engine Power Plant for the demonstration of working and testing of Power Plant / Generator.
29. Visit at a modern automotive workshop for the demonstration of different kinds of automotive diagnostic equipment.

AM-233 SUSPENSION, STEERING & BRAKES

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

Pre-requisite: Workshop Practice-I

LEARNING OUTCOMES:

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

Details 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 Vehicle sprung & un-sprung weight.
1.4 Independent, semi-independent and Non-independent Suspension system.
1.5 Components of suspension system.
- 1.5.1 Control arm
- 1.5.2 Steering knuckle.
- 1.5.3 Ball Joint.
- 1.5.4 Springs (coil and leaf)
- 1.5.5 Pivot shaft.
- 1.5.6 Shock Absorber.
- 1.5.7 Control arm bushing.
- 1.5.8 Stabilizer Bar
- 1.5.9 Idler Bar
- 1.5.10 Z-links

1.6 Springs used in suspension system.
- 1.6.1 Leaf Springs.
- 1.6.2 Coil Springs
- 1.6.3 Torsion bar spring.
- 1.6.4 Air Spring.

1.7 Performance of all suspension system springs.
1.8 Purpose of Shock Absorber.
1.9 Construction, types and working principle of Shock absorber.
1.10 Faults in shock absorber
- 1.10.1 Worn Out.
- 1.10.2 Damaged.
- 1.10.3 Oil, Air and Gas leakage.
- 1.10.4 Bended /deflected.

1.11 Methods to change shock absorber.
1.12 Replacement of springs (Coils Spring, Leaf spring and torsion bar).
1.13 Remedies for the following faults in springs
- 1.13.1 Fatigue.
- 1.13.2 Curb height
- 1.13.3 Curb weight.

1.14 Types of front Suspension System.
- 1.14.1 Long and short arm Suspension System.
- 1.14.2 Independent Front Suspension system with ball joints.
- 1.14.3 Independent Front Suspension system with king pin.
- 1.14.4 Front Axle Suspension with Leaf Springs.
- 1.14.5 Torsion bar Suspension system.
- 1.14.6 Macpherson strut Suspension system.
- 1.14.7 Aromatics Suspension system.

1.15 Types of Rear Suspension system.
- 1.15.1 Non-independent Suspension system.
- 1.15.2 Dead axle (Leaf spring suspension system & Coil spring
- 1.15.3 Suspension system).
- 1.15.4 Semi- independent Suspension system.
- 1.15.5 Independent rear Suspension system.

1.16 Types & parts of Electronic controlled suspension system
1.17 Purpose of vehicle suspension system leveling.
1.18 Active & adaptive suspension leveling system
1.19 Servicing of Ball joints , Control arm bushing, Strut, Stabilizer bar, torsion bar.
1.20 Servicing of springs.
1.21 Problems of Suspension systems.

STEERING SYSTEM

2. Construction, types, working, fault diagnosing, servicing and overhauling of vehicle steering system. 16 Hours

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 Types 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, center link (relay rod), idler arm, steering knuckle arm, tie rod, and steering knuckle.

2.12 Function of Power Steering.

2.13 Pascal's Law.

2.14 Main components of Power steering System.

2.15 Construction and working of following types of Power Steering Systems.

2.15.1 Rack & Pinion type power Steering system.

2.15.2 Electronically controlled type Power Steering System.

2.16 Characteristics of fluid used in Power steering System.

2.17 Electronic controlled type power steering system

2.18 Types of Electronic Power Steering Systems.

2.19 Faults and remedies of Electronic controlled Power steering System.

2.20 Purpose of steering geometry.

2.21 Steering Geometry angles (Caster, Camber, King pin Inclination, Toe-in, Toe-out, &Toe out on turn).

2.22 Effects of minor change in Steering geometry angles on vehicle.

2.23 Procedure for checking the Steering Geometry angles (Caster, Camber, King Pin Inclination, Toe-in, or Toe-out).

2.24 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).

2.25 Procedure for the computerized wheel Alignment of a vehicle.

2.26 Causes and remedies of following problems: under & over steer, steering wheel play, Tramp, shimmy, Bubbling, Poor return, excessive wheel play, pulling or drifting, Hard Steering, wandering, of steering system).

2.27 4-wheel steering system.

BRAKE SYSTEM

3. Purpose, construction, working, fault diagnosing and Servicing of brake System.

16 Hours

3.1 Purpose of Brake System.

3.2 Construction, working principle, and working of each component of following types of Brake Systems.

- 3.2.1 Mechanical Brake System.
- 3.2.2 Hydraulic Brake System (Disk and Drum type).
- 3.2.3 Hydraulic type (vacuum assisted) Power Brake System.
- 3.2.4 Pneumatic Brake System.
- 3.2.5 Electric Brake System.
- 3.2.6 Regenerative 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, construction and working of following types of vehicle electronic controlled assisted brake systems.

- 3.6.1 Anti-Lock Braking System (ABS System).
- 3.6.2 Electronic brake Force Distribution system (EBD System).
- 3.6.3 Vehicle Stability Control System (VSE).
- 3.6.4 Vehicle Electronic Traction Control System (VTC).
- 3.6.5 Vehicle Automatic Parking Brake System.
- 3.6.6 Vehicle Electro-pneumatically controlled exhaust brake system.
- 3.6.7 Brake Assist

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

4. Purpose, construction, types & working of wheel and tire. 12 Hours

4.1 Purpose of Wheels.

4.2 Construction and types of wheels.

4.3 Causes of wheel unbalancing.

4.4 Importance of Wheel balancing.

4.4.1 Method of wheel balancing (Static and Dynamic methods).

4.4.2 Computerized method of wheel balancing.

4.4.3 Hub & Wheel Bearing Assembly.

4.5 Purpose of tire.

4.6 Types of tires (tube & tubeless tire).

4.7 Construction of following types of tire.

4.7.1 Bias type tire.

4.7.2 Belted Bias Tire.

4.7.3 Radial Ply Tire.

4.8 Ply rating.

4.9 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, tire date).

4.10 Purpose of tube.

4.11 Material, valve stem, cap and care of tube valve.

4.12 Vulcanizing.

4.13 Equipments needed for vulcanizing.

4.14 Material and steps to be taken for vulcanizing.

4.15 Tire retarding

4.16 Procedure for tire inflation.

4.17 Checking of tire pressure.

4.18 Importance of tire rotation & rotation pattern.

4.19 Effect of tire over-inflation, under-inflation, toe-in, toe-out, camber, cornering, wear & unbalanced tire and rim.

4.20 Tire pressure electronically monitoring system.

4.21 Wheels (rim) and its types.

SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

5. Purpose, construction and working of supplemental restraint system (SRS) air bag control system. 4 Hours

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 Books:

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

AM-233 SUSPENSION, STEERING & BRAKES

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 Describe sprung & unsprung weight of vehicle.
    - 1.4 Describe the Independent and Non-independent Suspension system semi-independent suspension system.
    - 1.5 Identify the Components of suspension system.
        - 1.5.1 Control arm
        - 1.5.2 Steering knuckle.
        - 1.5.3 Ball Joint.
        - 1.5.4 Springs (coil and leaf)
        - 1.5.5 Pivot shaft.
        - 1.5.6 Shock Absorber.
        - 1.5.7 Control arm bushing.
        - 1.5.8 Stabilizer bar
        - 1.5.9 Idler bar
        - 1.5.10 Z link
    - 1.6 Describe the types of springs used in the suspension system.
        - 1.6.1 Leaf Springs.
        - 1.6.2 Coil Springs
        - 1.6.3 Torsion bar.
        - 1.6.4 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
        - 1.10.1 Worn Out.
        - 1.10.2 Damaged.
        - 1.10.3 Oil leakage, Air leakage and Gas leakage.
        - 1.10.4 Bended /deflected.
    - 1.11 Describe the methods to change the shock absorber.
    - 1.12 Replacement of springs (Coils Spring, Leaf Spring and torsion bar).
    - 1.13 Describe Remedies for the following faults in springs

1.13.1 Fatigue.
1.13.2 Curb height
1.13.3 Curb weight.

1.14 Explain the Types of front Suspension System.

1.14.1 Long and short arm Suspension System.
1.14.2 Independent Front Suspension system with ball joints.
1.14.3 Independent Front Suspension system with king pin.
1.14.4 Front Axle Suspension with Leaf Springs.
1.14.5 Torsion bar Suspension system.
1.14.6 Macpherson strut Suspension system.
1.14.7 Aromatics Suspension system.

1.15 Explain the types of Rear Suspension system.

1.15.1 Non-independent Suspension system.
1.15.2 Dead axle (Leaf spring suspension system & Coil spring
1.15.3 Suspension system).
1.15.4 Semi-independent Suspension system.
1.15.5 Independent rear Suspension system.

1.16 Types & parts of Electronically controlled suspension system
1.17 State purpose of vehicle suspension system leveling.
1.18 Describe Active & adaptive suspension leveling system
1.19 Explain the Servicing of Ball joints , Control arm bushing, Strut,
1.20 Stabilizer bar, torsion bar.
1.21 Describe Servicing of springs.
1.22 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 Describe Steering lock types.
2.5 Define energy absorbing steering column.
2.6 Describe different types of energy absorbing steering column.
2.7 Compare rigid, tilt and collapsible types 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, center link (relay rod), idler arm, steering knuckle arm, tie rod, and steering knuckle.

2.12 State the function of Power Steering.

2.13 Define the "Pascal's Law".

2.14 Enlist the Main components of Power steering System.

2.15 Describe the Construction and working of following types of Power steering Systems.

a. Rack & Pinion type power Steering system.

b. Electronically controlled type Power Steering System.

2.16 State the characteristics of fluid used in Power steering System.

2.17 Construction and working of following types of Electronically Power Steering Systems.

2.18 Describe Types of Electronic Power Steering Systems.

2.19 Describe the faults and their remedies in Electric type of Power steering System.

2.20 State the purpose of steering geometry.

2.21 Describe the Steering Geometry angles (Caster, Camber, King pin Inclination, Toe-in, Toe-out, Toe out on turn).

2.22 Describe the effects of minor change in Steering geometry angles on vehicle.

2.23 Explain the procedure for checking the Steering Geometry angles (Caster, Camber, King Pin Inclination, Toe-in, or Toe-out).

2.24 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).

2.25 Describe the procedure for the computerized wheel Alignment of vehicle.

2.26 Describe the causes and remedies of following problems. (under steer & oversteer, steering wheel play, Tramp, Bubbling, Poor return, excessive wheel play, pulling or drifting, Hard Steering of steering system) .

2.27 Describe 4-wheel 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.

3.2.1 Mechanical Brake System.

3.2.2 Hydraulic Brake System (Disk and Drum type).

3.2.3 Hydraulic type (vacuum assisted) Power Brake System.

3.2.4 Pneumatic Brake System.

3.2.5 Electric Brake System.

3.2.6 Regenerative type breaking 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 the following types of vehicles electronically controlled assisted brake systems.

3.6.1 Anti-Lock Braking System (ABS System).

3.6.2 Electronic brake Force Distribution system (EBD System).

3.6.3 Vehicle Stability Control System (VSE).

3.6.4 Vehicle Electronically Controlled Traction Control System (VTC).

3.6.5 Vehicle Automatic Parking Brake System.

3.6.6 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 TIRE

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.

4.4.1 Mechanical method of wheel balancing static and dynamic methods).

4.4.2 Computerized method of wheel balancing.

4.4.3 Hub & Wheel Bearing Assembly.

4.5 State the Purpose of tires.

4.6 Describe the types of tires (tube & tubeless tire).

4.7 Describe the construction of the following types of tire.

4.7.1 Bias type tire.

4.7.2 Belted Bias Tire.

4.7.3 Radial Ply Tire.

4.8 Define Ply rating.

4.9 Describe the following terminology of tire.
(Tire size, Tire maximum load rating, Tire maximum inflation pressure, Tread play, tread pattern, aspect ratio, Dot No, tire grade,

Tire wear, tire traction, tire temperature resistance).

4.10 State the Purpose of tube.

4.11 Describe tube material, valve stem, cap and care of tube valve.

4.12 Define vulcanizing.

4.13 Enlist equipment needed for vulcanizing.

4.14 Describe the materials and steps to be taken for vulcanizing.

4.15 Describe tire retarding

4.16 State procedure for tire inflation.

4.17 Describe checking of tire pressure.

4.18 Describe the importance of tire rotation & rotation pattern.

4.19 Describe the effect of tire over inflation ,under inflation, toe-in, toe-out, camber, cornering, wear & unbalanced tire and rim on the vehicle performance.

4.20 Describe the tire pressure electronically monitoring system.

4.21 Describe the wheels (rim) and its types.

SUPPLEMENTARY RESTRAINED SYSTEMS (SRS)

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.

AM-233 SUSPENSION, STEERING & BRAKES

List of practicals:

1. Draw the Lay-out of Suspension System.
2. Remove leaf springs from the frame dismantle, check and reassemble.
3. Remove coil springs from front suspension, check and refit.
4. Dismantle shock absorber, inspect, service and refit.
5. Perform complete overhauling of front suspension (independent) and refit it.
6. Perform removal of steering gearbox, servicing and refitting.
7. Visually inspect and report the steering wheel free play and diagnose fault
8. Dismantle, service, replace & refit tie rod ball joint end & rubber bushes.
9. Check & adjust camber angle, caster angle and toe-in by using computerize wheel alignment equipment.
10. Perform wheel Balancing on computerize wheel balancing machine.
11. Disassemble, service and assemble the drum type brake assembly.
12. Disassemble, service and assemble the disk type brake assembly.
13. Perform bleeding of hydraulic brake system.
14. Adjust the free play of brake pedal.
15. Perform brake shoes adjustment.
16. Service ABS type brake system.
17. Dismantle, inspect, refill and assemble the telescopic shock absorber.
18. Physical test and check the working of shock absorber without removing it from the vehicle.
19. Remove & refit the vehicle wheel hub bearing.
20. Perform vehicle tire rotation using different tire rotation methods.
21. Perform visual inspection of suspension, steering and brake system.
22. Perform visual inspection of vehicle tire and wheel.
23. Perform removing wheel from the vehicle, tire from the rim by using tire changer Machine & repair puncture/volcanize it, refit, and reinstall.
24. Visit to a Modern Automotive workshop, and prepare a report (Computerize wheel alignment & computerize wheel balancing).

AM-244 WORKSHOP PRACTICE-II

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

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

LEARNING OUTCOMES:

1. Understand the use of different tools, instruments, equipment for disassembly, assembly and testing of the engines.
2. Locate the faults of engine systems.
3. Understand the steps of automotive machining and finishing.
4. Familiarize with quality control standards.

Detail of Contents:

AUTOMOTIVE HAND TOOLS

1 Use of automotive hand tools **12 Hours**

1.1 Automotive hand tools:

- 1.1.1 Screwdriver (Flat Philips, impact & torx)
- 1.1.2 Hammers
- 1.1.3 Pliers
- 1.1.4 Lock Pliers.
- 1.1.5 Spanners & Wrenches Set
- 1.1.6 (Open end, Box type, Combination, Off set, Tubing)
- 1.1.7 Socket set (with all accessories).
- 1.1.8 Torque wrench
- 1.1.9 Pullers (Gears, Bearing, Pulleys, Steering).
- 1.1.10 Oil Seal extractors and installers.
- 1.1.11 Tube bender, Tube cutter and flaring tool.
- 1.1.12 Strap Wrench (Oil Filter wrench)
- 1.1.13 Automotive Stethoscope
- 1.1.14 Valve Spring Compressor.
- 1.1.15 Piston Ring Compressor.
- 1.1.16 Piston Ring Expander.
- 1.1.17 Grease Gun
- 1.1.18 Flexible wire magnet.
- 1.1.19 Pop Rivet Plier.
- 1.1.20 Tin Snips.

1.1.21 Hack Saw.
1.1.22 Punches & Chisels.
1.1.23 Hollow punch set.
1.1.24 Spark plug spanner.
1.1.25 Allen Key

AUTOMOTIVE MEASURING TOOLS

2 Use of automotive measuring tools. 4 Hours

2.1 Automotive measuring tools.

2.1.1 Steel Foot rule.
2.1.2 Spring Scale.
2.1.3 Vernier Caliper (Manual & digital)
2.1.4 Micrometer e.g. Screw Gauge (inside & outside).
2.1.5 Dial Gauge.
2.1.6 Depth gauge.
2.1.7 Thickness / Feeler gauge.
2.1.8 Thread pitch gauge
2.1.9 Wire gauge.
2.1.10 Belt tension gauge.
2.1.11 Telescoping gauge.
2.1.12 Tire Pressure gauge.

AUTOMOTIVE WORKSHOP EQUIPEMENT.

3 Purpose, types and use of automotive equipment. 12 Hours

3.1 Automotive equipment.

3.1.1 Chain Pulley Block.
3.1.2 Car Lift (Post Lift, Scissor Lift, Hydraulic lift)
3.1.3 Crane (hydraulic, pneumatic).
3.1.4 Spark Plug Cleaner Machine.
3.1.5 Automotive Tire changer.
3.1.6 Electronic Injector Testing Machine.
3.1.7 Ultrasonic Injector Cleaner
3.1.8 Heavy Duty Digital Tire inflator.
3.1.9 Engine repairing stand and repair trolley.
3.1.10 Compressor and pneumatic tool.
3.1.11 Ramp & Pits.
3.1.12 Waste Oil Receptacle.
3.1.13 Hydraulic press.
3.1.14 Mechanical Arbor press.

3.1.15 Drill Machine (Bench & Portable).
3.1.16 Grinder (Bench & Portable)
3.1.17 Radiator Pressure Cap tester.
3.1.18 Stud extractor.
3.1.19 Conveyers.
3.1.20 Jack (mechanical, hydraulic)
3.1.21 Safety stands (Floor stands).
3.1.22 Creeper.
3.1.23 Valve Grinding and Refacing Machine.
3.1.24 Cleaning Tank.

FASTNERS.

4 Function, types and construction of fasteners. 4 Hours

4.1 Purpose of Fasteners.
4.2 Fasteners and their 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.

5 Purpose and use of automotive testing instruments. 6 Hours

5.1 Instruments on engine.
5.1.1 Tachometer.
5.1.2 Compression Gauge.
5.1.3 Vacuum Gauge.
5.1.4 Engine Leakage Tester.

AUTOMOTIVE DIAGNOSTIC / TESTING

6 Purpose and use of automotive diagnostic techniques. 4 Hours

6.1 Automotive Diagnostic Techniques.
6.1.1 Describe the basic rules (steps) for diagnosing troubles.
6.1.2 Enlist troubles of vehicles in the light of driver complaints.
6.1.3 Identification of engine noises, their causes and their possible remedies.
6.1.4 Identification of engine faults , their causes and their possible remedies

7 Use of engine analyzer, engine diagnostic scanner, dynamometer and exhaust gas analyzer. 3 Hours

7.1 Purpose of Dynamometer.
7.2 Types (Electrical and Hydraulic type), and use of Dynamometer for testing Brake power and fuel consumption of an engine.
7.3 Universal Automotive Diagnostic Scanner/OBD-III
7.4 Purpose of Exhaust Gas Analyzer.
7.5 Safety Precautions for Tools and equipment.

AUTOMOTIVE LUBRICANTS / SEALS / GASKETS / BEARINGS.

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 Vehicle lubrication (necessary points)

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 Seal and Gasket failures.

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 vehicles with special reference to load and size.
10.4 Inspection of antifriction bearing.
10.5 Methods of removing and installing of bearing.

ENGINE MACHINING & REFINISHING

11. Importance and use of engine machining & refinishing 4 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.
11.5 Cylinder head grinding.
11.6 Flywheel grinding.

QUALITY CONTROL

12. Standards and their certification. **2 Hours**

12.1 Quality Control Standards for the following

- 12.1.1 Worker's timing.
- 12.1.2 Just in time (J.I.T)
- 12.1.3 Brain Storming.
- 12.1.4 Data Collection.
- 12.1.5 Quality Control and their Systematic application.

13. Quality and its measures. **3 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.
13.7 Euro standard for vehicle emission

SAFETY & PREVENTION

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

14.1 Accidents and their prevention.
14.2 Causes of Fire hazards.
14.3 Describe the types of Fire.
14.4 Methods of fire extinguishing.
14.5 Types and use of fire extinguishers.
14.6 PASS Method for fire extinguisher.

P- Pull to safety pin
A- Aim to seat of fire
S-Squeeze the valve
S-Sweep

Recommended Textbooks:

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

AM-244 WORKSHOP PRACTICE-II

Instructional Objectives:

AUTOMOTIVE HAND TOOLS

1 Understand the use of automotive hand tools

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

1.1.1 Screwdriver (Flat, Philips/, impact)
1.1.2 Hammers
1.1.3 Pliers
1.1.4 Lock Pliers.
1.1.5 Spanners & Wrenches Set
1.1.6 (Open end, Box type, Combination, off set, Tubing)
1.1.7 Socket set (with all accessories).
1.1.8 Torque wrench
1.1.9 Pullers (Gears, Bearing, Pulleys, Steering).
1.1.10 Oil Seal extractors and installers.
1.1.11 Tube bender, Tube cutter and flaring tool.
1.1.12 Strap Wrench (Oil Filter wrench)
1.1.13 Automotive stethoscope
1.1.14 Valve Spring Compressor.
1.1.15 Piston Ring Compressor.
1.1.16 Piston Ring Expander.
1.1.17 Grease Gun
1.1.18 Flexible wire magnet.
1.1.19 Pop Rivet Plier.
1.1.20 Tin Snips.
1.1.21 Hack Saw.
1.1.22 Punches & Chisels.
1.1.23 Hollow punch set.
1.1.24 Spark plug spanner.
1.1.25 Allen Key

AUTOMOTIVE MEASURING TOOLS

2 Understand the use of automotive measuring tools.

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

2.1.1 Steel Foot rule.

2.1.2 Spring Scale.

2.1.3 Vernier Caliper.

2.1.4 Micrometer (inside & outside).

2.1.5 Dial Gauge.

2.1.6 Depth gauge.

2.1.7 Thickness / Feeler gauge.

2.1.8 Thread pitch gauge

2.1.9 Wire gauge.

2.1.10 Belt tension gauge.

2.1.11 Telescoping gauge.

2.1.12 Tire Pressure gauge.

AUTOMOTIVE WORKSHOP EQUIPEMENTS.

3 Understand the purpose, types and use of automotive equipment.

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

3.1.1 Chain Pulley Block.
3.1.2 Car Lift (Post Lift, Scissor Lift, Hydraulic lift)
3.1.3 Crane (hydraulic, pneumatic).
3.1.4 Spark Plug Cleaner Machine.
3.1.5 Automotive Tire changer.
3.1.6 Electronic Injector Testing Machine.
3.1.7 Ultrasonic Injector Cleaner
3.1.8 Heavy Duty Digital Tire inflator.
3.1.9 Engine repairing stand and repair trolley.
3.1.10 Compressor and pneumatic tool.
3.1.11 Ramp & Pits.
3.1.12 Waste Oil Receptacle.
3.1.13 Hydraulic press.
3.1.14 Mechanical Arbor press.
3.1.15 Drill Machine (Bench & Portable).
3.1.16 Grinder (Bench & Portable)
3.1.17 Radiator Pressure Cap tester.
3.1.18 Stud extractor.
3.1.19 Conveyers.
3.1.20 Jack (mechanical, hydraulic)
3.1.21 Safety stands (Floor stands).
3.1.22 Creeper.
3.1.23 Valve Grinding and Refacing Machine.
3.1.24 Cleaning Tank.

INTRODUCTION OF FASTNERS.

4 Understand the function, types and construction of fasteners.

4.1 Describe the Purpose of Fasteners.
4.2 Describe Fasteners and its types.
4.3 Describe Fasteners threads, pitch, and size.
4.4 Describe Nuts and Lock washers and its types.
4.5 Describe the Purpose of Snap ring and its types.
4.6 Describe the Purpose of Rivet and its types
4.7 Describe Fasteners thread Lubrication.

AUTOMOTIVE ENGINE TESTING INSTRUMENTS.

5 Understand the purpose and use of automotive testing instruments.

5.1 Describe the function and use of following instruments on engine.

5.1.1 Tachometer.
5.1.2 Compression Gauge.
5.1.3 Vacuum Gauge.
5.1.4 Engine Leakage Tester.

AUTOMOTIVE DIAGNOSTIC/TESTING

6 Understand the purpose and use of automotive diagnostic techniques.

6.1 State the Purpose of Automotive Diagnosing Techniques.

6.1.1 Describe the basic rules (steps) of diagnosing troubles.
6.1.2 Enlist troubles of vehicles in the light of driver complaints.
6.1.3 Identification of engine noises, their causes and their possible remedies.
6.1.4 Identification of engine faults, their causes and their possible remedies.

7 Use of engine analyzer, engine diagnostic scanner, and exhaust gas analyzer.

7.1 State Purpose of Dynamometer.
7.2 Describe the types (Electrical and Hydraulic type), and use of Dynamometer for testing Brake power and fuel consumption of an engine.
7.3 Describe the use of Universal Automotive Diagnostic Scanner/OBD-III
7.4 State the Purpose of Exhaust Gas Analyzer.
7.5 Describe the Safety Precautions for Tools and equipment.

AUTOMOTIVE LUBRICANTS / SEALS / GASKETS / BEARINGS.

8 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 different points of Vehicle where Lubrication is necessary and Selection of proper Lubricant.

9 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.

10 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

11 Use of engine machining & refinishing

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.
11.5 Cylinder head grinding.
11.6 Flywheel grinding

QUALITY CONTROL

12 Understand the quality control standards and their certification.

12.1 Describe the Quality Control Standards for the following.

12.1.1 Worker's timing.
12.1.2 Just in time (J.I.T)
12.1.3 Brain Storming.
12.1.4 Data Collection.
12.1.5 Quality Control and their Systematic application.

13 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.
13.7 Describe Euro standard for vehicle emission

SAFETY & PREVENTION

14 Understand fire accident and their prevention.

14.1 Describe fire accidents and their prevention.
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
A- Aim to seat of fire
S- Squeeze the valve
S- Sweep

AM-244 WORKSHOP PRACTICE-II

List of Practical:

1. Identification of basic hand tools.
2. Practice to use Piston Ring Compressor.
3. Practice to use Valve Spring Compressor.
4. Practice to use Oil Filter wrenches.
5. Practice to bend, cut and Flare the tube.
6. Practice to change the tire by using the Jack (hydraulic & manual) properly.
7. Measure the size of Crankshaft Journal by Using Micrometer (screw gauge).
8. Practice the proper use of Pullers for the removal of Gears and Bearings,
9. Check the Ovality and tapperness of engine cylinder by using Dial Gauge.
10. Practice to use Chain 233Pulley 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.
12. Find the vacuum pressure of intake manifold using Vacuum Gauge.
13. Find the Leakage of compression pressure by using Cylinder Leakage Tester.
14. Check and adjust the ignition timing by using an Ignition Timing Gun.
15. Identify the different engine noises by using Stethoscope.
16. Perform the engine Tune-up (petrol & diesel).
17. Practice to use Automotive Diagnostic Scanner for Fault finding of Vehicle.
18. Identify the Vehicle Lubricating Points and lubricate them by using Grease Gun.
19. Identify the faults and change Engine Head Gasket.
20. Practice the use of different kinds of Fire Extinguisher.
21. Practice the use of potable drill machine.
22. Practice the use of potable grinder.
23. Test exhaust emissions by using of exhaust gas analyzer.
24. Visit at Modern Automotive workshop to observe proper use of different kinds of tools, instruments and equipment and prepare a visit report.

1.6.1

اسلامیات/مطالعہ پاکستان

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GEN 301

کل وقت 20 گھنٹے

نصاب سال سوئم

حصہ اول اسلامیات

حصہ دوئم مطالعہ پاکستان

موضوعات:

1۔ قرآن مجید:

سورۃ الفاتحہ، آیت الکرسی، سورۃ البقرہ کی آخری آیات از امن الرسول ﷺ تا آخر اور سورۃ اخلاق مع ترجمہ وتشریح

2۔ دس منتخب احادیث کا ترجمہ (تشریح)

() بنی الا سلام علی خمس شهادت انا الا اله الا لمر اقلم الصلوته و ایتا الزکوة و حج البیت و صوم رمضان

() الدین النصیحته

() المنشاء موتمن

() للمومن علی المومن سنت خصال یعود ماذا مرض و تژهده اذا مات و یحیبه اذا دعا

() لیسلم علیه اذا لقیه و لیثمته اذا عطس و فصیحله اذا غاب او شهد

() لا تخن من خانک

() لا یدخل الجنته قاتع

() ان الله حرم علیکم عقوق المهات و اضاعته المال

() لیسر اولا تعسر اولا تنفر

() ذاق طعم الایمان من مرضی بالله و با الا سلام دینابمجمدنبیا

() افضل الذکر لا اله الا الله

3۔ حقوق وفرائض:

حصول تعلیم بطور فرض، والدین اور اولاد کے حقوق وفرائض، ہمسایہ کے حقوق، بچوں کے حقوق، عورتوں کے حقوق، بزرگ شہریوں کے حقوق، مخنث افراد کے حقوق۔

4۔ اسلام کی اخلاقی اقدار:

صبر واستقلال، عفو ودرگزر، ایفائے عہد، اخوت، ایثار وقربانی۔

سال سوئم

حصہ اول اسلامیات

تدریس مقاصد

قرآن حکیم:

عمومی مقاصد: منتخب سورتوں اور آیات کی روشنی میں اسلام کے بنیادی مقاصد اور عبادات جان سکے

خصوصی مقاصد: طالب علم اس قابل ہو جائے گا کہ۔

سورۃ الفاتحہ، آیت لکرسی، سورۃ بقرہ کی آخری آیات ازمن الرسول سے اور سورۃ اخلاق کا ترجمہ وتشریح کر سکے

طالب علم درج ذیل کا مفہوم بیان کر سکے

- () رب العالمین صرف اللہ تعالیٰ ہے
- () اللہ رحم کرنے والا ہے
- () قیامت کے دن بادشاہی اللہ کی ہوگی
- () عبادات اور استعانت کا حقدار صرف اللہ ہے
- () طالب علم درج ذیل کا مفہوم بیان کر سکے
- () اللہ پاک ہر عیب سے پاک ہے
- () اللہ کے اسمائے حسنہ حق اور قیوم ہیں
- () تمام انبیاء پر ایمان لانا ضروری ہے
- () رسول، ملائکہ، کتب، سماویہ، پر ایمان لانا فرض ہے
- () اطاعت حقیقی صرف اللہ کے لیے ہے
- () اسلامی احکامات پر عمل کرنا امسانی بساط میں ہے
- () کفر کو اللہ کی مدد کے بغیر شکست نہیں دی جا سکتی
- () اللہ ایک ہے
- () اللہ کسی کا محتاج نہیں نہ اسکا کوئی شریک ہے

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 رہنمائی حاصل کر سکے

حقوق وفرائض:

عمومی مقاصد:

() اسلامی معاشرے کا ایک اچھا فرد بن سکے

خصوصی مقاصد:

() والدین کے حقوق وفرائض بیان کر سکے

() ہمسائیوں کے حقوق بیان کر سکے

() بچوں کے حقوق بیان کر سکے

() عورتوں کے حقوق کی پاسداری کر سکے

() بزرگ شہریوں کے حقوق کا خیال رکھ سکے

() مخنث حضرات کے حقوق جان سکے اور ان کے حقوق کی پاسداری کر کے انہیں معاشرے کا ایک مفید فرد بنایا جا سکے

() اسلام میں حقوق وفرائض کی آگاہی کی صورت میں اپنے اندر خدمت خلق کا جذبہ پیدا کر سکے

اسلامی اقدار:

عمومی مقاصد:

() طالب علم جان سکے گا کہ تعلیم کا مقصد حسن اخلاق سے متصف ہونا ہے

خصوصی مقاصد:

() اخلاق کے معنی ومفہوم کو بیان کر سکے

() اسلام میں حسن واخلاق کی اہمیت بیان کر سکے

() قرآن وسنت کی روشنی میں صبر واستقلال کی اہمیت بیان کر سکے

() ایفائے عہد کی اہمیت بیان کر سکے

() اخوت کے معنی ومفہوم بیان کر سکے

() اخوت اسلامی کی اہمیت بیان کر سکے

() اسلام کی اعلیٰ اقدار کو اپنا کر مثالی معاشرہ پیدا کر سکے

نصاب (سال سوئم)

GEN 301

مطالعہ پاکستان

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کل وقت 12 گھنٹے

حصہ دوئم

موضوعات:

() قیام پاکستان

() باؤنڈری کمیشن

() ریڈکلف ایوارڈ

() تقسیم بنگال

() تقسیم پنجاب

() مسئلہ مہاجرین

() ریاست کا الحاق

() ریاست جموں کشمیر

() نہری پانی کا تنازعہ

() قرارداد پاکستان

() علماء کے بائیس نکات

() 1956-1962-اور 1973 کے دساتیر کی اسلامی/انسانی حقوق کی دفعات (8 تا 28)۔

() اقلیتوں کے حقوق۔ دیگر محروم طبقات کے حقوق

() پاکستان کا محل وقوع اور اسکی جغرافیائی اہمیت۔ GSP+ کا تعارف اور عملی طریقہ کار

() قدرتی وسائل (تیل، گیس، کوئلہ)

مطالعہ پاکستان (حصہ دوئم)

قیام پاکستان

تدریس مقاصد:

عمومی مقاصد:

() قیام پاکستان کے بعد درپیش مسائل سے آگاہی حاصل کرے اور بیان کرے

خصوصی مقاصد:

() باؤنڈری کمیشن تشکیل اور اس کے فرائض بیان کر سکے

() ریڈکلف اور اس کے ایوارڈ کے بارے بیان کر سکے

() بنگال اور کلکتہ کی تقسیم کی وجوہات بیان کر سکے

() پنجاب کی تقسیم کی تفصیل بیان کر سکے

() مہاجرین کی آمد سے جو مسائل پیدا ہوئے انہیں بیان کر سکے

() ریاستوں کے الحاق کے بارے میں تفصیل بیان کر سکے

() ریاست جموں کشمیر کے بارے میں بیان کر سکے

() نہری پانی کے تنازعہ کو بیان کر سکے

() قرارداد مقاصد کی تفصیلات بیان کر سکے

() 22 علماء کے متفقہ اسلامی نکات بیان کر سکے

() 1973 کے آئین میں انسانی حقوق کی دفعات (8-28)۔اقلیتوں کے حقوق اور دیگر محروم طبقات کے حقوق کے بارے میں جان سکے

() قیام پاکستان کے بعد نفاذ اسلام کی کوششوں کو بیان کر سکے

() پاکستان کے محل وقوع اور اس کی جغرافیائی اہمیت بیان کر سکے اور GSP+ کے تعارف اور عملی طریقہ کار بیان کر سکے

() پاکستان میں قدرتی وسائل (تیل، گیس، کوئلہ) کے بارے میں بیان کر سکے

خصوصی مقاصد:

() احادیث کا ترجمہ بیان کر سکے

() احادیث کی تشریح کر سکے

() معاشرتی اور انفرادی زندگی میں احادیث سے رہنمائی حاصل کر سکے

حقوق وفرائض:

عمومی مقاصد:

() اسلامی معاشرے کا ایک اچھا فرد بن سکے

خصوصی مقاصد:

() والدین کے حقوق وفرائض بیان کر سکے

() ہمسائیوں کے حقوق بیان کر سکے

() بچوں کے حقوق بیان کر سکے

() عورتوں کے حقوق کی پاسداری کر سکے

() بزرگ شہریوں کے حقوق کا خیال رکھ سکے

() مخنث حضرات کے حقوق جان سکے اور ان کے حقوق کی پاسداری کر کے انہیں معاشرے کا ایک مفید فرد بنایا جا سکے

() اسلام میں حقوق وفرائض کی آگاہی کی صورت میں اپنے اندر خدمت خلق کا جذبہ پیدا کر سکے

اسلامی اقدار:

عمومی مقاصد:

() طالب علم جان سکے گا کہ تعلیم کا مقصد حسن اخلاق سے متصف ہونا ہے

خصوصی مقاصد:

() اخلاق کے معنی ومفہوم کو بیان کر سکے

() اسلام میں حسن واخلاق کی اہمیت بیان کر سکے

() قرآن وسنت کی روشنی میں صبر واستقلال کی اہمیت بیان کر سکے

() ایفائے عہد کی اہمیت بیان کر سکے

() اخوت کے معنی ومفہوم بیان کر سکے

() اخوت اسلامی کی اہمیت بیان کر سکے

() اسلام کی اعلیٰ اقدار کو اپنا کر مثالی معاشرہ پیدا کر سکے

نصاب (سال سوئم)

GEN 301

مطالعہ پاکستان

ٹی	پی	سی
1	0	1

حصہ دوئم

کل وقت 12 گھنٹے

موضوعات:

() قیام پاکستان
() باؤنڈری کمیشن
() ریڈکلف ایوارڈ
() تقسیم بنگال
() تقسیم پنجاب
() مسئلہ مہاجرین
() ریاست کا الحاق
() ریاست جموں کشمیر
() نہری پانی کا تنازعہ
() قرارداد پاکستان
() علماء کے بائیس نکات
() 1956-1962۔اور 1973 کے دساتیر کی اسلامی/انسانی حقوق کی دفعات (8 تا 28)۔
() اقلیتوں کے حقوق۔دیگر محروم طبقات کے حقوق
() پاکستان کا محل وقوع اور اسکی جغرافیائی اہمیت۔GSP+ کا تعارف اور عملی طریقہ کار
() قدرتی وسائل (تیل، گیس، کوئلہ)

غیر مسلم طلباء کے لیے
نصاب اخلاقیات (سال سوئم)

تدریس مقاصد:

عمومی مقاصد:

() ملکی ترقی کے لیے اعلیٰ اوصاف کے ساتھ بہتر طور پر ملک وملت کی خدمت کر سکے

خصوصی مقاصد: طالب علم اس قابل ہو سکے کہ

() موضوعات کا مطلب بیان کر سکے

() عملی زندگی سے مثالوں کی نشاندہی کر سکے

() موضوعات کی اہمیت بیان کر سکے

() اپنی شخصیت اور معاشرے پر موضوعات کے مطابق اثرات پیدا کرنے کے طریقے بیان کر سکے

() مثبت ذہن کے ساتھ کام کر سکے

() عدل وانصاف سے ادارہ میں، دفتر میں بہتر ماحول پیدا کر سکے

() ماحول کو اخلاقی طور پر پاکیزہ بنائے

() کارکنوں کی بہتر طور پر دل جوئی کر سکے

() کارکردگی میں اضافہ کر سکے

() باہمی احترام کی برکات سے استفادہ کر سکے

() بچوں کے حقوق بیان کر سکے

() عورتوں کے حقوق کی پاسداری کر سکے

() بزرگ شہریوں کے حقوق کا خیال رکھ سکے

() مخنث حضرات کے حقوق جان سکے اور ان کے حقوق کی پاسداری کر کے انہیں معاشرے کا ایک مفید فرد بنایا جا سکے

MGM-332 - Entrepreneurship and Freelancing

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

Pre-requisite: Computer Application

LEARNING OUTCOMES:

This course equips Automobile related technology students with

1. The knowledge and skills to navigate the exciting worlds of entrepreneurship and freelancing
2. The role of entrepreneurs in economic development
3. Business steps and business opportunities
4. The process of business registration
5. Comprehensive business plan
6. Creating an effective freelancing profile
7. Managing freelancing projects

COURSE CONTENTS

1 Introduction to entrepreneurship **4 Hours**

1.1 Introduction of entrepreneurship
1.2 Qualities of entrepreneur

2 Entrepreneurship for technologists **2 Hours**

2.1 Overview of the Industry.
2.2 Opportunities for DAE Professionals.
2.3 Expertise and adoptability as an entrepreneur

3 Entrepreneurship Process or steps **2 Hours**

3.1 Business plan
3.2 Financial Projections
3.3 Customer discovery
3.4 Customer development

4 Business Opportunities **3 Hours**

4.1 Production businesses
4.2 Specialty businesses
4.3 Service businesses

5 Quality Control **2 Hours**

5.1 Concept and advantages
5.2 Methods

6 Business registration Process in Pakistan 2 Hours

6.1 Registration process
6.2 Legal formalities
6.3 Importance of registration

7 Study of Pre-feasibilities 2 Hours

7.1 Pre-feasibilities

8 Entrepreneurship projects 2 Hours

8.1 Development of comprehensive business plan
8.2 AI and its applications

9 Introduction to Freelancing 4 Hours

9.1 What is Freelancing?
9.2 Benefits and Challenges of Freelancing
9.3 Popular Freelancing Platforms (e.g., Up work, Fiverr, Freelancer)
9.4 Freelancing vs. Traditional Jobs

10 Developing Marketable Skills 3 Hours

10.1 Identifying High-Demand Skills in Freelancing
10.2 Technical Skills (e.g., Graphic Design, Web Development, Content Writing)
10.3 Soft Skills (e.g., Communication, Time Management, Negotiation)
10.4 Continuous Learning and Skill Enhancement

11 Creating an Effective Freelancing Profile 2 Hours

11.1 Crafting a Professional Profile Bio
11.2 Portfolio Building: Showcasing Your Work
11.3 Setting Up Competitive Pricing and Packages
11.4 Writing Proposals That Get Noticed

12 Managing Freelancing Projects 2 Hours

12.1 Effective Communication with Clients
12.2 Understanding and Meeting Client Requirements
12.3 Time Management and Meeting Deadlines
12.4 Handling Revisions and Feedback

13 Growing and Sustaining a Freelance Career 2 Hours

13.1 Building a Personal Brand
13.2 Networking and Expanding Your Client Base
13.3 Handling Payments, Taxes, and Contracts
13.4 Dealing with Challenges: Difficult Clients and Downtime

Recommended Books

1. Burns, P., Hurst, J.D., (1996). Small Business and Entrepreneurship. Red Globe Press
2. Blank, S., (2013). The Four Steps to the Epiphany
3. Osterwalder, A., Pigneur, Y., (2010). Business Model Generation. John Wiley and Sons
4. Singh ,P.N., (1986). Developing Entrepreneurship for Economic Growth. New Delhi: Vikas publications.
5. Drucker, P.F., (2006). Innovation and Entrepreneurship. Harper Business
6. Miner, J.B., (1996).The 4 Routes to Entrepreneurial Success. Berrett-Koehler Publishers
7. Pre-Feasibility Study of different businesses by Small and Medium Enterprises Development Authority (SMEDA), Ministry of Industries and Production, Government of Pakistan.
8. The Gig Is Up: Thrive in the Gig Economy, Where Old Jobs Are Obsolete and Freelancing Is the Future by Olga Mizrahi

MGM-332 - Entrepreneurship and Freelancing

INSTRUCTIONAL OBJECTIVES

1 Introduction to entrepreneurship

1.1 Definition and Scope of Entrepreneurship
1.2 Importance of Entrepreneurship in Economic Development
1.3 What is entrepreneurship and who is an entrepreneur
1.4 Pros and Cons of an entrepreneurship
1.5 Skills and characteristics of an entrepreneur

2 Entrepreneurship for Technologists

2.1 Overview of the Industry
2.2 Role of DAE Professionals in Business
2.3 Technical Expertise and Innovation
2.4 Adaptability to Technological Changes

3 Entrepreneurship Process or steps

3.1 Components of a Business Plan
3.2 Importance of Goal Setting and Strategy
3.3 Developing Financial Projections
3.4 Customer Understanding Market Knowledge
3.5 Customer Validation

4 Business Opportunities

4.1 Production and Manufacturing Ventures
4.2 Specialty and Niche Markets
4.3 Opportunities in Service Sector

5 Quality Control

5.1 Define quality control
5.2 State the advantages of quality control
5.3 Explain methods of quality control

6 Business registration Process in Pakistan

6.1 Introduction to Business Registration
6.2 Significance of Legal Registration
6.3 Legal Structures for Businesses in Pakistan
6.4 Importance of Compliance

7 Study of Pre-feasibilities

7.1 Study of SMEDA (Small and Medium Enterprises Development Authority, Govt. of Pakistan) pre-feasibilities

8 Entrepreneurship projects

8.1 Application of the entrepreneurship knowledge to develop business idea considering the following aspects:
8.2 Idea and its potential
- 8.2.1 Potential customers
- 8.2.2 Financial plan
- 8.2.3 Marketing Plan
- 8.2.4 Comparison of Your Idea with Competitors

8.3 Describe AI and its applications.

9 Introduction to Freelancing

9.1 What is Freelancing?
9.2 Benefits and Challenges of Freelancing
9.3 Popular Freelancing Platforms (e.g., Up work, Fiverr, Freelancer)
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13.3 Handling Payments, Taxes, and Contracts
13.4 Dealing with Challenges: Difficult Clients and Downtime

MGM-332 - Entrepreneurship and Freelancing

List of Practicals:

1. Understand Entrepreneurship and Freelancing by exploring several entrepreneurial examples and Auto related Technology industry landscape and write a report.

2. Identify a niche and develop Portfolio by conducting market research and competitor analysis. Additionally build online portfolio on a suitable platform.

3. Develop ideas for potential Auto related Technology startups or freelancing ventures and give presentation.

4. Conduct market research to validate the feasibility of selected business ideas and submit report.
    1. Gather data on target market demographics, competitors, and industry trends.
    2. Analyze market demand and potential customer needs for Auto related Technology products or services.

5. Identify customer segments, value propositions, revenue streams, and key resources required.

6. Develop prototypes or minimum viable products (MVPs) for Auto related Technology startup ideas.
    1. Utilize Auto related Technology skills to build functional prototypes or proof-of-concept models.
    2. Test and iterate prototypes based on user feedback and market validation.

7. Create financial projections and budgets for Auto-related Technology startups or freelancing ventures.
    1. Calculate startup costs, operating expenses, and revenue forecasts.
    2. Explore funding options such as bootstrapping, crowdfunding, or seeking investment.
8. Provide constructive feedback and peer evaluation to enhance presentation skills.

9. Explore legal requirements and considerations for starting Auto-related Technology businesses.
    1. Discuss intellectual property protection strategies for inventions, designs, and innovations.
    2. Review sample contracts, agreements, and terms of service relevant to Auto-related Technology entrepreneurship.

10. Develop marketing plans and branding strategies for Auto-related Technology startups or freelancing ventures.
    1. Create promotional materials, such as logos, websites, and social media profiles.
    2. Explore digital marketing techniques, content creation, and online advertising platforms.

11. Simulate sales scenarios and customer interactions relevant to Auto related Technology products or services.
    1. Role-play sales pitches, negotiation tactics, and objection handling techniques.

12. Manage projects and tasks related to Auto related Technology entrepreneurship effectively.
    1. Utilize project management tools and techniques to plan, organize, and track progress.
    2. Prioritize activities, set deadlines, and allocate resources efficiently.

13. Organize networking events or industry talks with successful Auto-related Technology entrepreneurs and professionals.
    1. Facilitate opportunities for students to connect, collaborate, and learn from experienced practitioners.
    2. Encourage active participation in entrepreneurship communities and startup ecosystems.

14. Provide peer feedback and constructive criticism to support continuous improvement.
    1. Encourage students to critically evaluate their entrepreneurial mindset and readiness for future endeavors.

15. On boarding sessions on popular freelancing platforms, providing step-by-step guidance for creating account and searching for the suitable project and submit report.

16. Write project pitch/gig for applying on freelance project.

AM-313 CAD and Robotics

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

Pre-requisite: Computer Science Fundamentals.

LEARNING OUTCOMES.

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

1. Understand the importance of computer application in preparing drawingwith the help of Auto CAD software and organizing automation
2. Apply CAD commands to draw geometrical figures
3. Prepare drawing of Auto components by using Auto CAD software
4. Use CAD to make three dimensional simple views (3D view)
5. Know basic principles of computer applications in Automation (CAM)
6. Understand the basics of robotics and its importance
7. Understand different Robotic Control Systems

Details of Contents:

CAD

1 CAD (Computer Aided Design/Drawing) 4 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 4 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
2.5 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

4 Displaying Areas of a Drawing 2 Hours

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)

5 Working with Object Properties 3 Hours

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

6 Creating and Editing Shapes 8 Hours

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

7 Adding Text and Dimensions 4 Hours

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

8 Printing 3 Hours

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

9 Modeling in 3D 9 Hours

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 6 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) 4 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

ROBOTICS

12 Robotics 4 Hours

12.1 History & types of Robotics.
12.2 What is robot and its importance in production?
12.3 Application of robotics in industries and education.
12.4 Principle of robotics
12.5 Mechanical methods used in robotics
12.6 Components used in robotics (controller, actuators, sensors, power & structure)
12.7 Idea of computer programming for operation of robots
12.8 Types of operations/processes which can be done by robot e.g. assembling, fitting of engine parts, chassis and body of vehicle.
12.9 Welding techniques in vehicle body building with use of robots.
12.10 Robotic inspection of vehicle

13 Basics of Electronics 4 Hours

13.1 Voltage, Current, Resistance, Ohms' Law

13.2 Use of Breadboard, Resistors, LED's
13.3 Introduction to Audino Uno & Nano
13.4 Installing Arduino Coding.
13.5 Types of sensors (Digital & Analog)
13.6 Using Ultrasonic sensors for obstacle detection
13.7 Line following with IR sensors.
13.8 Temperature & Light sensors.
13.9 Introduction of actuators and output devices
13.10 Controlling motors with Arduino
13.11 . Buzzer. LEDs, and LCD display.

14 Robot Design, Control Systems & Programming 4 Hours

14.1 Writing Logic for movement, forward, backward, turn.
14.2 Chassis setup(2-wheel,4-wheel)
14.3 Wiring components properly
14.4 Robot control mechanism
14.5 Battery management & Safety.
14.6 Assembling sensors and motors on the chassis.
14.7 Robot motion control types
14.8 Point to point control.
14.9 Continuous path control
14.10 Controlled path control
14.11 Stop to stop control.
14.12 Robot control methods
14.13 Manual control
14.14 Wireless control
14.15 Fully autonomous control.

Recommended Textbooks:

1. Auto CAD-2012 for Engineers & Designers by Professor Smam Tichro.
2. Mastering Auto CAD 2008 and Auto CAD LT 2008 by George Omura.
3. Introduction to Robotics by J.J Craig
4. Fundamentals of robotics engineering by Harry H. Pool

AM-313 CAD and Robotics

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
1.2 Discuss the history of CAD
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
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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
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9.3 Describe Creating complex solids and surfaces
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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 Describe the history & types of Robotics.
12.2 Define robot and its importance in production
12.3 Describe the applications of robotics in industries and education.
12.4 Describe Principle of robotics
12.5 Describe Mechanical methods and components used in robotics
12.6 Describe the components used in robotics (controller, actuators, sensors, power & structure)
12.7 Describe Idea of computer programming for operation of robots
12.8 Describe Types of operations/processes which can be done by robot e.g. assembling, Fitting of engine Parts, chassis and body of vehicle.
12.9 Explain Welding techniques in vehicle body building with use of robots.
12.10 Explain the inspection of vehicle using robots.

13 Basics of Electronics

13.1 Describe Voltage, Current, Resistance, Ohms's Law
13.2 Describe the use of Breadboard, Resistors, LED's
13.3 Describe the introduction to Audino Uno & Nano
13.4 Describe the installation of Arduino Coding.
13.5 Identify the types of sensors (Digital & Analog)
13.6 Describe the using of Ultrasonic sensors for obstacle detection
13.7 Describe the line following with IR sensors.
13.8 Describe the Temperature & Light sensors.
13.9 Give the introduction of actuators and output devices
13.10 Identify the controlling motors with Arduino
13.11 . Describe Buzzer. LEDs, and LCD display.

14 Robot Design, Control Systems & Programming

14.1 Explain the writing Logic for movement, forward, backward, turn.
14.2 Describe the Chassis setup (2-wheel,4-wheel)
14.3 Understand the wiring components properly
14.4 Explain the Robot control mechanism
14.5 Describe the Battery management & Safety
14.6 Understand the basic principles of robot control mechanisms, including sensors, actuators, and controllers.

14.7 Explain how point-to-point control algorithms work to move a robot from one point to another.
14.8 Identify the different types of point-to-point control algorithms and their applications.
14.9 Explain how continuous path control algorithms follow a predefined path while moving a robot.
14.10 Explain how controlled path control algorithms adjust the robot's motion based on feedback from sensors.
14.11 Explain how stop-to-stop control algorithms bring a robot to a controlled stop at a specific point.
14.12 Explain how a human operator controls a robot using joysticks, buttons, or other interfaces.
14.13 Identify the applications of manual control in different robotic tasks.
14.14 Explain how a human operator controls a robot using a remote control or other wireless interfaces.
14.15 Explain how fully autonomous control system works.

List of Practicals:

1- Identify basic requirements of PC for loading AUTO CAD software into computer memory (Installation) and report them.
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- Draw an inclined line with Line command
9- Create a Layer for title block and draw title block with line command and assign layer to it. 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- Practice with Undo and Redo commands
15- Practice for Modify commands
16- Practice Basic drawing techniques
17- Practice Direct distance method
18- Practice Relative polar coordinate system
19- Practice Relative Cartesian coordinate system
20- Practice Absolute coordinate system
21- Draw detail of AUTO CAD screen/Graphical User Interface (GUI)
22- Practice of Key combinations and Function Key
23- Practice use of multimeter to measure volt, current and resistance.
24- Identify the different types of sensors & actuators (Digital & Analog).
25- Practice Arduino programming & digital output.
26- Practice the use of Breadboard making electronic Flip-flop circuit.
27- Practice the use of Arduino for controlling different applications (Motors, solenoids, buzzers.)
28- Practice the use of robotic arm (for the movement forward, backward, turn)
29- Practice controlling robot movement using mobile app.
30- Build a robot that avoids obstacles by turning.

AD-302 MOTOR VEHICLE DRIVING

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

Pre-requisite: I.C. Engine, Workshop Practice-I, Workshop Practice-II and Problems in I.C.Engine

LEARNING OUTCOMES:

1. Know driving techniques.
2. Understand the driving rules & regulations.
3. Understand the maintenance of a vehicle.

Detail of Contents:

1 Qualities of a good driver. 2 Hours

1.1 Main systems and components of Vehicle
1.2 Islamic Dua for traveling.
1.3 Fitness of driver w.r.t age, reaction time, state of mind, attitude, patience, cooperation.
1.4 Traffic Laws.
1.5 Standards for the driver vision and hearing.

2 Pre- starting inspection of a vehicle. 4 Hours

2.1 Pre-staring inspection of a Vehicle.
2.2 Checklist of Pre-staring inspection of a Vehicle.
2.3 Following pre-starting inspection of a Vehicle:

- 2.3.1 Vehicle tire pressure.
- 2.3.2 Fuel level.
- 2.3.3 Oil pressure.
- 2.3.4 Coolant level.
- 2.3.5 Battery Electrolyte level.
- 2.3.6 Brake Fluid level.
- 2.3.7 Head Lights, Turn Signal Lights, brake light and Horn working.
- 2.3.8 Brake Paddle Play, Accelerator Paddle Play, Clutch Paddle Play.
- 2.3.9 Hand brake operation.
- 2.3.10 Steering operation.
- 2.3.11 Check the working of different interiors and exteriors of a car

3 Vehicle braking. 4 Hours

3.1 Purpose of Brake and parking brake.
3.2 Factors effecting Vehicle Stopping.
3.3 Types of road surfaces and their effects on braking.
3.4 Vehicle Skidding.
3.5 Road Resistance / Road Grip.
3.6 Over Speeding and its disadvantages.
3.7 Vehicle tires wear & tear and its limits.
3.8 Car Speed / Vehicle inertia to Braking.
3.9 Effects of following factors on Vehicle Braking:

- 3.9.1 Sharpness of Road turns.
- 3.9.2 Side Slope of road.
- 3.9.3 Road ascend and descends.

3.10 Brake Stopping distance.
3.11 Brake reaction time.
3.12 Braking time
3.13 Emergency brake stopping.
3.14 In case of brake failure, how to stop vehicle.

4 Motor vehicle Act, traffic regulations. 7 Hours

4.1 Introduction of Motor Vehicle Act.
4.2 Highway code of Pakistan.
4.3 Safety driving rules / right of way.
4.4 Different types of Road Signs i.e.

- 4.4.1 Mandatory Signs.
- 4.4.2 Warning Signs.
- 4.4.3 Informative Signs.

4.5 Different types of road marking i.e.

- 4.5.1 Dashed Lines.
- 4.5.2 Double Solid Lines.
- 4.5.3 Solid and Dashed Lines.
- 4.5.4 Edge Lines.
- 4.5.5 Top Lines.
- 4.5.6 Zebra Crossing Lines.

4.6 Traffic signal Lights.
4.7 Intersection.
4.8 State the following.

4.8.1 Traffic regulation laws.
4.8.2 Traffic Supervision.
4.8.3 Traffic Courts.

4.9 Punishments on violation of traffic rules in Pakistan.
4.10 Vehicle Registration procedure.
4.11 Vehicle Number Plate Specifications.
4.12 Vehicle Driving License procedure for

4.12.1 Learner License.
4.12.2 Motorcycle License.
4.12.3 Car / Light Transport Vehicle (LTV License).
4.12.4 Heavy Transport Vehicle (HTV License).
4.12.5 International Driving Permit.

5 Starting of an engine. 2 Hours

5.1 Setting position of choke on.
5.2 Pre-starting Glow Plug Time period.
5.3 Ignition Switch different Positions (Off, Acc, On, ST).
5.4 Release of Ignition switch key just after the engine start.
5.5 Engine Warm-up Period.
5.6 Glow of Oil pressure light, Battery charging light and Vehicle Malfunction Indication Light just after Starting the engine.
5.7 Abnormal engine noises.
5.8 Engine Stopping.

6 Level of skill in the use of driving aids and controls. 3 Hours

6.1 Driving aids and controlsAccelerator Paddle.

6.1.1 Clutch Paddle.
6.1.2 Brake Paddle.
6.1.3 Parking Brake.
6.1.4 Gear shift lever.
6.1.5 Steering wheel.
6.1.6 Back -view mirror.
6.1.7 Side-view mirror.
6.1.8 Turn signal lights.
6.1.9 Driver seat.
6.1.10 Condition of cab roof door, wind screen.
6.1.11 Horn.

6.2 Gear up-shifting and down-shifting.

6.3 Techniques in clutch releasing and accelerator paddle operation.
6.4 Vehicle steering techniques during reversing.

7 Safe driving in different situations. 2 Hours

7.1 Safe moving on Hills.
7.2 Parking on Hills.
7.3 Releasing and accelerator paddle operation during downward.
7.4 Techniques in rain, snow fall.
7.5 Techniques in Storm.
7.6 Techniques at night driving.
7.7 Head Lights (High Beam & low Beam).
7.8 Helmet during motorcycle driving.

8 Driving techniques. 2 Hours

8.1 Driving.

8.1.1 On turn.
8.1.2 On an uneven road.
8.1.3 In road marking traffic lanes
8.1.4 In city traffic

8.2 Use of Turn Signals.
8.3 Speed Limits.
8.4 Overtaking.
8.5 Proper Lane usage.
8.6 Right way to drive at Round about.

9 Function and use of automotive accessories. 3 Hours

9.1 Accessories of the vehicles.

Vehicle Immobilizer system.

9.1.1 Vehicle navigation system.
9.1.2 Vehicle communication system.
9.1.3 Vehicle tracking system.
9.1.4 Power window system.
9.1.5 Seat belt.
9.1.6 Night vision mode.
9.1.7 Climate control system.
9.1.8 Key less entry system
9.1.9 Cigarette lighter.
9.1.10 Central locking door system.
9.1.11 Power side mirror.
9.1.12 Vehicle Rear camera.
9.1.13 Child door lock system.
9.1.14 Rear screen defogger.
9.1.15 Door suction system.
9.1.16 Air Conditioner.
9.1.17 Heater.
9.1.18 Ventilator.
9.1.19 Heated rear window system.
9.1.20 Auto light control system
9.1.21 Glass embedded point antenna.
9.1.22 Fuel Gauge.
9.1.23 Engine temperature gauge.
9.1.24 Charging Lamp in Dashboard Panel.
9.1.25 Oil Pressure Lamp in Dashboard Panel.
9.1.26 Engine Malfunction Indicating Lamp.
9.1.27 Identification of Green, Yellow & Red colors Lamps in Dash Board Panel.

10 Purpose, construction, & working of air bag control system. 2 Hours

10.1 Purpose of Air Bag Control System.
10.2 Components of Air Bag Control system.
10.3 Working of Air Bag Control System
10.4 How & when to use Supplemental restraint system (SRS) Air Bag Control System.

11 What to do in case of an accident /emergency. 1 Hour

11.1 What to do in case of an accident?
11.2 First aid
11.3 Call rescue
11.4 Shift patient properly on stature.
11.5 Shift Patient at proper hospital.

Recommended Textbooks:

1. Book of Driving by Automobile association.
2. Automotive Technology A System Approach by Jack Erjavec
3. Traffic codes manual.

AD-302 MOTOR VEHICLE DRIVING

Instructional Objectives:

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

1 Understand the qualities of a good driver.

1.1 Know the Purpose of Main systems and components of Vehicle
1.2 Learn the Islamic dua for traveling.
1.3 Define fitness of driver w.r.t age, reaction time, state of mind.
1.4 Describe the driver normal attitude, patience, cooperation.
1.5 Know the traffic laws.
1.6 Explain the Standards for the driver vision and hearing.

2 Understand pre- starting inspection of a vehicle.

2.1 Describe the Purpose of Pre-staring inspection of a Vehicle.
2.2 Enlist the checklist of Pre-staring inspection of a Vehicle.
2.3 Describe the following pre-starting inspection of a Vehicle.

2.3.1 Vehicle tire pressure.
2.3.2 Fuel level.
2.3.3 Oil pressure.
2.3.4 Coolant level.
2.3.5 Battery Electrolyte level.
2.3.6 Brake Fluid level.
2.3.7 Head Lights, Turn Signal Lights, brake light and Horn working.
2.3.8 Brake Paddle Play, Accelerator Paddle Play, Clutch Paddle Play.
2.3.9 Hand brake operation.
2.3.10 Steering operation.
2.3.11 Check the working of different interiors and exteriors of a car

3 Understand vehicle breaking.

3.1 Describe the Purpose of Brake and parking brake.
3.2 State the factors effecting Vehicle Stopping.
3.3 Describe the types of road surfaces and their effects on braking.
3.4 Define Vehicle Skidding.
3.5 Define Road Resistance / Road Grip.
3.6 Define Over Speeding and its Disadvantages.
3.7 Explain Condition of Vehicle tires wear & tear and its limits.
3.8 Relate effects of Car Speed / Vehicle inertia to Braking.
3.9 Explain the effects of following factors on Vehicle Braking.

3.9.1 Sharpness of Road turns.
3.9.2 Side Slope of road.
3.9.3 Road ascends and descends.

3.10 Describe Brake Stopping distance.
3.11 Describe Brake reaction time.
3.12 Describe Braking time
3.13 Describe emergency brake stopping.
3.14 Describe, in case of brake failure, how to stop vehicle.

4 Understand motor vehicle acts, traffic regulations.

4.1 Describe the introduction of Motor Vehicle Act.
4.2 State High way Code of Pakistan.
4.3 State Safety driving rules / right of way.
4.4 Explain Different types of Road Signs i.e.

4.4.1 Mandatory Signs.
4.4.2 Warning Signs.
4.4.3 Informative Signs.

4.5 Explain in details different types of road marking i.e.

4.5.1 Dashed Lines.
4.5.2 Double Solid Lines.
4.5.3 Solid and Dashed Lines.
4.5.4 Edge Lines.
4.5.5 Top Lines.
4.5.6 Zebra Crossing Lines.

4.6 Explain the Traffic signal Lights.
4.7 Describe intersection.
4.8 State the following.

4.8.1 Traffic regulation laws.
4.8.2 Traffic Supervision.
4.8.3 Traffic Courts.

4.9 Describe different punishments on violation of traffic rules in Pakistan.
4.10 Explain the Vehicle Registration procedure.
4.11 State the Vehicle Number Plate Specifications.
4.12 Explain Vehicle Driving License procedure for

4.12.1 Learner License.
4.12.2 Motorcycle License.
4.12.3 Car / Light Transport Vehicle (LTV License).
4.12.4 Heavy Transport Vehicle (HTV License).
4.12.5 International Driving Permit.

5 Understand the starting of an engine.

5.1 Describe setting position of choke on.
5.2 Describe a Pre-starting Glow Plug Time period.
5.3 Describe the Ignition Switch different Positions (Off, Acc, On, ST).
5.4 Describe the release of Ignition switch key just after the engine start.
5.5 Describe the Engine Warm up Period.
5.6 Describe Glow of Oil pressure light, Battery charging light and Vehicle Malfunction Indication Light just after Starting the engine.
5.7 Describe abnormal engine noises.
5.8 Describe Engine Stopping.

6 Understand purpose and the level of skill in the use of driving aids and controls.

6.1 Describe the purpose and proficiency skill in the use of following driving aids and controls

6.1.1 Accelerator Paddle.
6.1.2 Clutch Paddle.
6.1.3 Brake Paddle.
6.1.4 Parking Brake.
6.1.5 Gear shift lever.
6.1.6 Steering wheel.
6.1.7 Back View mirror.
6.1.8 Side View mirror.
6.1.9 Turn signal lights.
6.1.10 Driver seat.
6.1.11 Condition of cab roof door, wind screen.
6.1.12 Horn.

6.2 Describe the procedure for Gear up-shifting and down-shifting.
6.3 Explain techniques in clutch releasing and accelerator paddle operation.
6.4 Explain Vehicle Steering techniques during reversing.

7 Understand the procedure of safe driving in different situations.

7.1 State the Procedure of safe moving on Hills.
7.2 Describe how to parking on Hills.

7.3 Explain the Clutch releasing and accelerator paddle operation during downward.
7.4 Explain Driving techniques in rain, snow fall.
7.5 Explain Driving techniques in Storm.
7.6 Explain Driving techniques at night driving.
7.7 Describe proper use of Head Lights (High Beam & low Beam).
7.8 State the Use of Helmet during motorcycle driving.

8 Understand driving techniques.

8.1 Describe the driving.

8.1.1 On turn.
8.1.2 On an uneven road.
8.1.3 In road marking traffic lanes
8.1.4 In city traffic

8.2 Describe the use of Turn Signals.
8.3 Know the Speed Limits.
8.4 Describe Overtaking.
8.5 Describe proper Lane usage.
8.6 Explain the right way to drive at Round about.

9 Understand the function and use of automotive accessories.

9.1 Describe the purpose and the proper use of the following accessories of the vehicles.

9.1.1 Vehicle Immobilizer system.
9.1.2 Vehicle navigation system.
9.1.3 Vehicle communication system.
9.1.4 Vehicle tracking system.
9.1.5 Power window system.
9.1.6 Seat belt.
9.1.7 Night vision mode.
9.1.8 Climate control system.
9.1.9 Key less entry system
9.1.10 Cigarette lighter.
9.1.11 Central locking door system.
9.1.12 Power side mirror.
9.1.13 Vehicle Rear camera.
9.1.14 Child door lock system.
9.1.15 Rear screen defogger.
9.1.16 Door suction system.
9.1.17 Air Conditioner.
9.1.18 Heater.
9.1.19 Ventilator.
9.1.20 Heated rear window system.
9.1.21 Auto light control system
9.1.22 Glass embedded point antenna.
9.1.23 Fuel Gauge.
9.1.24 Engine temperature gauge.
9.1.25 Charging Lamp in Dashboard Panel.
9.1.26 Oil Pressure Lamp in Dashboard Panel.
9.1.27 Engine Malfunction Indicating Lamp.
9.1.28 Identification of Green, Yellow & Red colors Lamps in Dashboard Panel.

10 Understand purpose, construction, & working of air bag control system.

10.1 State the purpose of Air Bag Control System.
10.2 Enlist the Components of Air Bag Control system.
10.3 Describe the Working of Air Bag Control System
10.4 Describe how & when to use the Supplementary restrain system (SRS) Air Bag Control System.

11 Understand what to do in case of an accident /emergency.

11.1 What to do in case of an Accident, describe it?
11.2 First aid
11.3 Call rescue
11.4 Shift patient properly on stature.
11.5 Shift Patient at proper hospital.

AD-302 MOTOR VEHICLE DRIVING

List of Practical:

1. Identification of driving controls on Vehicle.
2. Perform pre-operational inspections on vehicles.
3. Practice the use of accelerator, clutch, and gearshift lever on vehicle.
4. Practice the use of foot brake and parking brake on vehicle.
5. Practice to use brakes on straight and inclined road on different speeds of vehicle.
6. Identify Traffic Signals, Road signs, Marking Lanes on the Road.
7. Prepare a checklist before starting an engine.
8. Practice to Start and stop the engine on vehicle and the use of different controls.
9. Driving practice on straight roads and hilly areas by observing lane and lines.
10. Practice to Learn Overtaking on Vehicle.
11. Practice to learn techniques involved in night driving On Vehicle.
12. Practice to park the vehicle at proper place.
13. Practice changing the wheel by using jack properly.
14. Change the flat tire of vehicle and inflate the tire pressure according to the manufacturer specifications
15. Practice to Drive the Vehicle equipped with Manual Transmission.
16. Practice to Drive the Vehicle equipped with Automatic Transmission.
17. Practice to Drive the Motor cycle safely.
18. Practice to drive the vehicle on economy speed for fuel saving.
19. Practice to use of first aid for an emergency.
20. Practice to use of basic tools kit/techniques for an emergency repair.
21. Locate the causes and remedies of following engine faults
    (Excessive Oil Consumption, Excessive Fuel Consumption, Low engine oil pressure. Leakage of engine coolant, Leakage of engine oil).
22. Jump Start a car if battery is dead.
23. Visit to local vehicle registration office &vehicle Insurance.
24. Visit at traffic police driving center to observe the procedure of testing and issuance of driving license for different kinds of vehicles.

AFM-312 MOTOR VEHICLE INSPECTION

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

Pre-requisite: I.C. Engines, Suspension steering and Brakes and Workshop Practice-II

LEARNING OUTCOMES:

1. Understand the motor vehicle inspection
2. Understand the inspecting vehicle license, registration, and insurance.
3. Understand the tire and wheel, suspension system, steering system, front end alignment, brakes, lighting and electrical system.
4. Understand the inspection vehicle glazing, vehicle body and accessories, fuel system, exhaust system, automotive emission control.
5. 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:

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.

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.

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.

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.

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.
8.5 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.

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.

INSPECTIONS OF HEAVY-DUTY MOTOR VEHICLES

12 Tires, wheel, steering, alignment and suspension system 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 Kingpin 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 preparation for headlight inspection and Neutral safety starting switch inspection.
13.7 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.

INSPECTIONS OF SCHOOL BUSES

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:

1. Motor Vehicle Inspection by W. H. Crouse & D. L. Anglin
2. A Practical Approach to Motor Vehicle Engineering & maintenance by Allan Bonnick

AFM-312 MOTOR VEHICLE INSPECTION

Instructional Objectives:

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

INSPECTION OF PASSENGER CARS AND LIGHT TRUCKS

1 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.

2 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.

3 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.

4 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.

5 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.

6 Understand the inspection of vehicle steering system.

6.1 Explain the 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.

7 Understand the front-end linkage and brake inspection of vehicles.

7.1 Explain the frond-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 hydraulic system.
7.8 State the method of inspection of the electronic controls of brake system.

8 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.

9 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.

10 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.

11 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.

INSPECTIONS OF HEAVY-DUTY MOTOR VEHICLES

12 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.

13 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

14 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.

INSPECTIONS OF SCHOOL BUSES

15 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.

AFM-312 MOTOR VEHICLE INSPECTION

List of Practicals:

Part - I

1. Inspect vehicle tires and wheels
2. Inspect Vehicle tracking.
3. Inspect vehicle shock absorber visually, on the vehicle & off the vehicle.
4. Inspect Vehicle Suspension system and, Front-End Alignment
5. Inspect the Vehicle steering system.
6. Inspect vehicle Brake System.
7. Inspect Vehicle lighting and electric system
8. Inspect Vehicle Glazing and Fuel System.
9. Inspect Vehicle Body and Accessories.
10. Inspect Exhaust system of Vehicle.
11. Inspect Vehicle emission controls.

Part - II

12. Inspect Tire and wheels of Heavy Duty Vehicles.
13. Inspect Vehicle tracking.
14. Inspect suspension and steering system of Heavy Duty Vehicles.
15. Inspect Brakes System of Heavy Duty Vehicles.
16. Inspect lighting and Electric System of Heavy Duty Vehicles.
17. Inspect Heavy Duty Vehicle Body and Engine Systems.
18. Inspect Preventive- Maintenance Program.
19. Prepare Comprehensive Vehicle Inspection Report.
20. Prepare Certificate of registration.
21. Prepare Certificate of Title for a Vehicle.
22. Visit at Local office of Motor Vehicle Examiner/VICS STATION for the demonstration of inspection of Light & Heavy-duty Vehicles.

AM-323 FUEL INJECTION & CARBURETION

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

Pre-requisite: IC ENGINE

LEARNING OUTCOMES:

1. Understand the construction and working of Intake and Exhaust system.
2. Understand the construction and working of carburetor Fuel supply system.
3. Understand the construction and working of LPG Fuel supply system.
4. Understand the construction and working of CNG Fuel supply system.
5. Understand the construction and working of EFI Fuel supply system.
6. Show skill in maintenance and repair of fuel injection pumps &governors.
7. Understand the construction and working of Variable valve timing.
8. Understand the construction and working of Vehicle cruisetronic system.
9. Understand the basis of working Hybrid vehicle.
10. Understand the basic working of the Locomotive engine.

Detail of Contents:

1 Fuel and its types, use in automobile. 4 Hours

1.1 Fuel and its basic properties.
1.2 Fuel rating factors.

a. Octane Rating.
b. 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 Construction, working and troubleshooting of Carburetor

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 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 Explain the working of each component of CNG fuel supply system
10.4 Explain the working of each component of LNG fuel supply system.

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

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,
11.5 RPM sensor, Oxygen sensor).
11.6 Function, construction and circuit working of following actuators. (Injectors, Ignition system igniter, idle speed control valve).
11.7 Purpose of Microcomputer/Electronic Control Unit (ECU).
11.8 Working of EFI Systems w.r.t D-Jetronics system, L-Jetronics system, and K/KE-Jetronics system.
11.9 Construction and working of EFI Systems w.r.t Multiport Fuel Injection system (MPFI system) and Throttle Body Fuel injection system (BI system).
11.10 Working of drive by a wire system (DBW).
11.11 Gasoline Direct Fuel Injection system

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.

13 Working of diesel engine. 10 Hours

13.1 Properties of diesel fuel.
13.2 Working principle of four strokes diesel engine.
13.3 Main Components of diesel fuel supply system
13.4 Purpose of diesel fuel filter.
13.5 Construction and working of diesel fuel filter.
13.6 Purpose of diesel water sedimenter.
13.7 Construction and working of diesel water sedimenter.
13.8 Purpose of primer/lifty pump.
13.9 Construction and working of primer/lifty pump.
13.10 Function of diesel fuel feed pump.
13.11 Types and working of diesel fuel feed pumps.
13.12 Construction and working of Distributor type (rotary) Diesel Fuel injection Pump.
13.13 Construction and working of In-Line type Diesel Fuel injection Pump.
13.14 Function of Governor.
13.15 Types and working of Governors.
13.16 Phasing and calibration.
13.17 Procedure of phasing and calibration of diesel fuel injection pumps.
13.18 Procedure of setting of timing of diesel fuel injection pump.
13.19 Function of diesel fuel injector.
13.20 Types and working of diesel fuel injectors.
13.21 Purpose of high-pressure lines.
13.22 Purpose of diesel engine glow plugs.
13.23 Construction and working of diesel engine glow plugs.
13.24 Electronically controlled Diesel Fuel Injection System.
13.25 Electronically controlled Diesel Fuel Injection System& Common Rail direct injection (CRDI).
13.26 Describe the Diesel particle filter (DPF)

14 Working of vehicle cruisetronic control system. 2 Hours

14.1 Purpose of Vehicle Cruisetronic Control System.
14.2 Components of Vehicle Cruisetronic Control System.
14.3 Working principle of Vehicle Cruisetronic Control System.

15 Construction and working principal of variable valve timing, control system. **2 Hours**

15.1 Purpose of Variable valve timing control systems (VVT-i/i-VTec).
15.2 Components of Variable valve timing control systems (VVT-i/i-VTec).
15.3 Working principles of Variable valve timing control systems (VVT-i/ i-VTec).

16 Construction and working principle of Locomotive engine. **1 Hour**

16.1 Main components of Locomotive Engine.
16.2 Basic working principle of Locomotive Engine.

17 Basic working principle of jet engine. **1 Hour**

17.1 Main components of jet engine.
17.2 Working principle of jet engine.
17.3 Enlist the types of Jet Engine

Recommended Textbooks:

1. Modern Automotive Technology (9th Edition) by James E. Duffy.
2. Automotive Technology A System Approach by Jack Erjavec
3. Automotive Electricity, Electronics & Computer Controls by Barry Hollembeak

AM-323 FUEL INJECTION & CARBURETION

Instructional Objectives:

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

1 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.
   a. Octane Rating.
   b. 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.

2 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.

3 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),

4 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.

5 Understand the working of turbocharger.

5.1 Define volumetric efficiency of I.C engine.
5.2 Describe factors affecting 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.

6 Understand working of a 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 thermistor type).
6.5 Describe construction and working of evaporative fuel emission control system.
6.6 State function and types of fuel filter.

7 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.

8 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 Describe the construction and working of Carburetor

9 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 LPG fuel supply system.
9.4 Compare advantages and disadvantages of LPG fuel system with gasoline fuel system.

10 Understand the construction and working of CNG fuel supply system.

10.1 Describe gasoline Direct Fuel Injection system
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.

11 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).
11.10 Describe the gasoline Direct Fuel Injection system
11.11 Describe gasoline Direct Fuel Injection system.

12 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.

13 Understand the working of diesel engine.

13.1 State the properties of diesel fuel.
13.2 Describe the working principle of four strokes diesel engine.
13.3 Enlist the main Components of diesel fuel supply system
13.4 State the purpose of diesel fuel filter.
13.5 Describe the construction and working of diesel fuel filter.
13.6 State the purpose of diesel water sedimenter.
13.7 Describe the construction and working of diesel water sedimenter.
13.8 State the purpose of primer/lifty pump.
13.9 Describe the construction and working of primer/lifty pump.
13.10 State function of diesel fuel feed pump.
13.11 Describe the types and working of diesel fuel feed pumps.
13.12 Describe the construction and working of Distributor type (rotary) Diesel Fuel injection Pump.
13.13 Describe the construction and working of In-Line type Diesel Fuel injection Pump.
13.14 State the function of Governor.
13.15 Describe the types and working of Governors.
13.16 Define phasing and calibration.
13.17 Explain the procedure of phasing and calibration of diesel fuel injection pumps.
13.18 Explain the procedure of setting of timing of diesel fuel injection pump.
13.19 State the function of diesel fuel injector.
13.20 Describe the types and working of diesel fuel injectors.
13.21 State the purpose of high pressure lines.
13.22 State the purpose of diesel engine glow plugs.
13.23 Describe the construction and working of diesel engine glow plugs.
13.24 Enlist the components of electronically controlled Diesel Fuel Injection System.
13.25 Describe the construction and working of each component of electronically controlled Diesel Fuel Injection System& Common Rail direct injection (CRDI).
13.26 Describe the Diesel particle filter (DPF).

14 Understand the working of vehicle cruisetronic control system.

14.1 State the Purpose of Vehicle Cruisetronic Control System.
14.2 Enlist the components of Vehicle Cruisetronic Control System.
14.3 Describe the working principle of Vehicle Cruisetronic Control System.

15 Understand the basic construction and working principle of variable valve timing control system.

15.1 State the Purpose of Variable valve timing control systems (VVT-i/ i-VTec)
15.2 Enlist the components of Variable valve timing control systems (VVT-i/ i-VTec)
15.3 Describe the working principles of Variable valve timing control systems (VVT-i/ i-VTec)

16 Understand the basic construction and working principal of Locomotive engine.

16.1 Enlist Main components of Locomotive Engine.
16.2 Describe basic working principle of Locomotive Engine.

17 Understand the basic working principle of jet engine.

17.1 Enlist the Main components of jet engine.
17.2 Describe the basic working principle of jet engine.
17.3 Describe the types of jet engine.

AM-323 FUEL INJECTION & CARBURETION

List of Practical:

1. Identify the components of Air intake system.
2. Dismantle dry type air cleaner assembly & replace its filter element and re-assemble it.
3. Dismantle service and assemble oil bath type air cleaner.
4. Identify the parts of turbo charger & service it.
5. Troubleshoot the engine exhaust system.
6. Practice to remove & reinstall fuel tank after cleaning.
7. Remove and reinstall electric fuel pump from the fuel tank.
8. Dismantle, service and adjustment of carburetor.
9. Dismantle and service the LPG regulator kit.
10. Dismantle and service the CNG regulator kit.
11. Identify the components of EFI system.
12. Practice fault finding by Coding and Decoding of EFI System manually.
13. Practice fault finding by Automotive Diagnostic Scanner.
14. Identify components of diesel fuel supply system.
15. Dismantle, service, assemble, test and readjust pressure of the injector (manual and Ultrasonic).
16. Dismantle and assemble the distributor type diesel fuel injection pump.
17. Dismantle and assemble the in- line type diesel fuel injection pump.
18. Carry out phasing of diesel fuel injection pumps on the test bed.
19. Carry out calibration of diesel fuel injection pumps on the test bed
20. Carry out setting of timing of diesel fuel injection pump on engine.
21. Identify components of Vehicle variable valve timing control system.
22. Identify components of Vehicle Cruisetronic control system.
23. Visit at Modern automotive workshop for the demonstration of modern automotive systems and submit visit report.

AM-334 AUTOMOTIVE TRANSMISSION

Total Contact Hours		**T**	**P**	**C**
Theory	**96**	**3**	**3**	**4**
Practical	**96**			

Pre-requisite: IC ENGINE + WORKSHOP PRACTICE-I

LEARNING OUTCOMES:

1. Understand the working of mechanical transmission system
2. Repair and maintain conventional transmission from clutch and gear box to final drive unit.
3. Understand the working of automatic and hydraulic transmission.
4. Develop skill in servicing, repair of electronically controlled automatic transmission systems.
5. Understand gear ratio and working of Epicyclic gear train.
6. Understand the construction, working principal & types of automatic transmission.
7. Identify key components & their function of automatic transmission.
8. Diagnose and repair of automatic transmission
9. Develop hands-on skill in disassembly, inspection and reassembly of automatic transmission units.

Detail of Contents:

PART-A

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, Gear reduction)

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.

2.3.1 2-Wheel drive.
2.3.2 Front engine front wheel drive.
2.3.3 Rear engine rear wheel drive.
2.3.4 Front engine rear wheel drive.
2.3.5 4-Wheel drive.
2.3.6 AWD

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:

3.5.1 Simple Gear Train
3.5.2 Compound Gear Train.
3.5.3 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. 8 Hours

4.1 Function of Clutch.
4.2 Main parts of clutch.
4.3 Various types of Clutches used in automotive.

4.3.1 Single Plate Clutch.
4.3.2 Multi Plate Clutch.
4.3.3 Dry and wet type Clutch.
4.3.4 Diaphragm type Clutch.
4.3.5 Centrifugal Clutch.
4.3.6 Dual clutch
4.3.7 Electromagnetic clutch

4.4 Material used for Clutch Lining
4.5 Cable operated Clutch mechanism
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.

5.2.1 Sliding Mesh type Gear Box.
5.2.2 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 1st gear, 2nd gear, 3rd gear, 4th gear, 5th gear, 6th gear and in reverse gears.
5.8 Properties of Gear 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.

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.

6.2.1 Universal joint and Slip Joint.
6.2.2 Constant Velocity Joint.
6.2.3 Hotchkiss drive

6.3 Faults, Causes and possible remedies of Propeller Shaft.

7 Purpose, construction, and working of differential gear box. 6 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.

7.7.1 Locked differential
7.7.2 Torque vectoring differential
7.7.3 Active differential
7.7.4 Torsion differential

8 Purpose, construction, types and working of drive axles. 4 Hours

8.1 Purpose of driving axle.
8.2 Live axle and Dead axle.
8.3 Types of Rear Axle.

8.3.1 Semi floating axle.
8.3.2 Three quarter floating axle.
8.3.3 Full floating axle.

8.4 Types of Axle Housing.

8.4.1 Banjo type Axle Housing.
8.4.2 Slit type Axle Housing.

8.5 Axle to weight ratio.
8.6 Axle Hub.
8.7 Problems, Causes and possible remedies of axle faults.

PART-B

9 Introduction of Automatic Transmission 10 Hours

9.1 Purpose & advantages of automatic transmission.
9.2 History & evolution of automatic transmission.
9.3 Difference between Automatic & manual transmission.
9.4 Gear boxes classifications/types based on their gear set design.

9.4.1 Planetary gear set based automatic gear box (Conventional Automatic type)
9.4.2 Non-planetary gear set based automatic gear box (Modern Automatic type)

10 Understand the Planetary Gear Set based Automatic Transmission/Gear Box 10 Hours

10.1 Working principal of planetary gear Set.
10.2 Construction & characteristics of planetary gear set components
10.3 (Sun Gear, Planet Gears, Ring Gear, Carrier, Input and output shafts, Bearings and pins)
10.4 Main components used to control the planetary gear Set. (transmission bands, transmission servos, compound servos multiple disk clutches, one-way clutches, accumulators, solenoids, clutch packs and bands, valve body & hydraulic control system, transmission shafts configuration, bearings, bushings, thrust washers, snap rings, gaskets & seals, sensors, actuators & electronic control module)
10.5 Kinematics and dynamics of planetary gear sets, gear ratios and speed reduction, torque multiplication.
10.6 Power flow (lay-out) through a typical automatic transmission.
10.7 Applications of planetary gear sets (i.e. automotive transmission, Industrial and Machinery, Wind turbines, and Robotics).
10.8 Simpson gear set (compound planetary gear set), commonly used in automatic transmissions
10.9 Shift-by-wire systems
10.10 Difference between Automatic Transaxle & transmission.
10.11 Maintenance and troubleshooting of planetary gear set gear box.
10.12 Purpose of torque converter.
10.13 Basic design & operation of each component of torque converter (Impeller, Turbine, Stator, overrunning clutch).
10.14 Types of oil flow.

10.14.1 Rotary oil flow.
10.14.2 Vortex oil flow

10.15 Types of automatic transmission fluids (ATF).
10.16 Automatic transmission fluid is circulated through the system and how it is cooled.
10.17 Procedure to locate automatic transmission fluid leaks.
10.18 Steps to replace & flush automatic transmission fluid.
10.19 Automatic transmission oil cooler works.

11 Understand the Continuous Variable Transmission (CVT)-non-planetary gear Set based automatic gear box 7 Hours

11.1 Purpose of CVT.
11.2 Importance of CVT in modern automotive technology
11.3 Basic concept of variable gear ratios in CVT.
11.4 Types of CVT Systems.

- 11.4.1 Pulley-Based CVT (Belt or Chain Drive)
- 11.4.2 Toroidal CVT
- 11.4.3 Hydrostatic CVT
- 11.4.4 Electronic CVT (e-CVT) used in hybrid vehicles

11.5 Design and operation of main components of CVT.

- 11.5.1 Primary (drive) pulley
- 11.5.2 Secondary (driven) pulley
- 11.5.3 Metal belt or chain
- 11.5.4 Hydraulic or electronic actuators
- 11.5.5 Control module (TCM or ECM)
- 11.5.6 Hydraulic controls and valves
- 11.5.7 Pressure regulator valve Throttle vale & governor assembly
- 11.5.8 Manual valves, shift valves & kick down valve
- 11.5.9 Complete hydraulic valve body.

11.6 Various pressure locations in the transmission.
11.7 Advantages & disadvantages of ECT Transmission system.
11.8 CVT Transmission system with other types of automatic transmission.
11.9 Applications of CVT Transmission system.
11.10 Recent developments and innovations in CVT.

- 11.10.1 Use of CVTs in hybrid powertrains
- 11.10.2 Improvements in belt materials and durability
- 11.10.3 Artificial gear steps to simulate traditional shifts

12 Understand the Prosmatec type Automatic Transmission/Gearbox (Semi-Automatic type) 4 Hours

12.1 Features of Prosmatec type gear box transmission.
12.2 Main components of Prosmatec type gear box
12.3 Layout & working principal of Prosmatec type gear box transmission.
12.4 Advantages & disadvantages of Prosmatec type gear box transmission.
12.5 Compare Prosmatec type gear box transmission with other types of auto transmission.
12.6 Maintenance and troubleshooting of Prosmatec type gear box transmission.

13 Understand the Automotive AGS (Auto Gear Shift) Transmission Gearbox (based on manual gearbox) 5 Hours

13.1 Features of AGS Transmission system.
13.2 History and origin of AGS Transmission system.
13.3 Construction, function and working of AGS Transmission system.
13.4 Uses of an electro-hydraulic actuator to automate clutch and gear shift operations.
13.5 Modes of operation of AGS Transmission system

- 13.5.1 Drive (D) – Fully automatic mode
- 13.5.2 Manual (M) – Sequential gear shifting by the driver (+ / –)
- 13.5.3 Neutral (N)
- 13.5.4 Reverse (R)

13.6 Advantages & disadvantages of AGS Transmission system.
13.7 Compare AGS Transmission system with other types of auto transmission.
13.8 Applications of AGS Transmission system.
13.9 Driving tips about AGS Transmission system.

14 Understand the Electronically Controlled Transmission (ECT) 8 Hours

14.1 Purpose of ECT
14.2 Evolution of automatic transmissions with electronic control
14.3 Role of sensors, actuators, and the transmission control unit (TCU)
14.4 Comparison of ECT with purely hydraulic systems type automatic transmission.
14.5 Main Components of ECT System

- 14.5.1 Transmission Control Unit (TCU) or ECM
- 14.5.2 Sensors: Throttle position, vehicle speed, engine RPM, gear position, temperature
- 14.5.3 Actuators: Solenoid valves, shift motors
- 14.5.4 Hydraulic control system
- 14.5.5 Gear sets and torque converter
- 14.5.6 Operation Mechanism

14.6 ECT selects optimal gear based on driving conditions
14.7 Interaction between engine control unit (ECU) and TCU
14.8 Shift scheduling.
14.9 Fail-safe or limp mode operation.
14.10 Types of ECT Systems.

- 14.10.1 Hydraulically controlled ECT with electronic oversight
- 14.10.2 Fully electronically controlled automatic transmission.

14.11 Advantages & disadvantages of ECT Transmission system.
14.12 ECT Transmission system with other types of automatic transmission.
14.13 Applications of ECT Transmission system.
14.14 Recent developments and innovations in ECT.

15 Understand the Automatic transmission diagnostic & maintenance. 4 Hours

15.1 Common symptoms of transmission problems.
15.2 Procedure for automatic transmission fault finding by on Board diagnostic.
15.3 Procedure of Automotive Scan Tool for interpreting the DTCs.
15.4 Service interval for automatic transmission.
15.5 Procedure for shift linkage and bands adjustment.
15.6 Procedure for replacement of oil and oil filter of automatic transmission gear box.

Recommended Textbooks:

1. Automotive Excellence (Volume 1 & 2) by McGRAW Hill International
2. Automotive Mechanics (Volume 1 & 2) by Ed May
3. Automotive Technology A System Approach by Jack Erjavec
4. Automotive Transmission (2nd edition) Fundamental selection, Design & Application by Harald Naunheomer, Bernds Bertsche, Joachim Ryborz & Wolfgang Novak
5. Modern Automotive Technology (10th edition) by James E. dufy.

AM-334 AUTOMOTIVE TRANSMISSION

Instructional Objectives:

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

PART-A

1 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, Gear reduction)

2 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.

- 2.3.1 2-Wheeler drive.
- 2.3.2 Front engine front wheel drive.
- 2.3.3 Rear engine rear wheel drive.
- 2.3.4 Front engine rear wheel drive.
- 2.3.5 4-Wheel drive.
- 2.3.6 AWD

3 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.

- 3.5.1 Simple Gear Train
- 3.5.2 Compound Gear Train.
- 3.5.3 Reverse Gear Train.

3.6 Define Gear Ratio, Torque Ratio, and Velocity Ratio.
3.7 Solve the numerical problems regarding gear ratio, torque ratio, and speed ratio.

4 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.

- 4.3.1 Single Plate Clutch
- 4.3.2 Multi Plate Clutch.
- 4.3.3 Dry and wet type Clutch.
- 4.3.4 Diaphragm type Clutch.
- 4.3.5 Centrifugal clutch.
- 4.3.6 Dual clutch
- 4.3.7 Electromagnetic clutch

4.4 Describe the material use for Clutch Lining
4.5 Describe Cable operated Clutch mechanism
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.

5 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.

- 5.2.1 Sliding Mesh type Gear Box.
- 5.2.2 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 1st gear, 2nd gear, 3rd gear, 4th gear, 5th Gear, 6th Gear and in reverse gear.
5.8 Describe Properties of Gear 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.

6 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.

6.2.1 Universal joint and Slip Joint.
6.2.2 Constant Velocity Joint.
6.2.3 Hotchkiss drive.

6.3 Describe the faults, Causes and possible remedies of Propeller Shaft.

7 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 Gear Box

7.7.1 Explain Locked differential
7.7.2 Explain Torque vectoring differential
7.7.3 Explain Active differential
7.7.4 Explain Torsion differential

8 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.

8.3.1 Semi floating axle.
8.3.2 Three quarter floating axle.
8.3.3 Full floating axle.

8.4 Describe Types of Axle Housing.

8.4.1 Banjo type Axle Housing.
8.4.2 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.

PART-B

9 Introduction of Automatic Transmission

9.1 Describe the purpose & advantages of automatic transmission.
9.2 Describe history & evolution of automatic transmission.
9.3 Difference between Automatic & Manual Transmission.

9.4 Explain the gear boxes classifications/types based on their gear set design.

9.4.1 Planetary gear set based automatic gear box (Conventional Automatic type)
9.4.2 Non-planetary gear set based automatic gear box (Modern Automatic type

10 Understand the Planetary Gear Set based Automatic Transmission/Gear Box

10.1 Describe the working principal of planetary gear Set.
10.2 Describe the construction & characteristics of planetary gear set components (Sun Gear, Planet Gears, Ring Gear, Carrier, Input and output shafts, Bearings and pins)
10.3 Describe the main components used to controls the planetary gear Set.
10.4 (transmission bands, transmission servos, compound servos multiple disk clutches, one-way clutches, accumulators, solenoids, clutch packs and bands, valve body & hydraulic control system, transmission shafts configuration, bearings, bushings, thrust washers, snap rings, gaskets & seals, sensors, actuators & electronic control module)
10.5 Describe the kinematics and dynamics of planetary gear sets, gear ratios and speed reduction, torque multiplication.
10.6 Explain the power flow (lay-out) through a typical automatic transmission.
10.7 Briefly state the applications of planetary gear sets (i.e. automotive transmission, Industrial and construction machinery, Wind turbines, and Robotics).
10.8 Describe the Simpson gear set (compound planetary gear set), commonly used in automatic transmissions.
10.9 Shift-by-wire systems
10.10 Describe the difference between Automatic Transaxle & transmission.
10.11 Describe the maintenance and troubleshooting of planetary gear set gear box.
10.12 Describe the purpose of torque converter.
10.13 Explain the basic design & operation of each component of torque converter (Impeller, Turbine, Stator, overrunning clutch).
10.14 Describe the types of oil flow.
10.14.1. Rotary oil flow.
10.14.2.Vortex oil flow
10.15 Describe the types of automatic transmission fluids (ATF).
10.16 Explain how automatic transmission fluid is circulated through the system and how it is cooled.
10.17 Describe a procedure to locate automatic transmission fluid leaks.
10.18 Describe steps to replace & flush automatic transmission fluid.
10.19 Describe how automatic transmission oil cooler works.

11 Understand the Continuous Variable Transmission (CVT) - non-planetary gear Set based automatic gear box:

11.1 Define the purpose of CVT.
11.2 Describe the Importance of CVT in modern automotive technology
11.3 Explain the basic concept of variable gear ratios in CVT.
11.4 State the types of CVT Systems.

11.4.1 Pulley-Based CVT (Belt or Chain Drive)
11.4.2 Toroidal CVT
11.4.3 Hydrostatic CVT
11.4.4 Electronic CVT (e-CVT) used in hybrid vehicles

11.5 Describe the design and operation of main components of CVT.

11.5.1 Primary (drive) pulley
11.5.2 Secondary (driven) pulley
11.5.3 Metal belt or chain
11.5.4 Hydraulic or electronic actuators
11.5.5 Control module (TCM or ECM)
11.5.6 Hydraulic controls and valves
11.5.7 Pressure regulator valve Throttle vale & governor assembly
11.5.8 Manual valves, shift valves & kick down valve
11.5.9 Complete hydraulic valve body.

11.6 Identify the various pressure locations in the transmission.
11.7 Describe the advantages & disadvantages of ECT Transmission system.
11.8 Compare CVT Transmission system with other types of automatic transmission.
11.9 Describe the applications of CVT Transmission system.
11.10 Describe the recent developments and innovations in CVT.

11.10.1 Use of CVTs in hybrid powertrains
11.10.2 Improvements in belt materials and durability
11.10.3 Artificial gear steps to simulate traditional shifts

12 Understand the Prosmatec type Automatic Transmission/Gearbox (Semi-Automatic type)

12.1 Describe the features of Prosmatec type gear box transmission.
12.2 Describe the main components of Prosmatec type gear box
12.3 Describe the layout & working principal of Prosmatec type gear box transmission.
12.4 Describe the advantages & disadvantages of Prosmatec type gear box transmission.
12.5 Compare Prosmatec type gear box transmission with other types of auto transmission.
12.6 Describe the maintenance and troubleshooting of Prosmatec type gear box transmission.

13 Understand the Automotive AGS (Auto Gear Shift) Transmission Gearbox (based on manual gearbox)

13.1 Describe features of AGS Transmission system.
13.2 Brief history and origin of AGS Transmission system.
13.3 Describe the construction, function and working of AGS Transmission system.
13.4 Describe the uses of an electro-hydraulic actuator to automate clutch and gear shift operations.

13.5 Briefly elaborate the modes of operation of AGS Transmission system

13.5.1 Drive (D) – Fully automatic mode
13.5.2 Manual (M) – Sequential gear shifting by the driver (+ / –)
13.5.3 Neutral (N)
13.5.4 Reverse (R)

13.6 Describe the advantages & disadvantages of AGS Transmission system.
13.7 Compare AGS Transmission system with other types of auto transmission.
13.8 Describe applications of AGS Transmission system.
13.9 Describe the driving tips about AGS Transmission system.

14 Understand the Electronically Controlled Transmission (ECT)

14.1 Define the purpose of ECT
14.2 Describe the evolution of automatic transmissions with electronic control
14.3 Describe the role of sensors, actuators, and the transmission control unit (TCU)
14.4 Describe the comparison of ECT with purely hydraulic systems type automatic transmission.
14.5 Describe the main Components of ECT System

14.5.1 Transmission Control Unit (TCU) or ECM
14.5.2 Sensors: Throttle position, vehicle speed, engine RPM, gear position, temperature
14.5.3 Actuators: Solenoid valves, shift motors
14.5.4 Hydraulic control system
14.5.5 Gear sets and torque converter
14.5.6 Operation Mechanism

14.6 Explain how ECT selects optimal gear based on driving conditions
14.7 Describe interaction between engine control unit (ECU) and TCU
14.8 Describe Shift scheduling.
14.9 Explain Fail-safe or limp mode operation.
14.10 Describe the types of ECT Systems.

14.10.1 Hydraulically controlled ECT with electronic oversight
14.10.2 Fully electronically controlled automatic transmission.

14.11 Describe the advantages & disadvantages of ECT Transmission system.
14.12 Compare ECT Transmission system with other types of automatic transmission.
14.13 Describe applications of ECT Transmission system.
14.14 Briefly elaborate the recent developments and innovations in ECT.

15 Understand the Automatic transmission diagnostic & maintenance.

15.1 Describe the common symptoms of transmission problems.

15.2 Describe the procedure for automatic transmission fault finding by on Board diagnostic.

15.3 Explain the procedure of Automotive Scan Tool for interpreting the DTCs.

15.4 Describe the service interval for automatic transmission.

15.5 Describe the procedure for shift linkage and bands adjustment.

15.6 State the procedure for replacement of oil and oil filter of automatic transmission gear

AM-334 AUTOMOTIVE TRANSMISSION

List of Practical:

1. Draw various Vehicle Layouts for 2-wheeler, 3-wheeler, and 4-wheeler and compare them.
2. Identify the main units of automotive transmission system.
3. Identify different types of Gears.
4. Remove, reinstall, re-align and adjust clutch assembly and clutch pedal.
5. Remove and reinstall the manual transaxle on the vehicle.
6. Check the proper working of gear shift control mechanism.
7. Check working of Free-wheeling devices.
8. Disassemble and identify the main parts of overdrive mechanism.
9. Remove, inspect and reinstall the propeller shaft and reassemble the universal and slip joints
10. Check play and noise in constant velocity joint and report the findings.
11. Remove rear axle, inspect and re-install it.
12. Identify the main components of an automatic transmission system.
13. Test an automatic transmission/transaxle using an automotive scan tool.
14. Perform flushing and replace automatic transmission fluid.
15. Locate fluid leaks in automatic transmission.
16. Identify the faults in transmission/transaxle.
17. Dismantle, inspect, service and reassemble planetary gear based automatic transaxle.
18. Dismantle, inspect, service and reassemble Prosmatec type automatic transaxle.
19. Dismantle, inspect, service and reassemble AGS type automatic transaxle.
20. Dismantle, inspect, service and reassemble CVT type automatic transaxle.
21. Dismantle, inspect, service and reassemble ECT type automatic transaxle.
22. Visit at modern automotive workshop for the demonstration of disassembling, inspection, identification of parts and reassembling of (Prosmatec transmission gear box & continuously variable transmission (CVT) gear box.

AM-343 AUTO BODY BUILDING & FINISHING

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

Pre-requisite: IC ENGINE

LEARNING OUTCOMES:

1. Understand auto body parts and construction
2. Recognize body styles
3. Know frame construction, damages and repair
4. Know various body fasteners
5. Use body worker hand tools and power tools
6. Analyze body metal damages
7. Learn techniques of metal working
8. Aligning doors, trunk lid, hood
9. Understand body insulation
10. Know various finishing materials
11. Understand refinishing procedure
12. Understand surface preparation
13. Know masking, painting, spraying techniques
14. List paint spray requirement
15. Know Spray painting problems and their prevention

Detail of Contents:

1 Types, construction, styles, attachments and materials of automotive body

6 Hours

1.1 Purpose of Automotive Body.

1.2 Components of automotive body.

1.3 Major Structural Components, Sections, and assemblies of Body-over-Frame Vehicles.

1.4 Automotive body w.r.t (Use, Construction, No. of doors) Panel.

1.5 Automotive body construction.

a. Automotive body front section Panels (cowl, shock towers, dash panel).
b. Automotive body center section Panels (pillars, instrument panels).
c. Automotive body rear section Panels (Deck, Lid, Quarter panel).
d. Accessories (Bumpers, Grilles, Moldings).

1.6 Automotive body Styles.

a. Hatch Back type body style.
b. Sedan type body style.

c. SUV type body style
d. Crossover type body style
e. Hard top type body style.
f. Convertible type body style.
g. Station wagon type body style.

1.7 Automotive Car Body Styles.

a. Coupe
b. Saloon.
c. Convertibles.
d. Limousine.
e. Estate Van.
f. Racing Car & Sports Car.

1.8 Automotive Bus body Styles.

a. Mini Bus.
b. Single Decker & Double Decker Bus.

1.9 Parts of body of motorcycle.
1.10 Body of motorcycle, & labeled the parts name and its function.
1.11 Methods of attaching automotive body to frame.

a. Bolting Method of attaching automotive body to frame.
b. Welding Method of attaching automotive body to frame

1.12 Automotive Body Material and their characteristics.

a. Sheet metal.
b. Types of sheet metal
c. General characteristics of Sheet metal.
d. Effect of temperature & moisture on sheet metal

2 Vehicle Aerodynamics. 2 Hours

2.1 Vehicle aerodynamics.
2.2 Vehicle drag and its types.
2.3 Various types of forces and moments.
2.4 Effects of forces and moments.
2.5 Body optimization techniques for minimum drag.

3 Types, construction and alignment of vehicle frames. 6 Hours

3.1 Purpose of Vehicle Frame.
3.2 Vehicle identification number (VIN).

3.3 Characteristics of following types of frame cross section members.

a. Channel type cross-section frame member.
b. Box type cross-section frame member.
c. Round type cross-section frame member.
d. I type cross-section frame member.

3.4 Frame of motorcycle.
3.5 Lay-out of the frame of motorcycle, sketch it & label the parts name and its function.
3.6 Estimated repair cost of vehicle accidents.
3.7 Different types of frame damage.
3.8 Frame alignment and damages with

a. Plumb Bob
b. Tram Gauge.

3.9 Steps involved for computerized method of automotive Frame alignment.

4 Automotive body fasteners. 2 Hours

4.1 Purpose, size ,and use of Automotive Body Fasteners (Machine Screws, Sheet metal Screws, Bolts & Nuts, Finishing Washers, Speed Nuts, Rivets).

5 Types and their use of automotive body hand tools. 6 Hours

5.1 Purpose, types and use of following automotive body Hand Tools.

a. Hammers (Digging, Combination, Shrinking, Finishing).
b. Dolly Blocks (Heel, Toe in, Wedges, Rouging).
c. Spoons (Short elbow, Long-elbow, Off-set Straight, Curved Flat, Flat Top, Curved).
d. Pick Tools (Deep throat, Short Pick, Short Curved, Long Curved, Chisel Vit).
e. Files (Long Blocking, Short Block, Special Contour, Slapping).
f. File Holders (Adjustable, Non-adjustable).
g. Wrenches (Open end, Box end, Socket set).
h. Metal Shears / Snips.
i. Pry Bars.
j. Pliers, Vice Grip, Lock and Panel.
k. Screw Drivers
l. Clips.

6 Purpose and use of power tools. 2 Hours

6.1 Purpose and Proper use of following Power Tools.

a. Grinders and its types
b. Sanders and its types
c. Polishers and its types
d. Portable Drill machines.
e. Pneumatic Impact tools.
f. Hydraulic Body Jack.

7 Techniques for metal working. 2 Hours

7.1 Techniques for metal working.

a. Uses of Pulling and Pushing Setups.
b. Shrinking metal.
c. Metal finishing (Removing Paint and under coating, Smoothing, Filing, Sanding).

8 Purpose, types and techniques of welding. 2 Hours

8.1 Purpose of Welding.
8.2 Types of welding (Gas Welding, Arc Welding, Spot Welding).
8.3 Use of welding equipment.

9 Dry denting 2 Hours

9.1 Dent lifters
9.2 Glue puller with tab
9.3 Slide hammers
9.4 Denting rods and hooks

10 Collision damages and its repair 2 Hours

10.1 Types of Collisions damages and their repair.

a. Front end collisions.
b. Rear end collisions.
c. Side wise collisions.
d. Roll over collisions.

10.2 Impact and its effects on a Vehicle.

11 Automotive body glasses and plastics. 2 Hours

11.1 Glasses and its types
11.2 Wind shield and rear windows shield.

11.3 Glass servicing and its repair.
11.4 Plastic and its types
11.5 Repair and replacement of Fiber Glass and Plastic body components.

12 Body hardware & accessories. 6 Hours

12.1 Automotive body Hardware's.
12.2 Maintenance of automotive doors.
12.3 Removal and installation of automotive doors.
12.4 Adjustment of automotive doors.
12.5 Purpose and working principle of

a. Central Locking door system.
b. Child Lock door system.
c. Emergency Locking retractor.

12.6 Purpose and working principle of

a. Door suction system.
b. Rear Screen Wiper.
c. Rear Screen Defogger.
d. Rear Screen Camera.

12.7 Construction of Two & Three Point Seat belt.
12.8 Power Seat adjustment.
12.9 Purpose and working of

a. Power Window System.
b. Power Side View Mirror (opening and retraction).

12.10 Purpose of

a. Power Sunroof.
b. Embedded print antenna.
c. SUV Bumper Guard.
d. Fuel Lid & Trunk Opener.

12.11 Adjustment of trunk lid, bumpers, Panels, hood.

13 Automotive body fillers and solders. 2 Hours

13.1 Purpose and types of automotive

a. Body Fillers.
b. Body Solders.

14 Automotive body insulation. 4 Hours

14.1 Automotive insulations.

a. Body Sealers.
b. Rubber Comment.
c. Cavity noise.
d. Water & Dust locks.
e. Wind Noise.
f. Body Wrestles.
g. Weather strip maintenance.

14.2 Removal of Specific Stains from upholstery i.e. Blood, Chewgum, Shoe polish, Fruit stain, Tar, Ice cream, Urine, Mustard, Lipstick, Vomit, Grease, and Oil.

15 Automotive body finishing materials. 2 Hours

15.1 Purpose of paint.
15.2 Contents of Paint.
15.3 Automotive body finishing materials. (Paint and its types (Enamels & Lacquers), Binder, Pigment, Solvent, Thinner, Primary Surface, Putty paint polish, paint rubbing compound, paint protective wax).

16 Automotive body surface preparation. 4 Hours

16.1 Abrasive and Sanding.
16.2 Types of Sanding (Hand Sanding & Power Sanding).
16.3 Method of Sanding (Dry & Wet Sanding).
16.4 Feather-edging.
16.5 Describe Clearing.
16.6 Glazing.
16.7 Masking.
16.8 Body Masking (Tape Masking & Paper Masking).
16.9 Techniques for the removal of rust and corrosion.
16.10 Methods for the removal of Auto Body scratching.

17 Automotive body spray paint equipments. 4 Hours

17.1 Proper use of following automotive spray painting equipments.

a. Air Compressor.
b. Pressure Regulator.
c. Spray Painting Gun and its types (Suction and pressure type & Bleeder and Non-Bleeder type).
d. Spray Painting Booth
e. Computerize Spray Painting Booth.
f. Spray Paint Drying equipments.

g. Respirator.
h. Electrostatic Paint

18 Automotive body spray painting techniques. 4 Hours

18.1 Color Wheel Chart.
18.2 Terms relating to Color.
18.3 Temperature, Viscosity and reduction.
18.4 Color Matching Scheme.
18.5 Setting of Air control, air gap, fluid volume, and Spray Pattern.
18.6 Distance from the surface, tilting, triggering, Overlap, Zebra effect.
18.7 Cornering, Over Spray & Film thickness.
18.8 Different Spray-painting problems.
18.9 Steps involved in computerize method of accurate preparation of paint matching Scheme.
18.10 Special Safety Precautions for Spray Painting.
18.11 Steps involved computerized methods of automotive body spray painting and paint baking.

19 Automotive detailing exterior and interior and paint correction 2 Hours

19.1 Vehicle Interior detailing
19.2 Vehicle Exterior detailing.
19.3 Vehicle Engine detailing
19.4 Vehicle Paint correction, new addition.

20 Introduction of use automotive PPF Techniques 2 Hours

20.1 Introduction of PPF
20.2 Types of PPF
20.3 Cutting & heating of PPF
20.4 Discuss steps involve installing PPF
20.5 Safety precautions for installing PPF
20.6 Ceramic coating

Recommended Textbooks:

1. Automotive Body Work and Rust Repair by M. Joseph
2. Auto Body Repair by Duenk-Williams-Brooks
3. Auto Body Repair Technology (7th edition) by James E.Duffy

AM-343 AUTO BODY BUILDING & FINISHING

Instructional Objectives:

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

1 Understand the purpose, types, construction, styles, attachments and materials of automotive body.

1.1 State the Purpose of Automotive Body.
1.2 Identify the major Components of the automotive body.
1.3 Identify the Major Structural Components, Sections, and assemblies of Body-over-Frame Vehicles.
1.4 Describe the types of automotive body w.r.t (Use, Construction, No. of doors) Panel.
1.5 Explain the automotive body construction.

a. Automotive body front section Panels (cowl, shock towers, dash panel).
b. Automotive body center section Panels (pillars, instrument panels).
c. Automotive body rear section Panels (Deck, Lid, Quarter panel).
d. Accessories (Bumpers, Grilles, Moldings).

1.6 Describe the automotive body Styles.

a. Hatch Back type body style.
b. Sedan type body style.
c. SUV type body style
d. Crossover type body style
e. Hard top type body style.
f. Convertible type body style.
g. Station wagon type body style.

1.7 Describe the automotive Car Body Styles.

a. Coupe
b. Saloon.
c. Convertibles.
d. Limousine.
e. Estate Van.
f. Racing Car & Sports Car.

1.8 Describe the automotive Bus body Styles.

a. Mini Bus.
b. Single Decker & Double Decker Bus.

1.9 Enlist the parts of body of motorcycle.
1.10 Draw the sketch of the body of motorcycle, & labeled the parts name and its function.
1.11 Describe the Methods of attaching automotive body to frame.

a. Bolting Method of attaching automotive body to frame.
b. Welding Method of attaching automotive body to frame

1.12 Describe the automotive Body Material and their characteristics.

a. Sheet metal.
b. Types of sheet metal
c. General characteristics of Sheet metal.
d. Effect of temperature & moisture on sheet metal

2 Understand the vehicle aerodynamics.

2.1 State the Objective of Vehicle aerodynamics.
2.2 Describe Vehicle drag and its types.
2.3 Describe various types of forces and moments.
2.4 Describe effects of forces and moments.
2.5 Describe various body optimization techniques for minimum drag.

3 Understand the purpose, types, construction and alignment of vehicle frame.

3.1 State the Purpose of Vehicle Frame.
3.2 Read Vehicle identification number (VIN).
3.3 Describe the types and Characteristics of following types of frame cross section members.

a. Channel type cross-section frame member.
b. Box type cross-section frame member.
c. Round type cross-section frame member.
d. I type cross-section frame member.

3.4 Enlist the parts of frame of motorcycle.
3.5 Draw the Lay-out of the frame of motorcycle, sketch it & labeled the parts name and its function.
3.6 Describe estimated repair cost of accident vehicles.
3.7 Explain the different types of frame damages.
3.8 Describe the checking of frame alignment and damages with

a. Plumb Bob
b. Tram Gauge.

3.9 Describe the procedure and steps involved for computerize method of automotive Frame alignment.

4 Understand the automotive body fasteners.

4.1 Describe the purpose, size, and use of Automotive Body Fasteners (Machine Screws, Sheet metal Screws, Bolts & Nuts, Finishing Washers, Speed Nuts, Rivets).

5 Understand the types and their use, of automotive body hand tools.

5.1 Describe the purpose, types and use of the following automotive body Hand Tools.

a. Hammers (Digging, Combination, Shrinking, Finishing).
b. Dolly Blocks (Heel, Toe in, Wedges, Rouging).
c. Spoons (Short elbow, long elbow, Off-set Straight, Curved Flat, Flat Top, Curved).
d. Pick Tools (Deep throat, Short Pick, Short Curved, Long Curved, Chisel Vit).
e. Files (Long Blocking, Short Block, Special Contour, Slapping).
f. File Holders (Adjustable, Non-adjustable).
g. Wrenches (Open end, Box end, Socket set).
h. Metal Shears / Snips.
i. Pry Bars.
j. Pliers, Vice Grip, Lock and Panel.
k. Screw Drivers
l. Clips.

6 Understand purpose and use of power tools.

6.1 Describe the purpose and Proper use of following Power Tools.

a. Grinders and its types.
b. Sanders and its types.
c. Polishers and its types.
d. Portable Drill machines.
e. Pneumatic Impact tools.
f. Hydraulic Body Jack.

7 Understand the techniques for metal working.

7.1 Describe the following techniques for metal working.

a. Uses of Pulling and Pushing Setups.
b. Shrinking metal.
c. Metal finishing (Removing Paint and Under coating, Smoothing, Filing, Sanding).

8 Understand purpose, types and techniques of welding.

8.1 State Purpose of Welding.

8.2 Describe the different types of welding (Gas Welding, Arc Welding, Spot Welding).
8.3 Describe use of welding equipments.

9 Understand Dry denting.

9.1 Explain the use of Dent lifters
9.2 Explain the use of Glue puller with tab
9.3 Explain the use of Slide hammers
9.4 Explain the use of Denting rods and hooks

10 Understand collision damages and its repair.

10.1 Explain following types of Collisions damages and their repair.

a. Front end collisions.
b. Rear end collisions.
c. Side wise collisions.
d. Roll over collisions.

10.2 Describe impact and its effects on a Vehicle.

11 Understand automotive body glasses and plastics.

11.1 Describe Glasses and its types
11.2 Explain the procedure for the removal and installation of wind shield and rear windows shield.
11.3 Describe the Glass servicing and its repair.
11.4 Describe Plastic and its types
11.5 Explain the repair and replacement of Fiber Glass and Plastic body components.

12 Understand automotive body hardware & accessories.

12.1 Describe the Automotive body Hardware.
12.2 Describe the maintenance of automotive doors.
12.3 Describe the procedure for removal and installation of automotive doors.
12.4 Describe the procedure for adjustment of automotive doors.
12.5 Describe the purpose and working principle of

a. Central Locking door system.
b. Child Lock door system.
c. Emergency Locking retractor.

12.6 Describe the purpose and working principle of

a. Door suction system.
b. Rear Screen Wiper.
c. Rear Screen Defogger.

d. Rear Screen Camera.

12.7 Describe the purpose and construction of Two & Three Point Seat Belt.
12.8 Describe the Power Seat adjustment.
12.9 Describe the purpose and working of

a. Power Window System.
b. Power Side View Mirror (opening and retraction).

12.10 State Purpose of

a. Power Sunroof.
b. Embedded print antenna.
c. SUV Bumper Guard.
d. Fuel Lid & Trunk Opener.

12.11 Describe the procedure for the adjustment of trunk lid, bumpers, Panels, hood.

13 Understand automotive body fillers and solders.

13.1 Describe the Purpose and types of automotive

a. Body Fillers.
b. Body Solders.

14 Understand the automotive body insulation.

14.1 Describe the following automotive insulations.

a. Body Sealers.
b. Rubber Comment.
c. Cavity noise.
d. Water & Dust locks.
e. Wind Noise.
f. Body Wrestles.
g. Weather strip maintenance.

14.2 Explain the procedure for the removal of Specific Stains from upholstery i.e. Blood, Chew gum, Shoe polish, Fruit stain, Tar, Ice cream, Urine, Mustard, Lipstick, Vomit, Grease, and Oil.

15 Understand automotive body finishing materials.

15.1 State purpose of paint.
15.2 Describe Contents of Paint.
15.3 Describe the following automotive body finishing materials. (Paint and its types (Enamels & Lacquers), Binder, Pigment, Solvent, Thinner, Primary Surface, Putty, paint polish, paint rubbing compound, paint protective wax).

16 Understand automotive body surface preparation.

16.1 Describe Abrasive and Sanding.
16.2 Explain types of Sanding (Hand Sanding & Power Sanding).
16.3 Describe the method of Sanding (Dry & Wet Sanding).
16.4 Explain the Feather-edging.
16.5 Describe Clearing.
16.6 Describe Glazing.
16.7 Define Masking.
16.8 Explain Body Masking (Tape Masking & Paper Masking).
16.9 Describe techniques for the removal of rust and corrosion.
16.10 Describe techniques and methods for the removal of Auto Body Scratching.

17 Understand automotive body spray paint equipments.

17.1 Describe the Purpose and proper use of following automotive spray painting equipments.

a. Air Compressor.
b. Pressure Regulator.
c. Spray Painting Gun and its types (Suction and pressure type & Bleeder and Non-Bleeder type).
d. Spray Painting Booth
e. Computerize Spray Painting Booth.
f. Spray Paint Drying equipments.
g. Respirator.
h. Electrostatic Paint

18 Understand automotive body spray painting techniques.

18.1 Describe the Color Wheel Chart.
18.2 Define terms relating to Color.
18.3 Describe temperature, Viscosity and reduction.
18.4 Describe Paint Color Matching Scheme.
18.5 Describe setting of Air control, air gap, fluid volume, and Spray Pattern.
18.6 Describe motion, distance from the surface, tilting, triggering, Over Lap, Zebra effect.
18.7 Explain Banding, Cornering, Over Spray & Film thickness.
18.8 Describe the different Spray painting problems.
18.9 Describe the procedure and steps involved in computerize method of accurate preparation of paint matching Scheme.
18.10 Describe the Special Safety Precautions for Spray Painting.
18.11 Describe the procedure and steps involved in computerize method of automotive body spray painting and paint baking.

19 Understand Automotive detailing exterior and interior and paint correction

19.1 Describe Vehicle Interior detailing
19.2 Describe Vehicle Exterior detailing.
19.3 Describe Vehicle Engine detailing
19.4 Describe Vehicle Paint correction, new addition.

20 Understand the use automotive PPF Techniques

20.1 Introduction of PPF
20.2 Describe the types of PPF
20.3 Describe the cutting & heating of PPF
20.4 Describe the steps involve installing PPF
20.5 Describe the safety precautions for installing PPF
20.6 Describe the ceramic coating

AM-343 AUTO BODY BUILDING AND FINISHING

List of Practicals:

1. Identify the main parts of an automobile body and frame.
2. Identify the various vehicles body styles.
3. Identify the various types of vehicle frames.
4. Check the Frame alignment by Plumb Bob and damages by frame Gauge and report findings.
5. Practice the use of automotive body hand tools.
6. Practice the use of techniques ~~of~~ for sheet metal forming.
7. Align the doors and hood of the car by using different techniques.
8. Practice the use of Hydraulic body Jack.
9. Practice the use of Pull Rod Chains.
10. Practice the use of Power Sander (wet & dry) and Polisher.
11. Perform techniques for the removal of rust and corrosion.
12. Perform techniques for the removal of Auto Body Scratches.
13. Practice to Shrink the Stretched Panel.
14. Remove the old paint from the Auto body surface.
15. Carry out Repairs of Plastic body components.
16. Remove and reinstall the front and rear wind screen shield.
17. Adjust the doors, hood latch and trunk lid.
18. Repair minor bumper dents and align them.
19. Remove and refit the door handles arm rests.
20. Identify the Auto body finishing materials.
21. Prepare surface for auto body spray painting.
22. Draw the Basic Color Wheel Chart.
23. Perform paint mixing and Color matching scheme.
24. Perform spray painting gun drive and make its adjustments.
25. Perform auto body paint spraying and identify painting problems.
26. Carry out alignment of automotive frame of an accidental Vehicle.
27. Perform vehicle interior detailing.
28. Perform vehicle exterior detailing.
29. Perform different methods of engine detailing
30. Perform different methods of Paint correction.
31. Perform installation of different types of PPF on vehicle.
32. Visit at modern automotive workshop for the demonstration of (paint color matching scheme, working of computerized vehicle spray painting booth & vehicle complete detailing process and submit the visit report).

AM-354 WORKSHOP PRACTICE-III

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

Pre-requisite: Workshop Practice-II and I.C. Engines

LEARNING OUTCOMES:

1. Understand tune- up of petrol and diesel engines.
2. Practice the use of engine testing instrument/equipment.
3. Diagnose engine troubles and rectify them.
4. Practice the use of Automotive Diagnostic Scanner.
6. Know tests for engine exhaust gasses emission controls.
7. Layout of an automotive workshop/garage.
8. Maintain inventories, organize stores and issuance of equipment and parts
9. Know periodic lubrication.
10. Prepare automotive workshop customer handling documents.

Detail of Contents:

1 Tune-up procedure and vehicle periodic maintenance charts. 4 Hours

1.1 Tune-up.
1.2 Major and minor tune-up.
1.3 General Safety rules for engine tune-up.
1.4 Procedure of tune-up for petrol engine.
1.5 Tune-up for Diesel engine.
1.6 Green Tuning.
1.7 General and Periodic Maintenance Chart.
1.8 Develop the Periodic Maintenance Charts for different local (assembled)brands of vehicles for 1000 Km, 5000 Km, 10000 Km, 20000 Km, 300000 Km, .
1.9 Service Charts of different local assembled brands of vehicles.
1.10 Daily inspection of a vehicle.
1.11 Periodic lubricating chart for a vehicle.

2 Lay-out and use of workshop & garage equipments. 6 Hours

2.1 Auto workshop and garage.
2.2 Garages (small, medium, large, service station).
2.3 Comprehensive List of machines, equipment and tools for an automotive workshop and garage.
2.4 Lay-out of an auto workshop.
2.5 Rigging & grouting.
2.6 Techniques involved for the installation of automotive machines.
2.7 Use of lifting tackle and salvage equipment.
2.8 Equipments use for the lubricating and cleaning purposes.
2.9 Use of battery charger.

2.10 Use of air compressor.
2.11 Precautionary measures to be observed while shifting machinery.

3 Preparation of documentation of an automotive workshop & garage. 8 Hours

3.1 Different kinds of record /documentation of auto workshop and garage.
3.2 Principles of record maintenance.
3.3 Workshop inventory stock register and consumption register.
3.4 Procedure for reading of vehicle service manual.
3.5 Procedure for reading of vehicle parts catalog manual.
3.6 Job card and time Sheet.
3.7 Repair cost of work from job card and time sheet.
3.8 Documents of an auto workshop and garage.

a. Technical Report writing.
b. Customer handling skill.
c. Warranty terms & conditions (policies).
d. Work shop operation / Flow of workshop.
e. Complain Handling skills.
f. Assessment of engine condition and report writing.
g. Assessment sheet for engine condition and report writing.

4 Maintenance of service station equipment. 4 Hours

4.1 Purpose of maintenance.
4.2 Purpose of jacks, cranes, and car lifts.
4.3 Describe the working and uses of different kinds of

a. Jacks.
b. Cranes.
c. Car Lifts.

4.4 Periodic lubrication of jacks, cranes, and car lifts

5 Working environment of automotive fleet organization. 2 Hours

5.1 Organization chart relating to automotive fleet.
5.2 Functions of various sections of fleet.
5.3 Metro Bus Corporation, Daewoo bus corporation, & PIA Organization.

6 Vehicle heating, ventilating and air-conditioning system. 6 Hours

6.1 Vehicle heating, ventilation and air conditioning system.
6.2 Construction and working principle of automotive air conditioning system with dual-zone climate control.
6.3 Evacuating of automotive air conditioning system.

6.4 Charging of automotive air conditioning system.
6.5 Refrigerants and their properties.
6.6 Vapor compression refrigeration system.

7 Euro standards, and International hydraulic and pneumatic codes & symbols. 2 Hours

7.1 Euro Standards.
7.2 International hydraulic & pneumatic codes and symbols.

Automotive Fault Diagnostics

8 Importance of Diagnostics in Automotive Repair 2 Hours

8.1 Introduction & importance of automotive diagnostics
8.2 Reducing repair time and costs
8.3 On-board vehicle diagnostics (OBD)
8.4 Off-board vehicle diagnostics

9 PC based Automotive Scanner (OBD-II) 6 Hours

9.1 Setting up Diagnostic Scanners
9.2 Selecting vehicle make, model, and year
9.3 Diagnostic Procedures
9.4 Understanding diagnostic trouble codes (DTCs)
9.5 Common DTCs and Their Meanings
9.6 DTC Code structure and meaning
9.7 Advanced Sensor Testing
9.8 MIL Status
9.9 Readiness Monitor Test Status
9.10 Snap shot of the history of vehicle diagnostic
9.11 Vehicle health monitoring
9.12 Fault codes and warning lights
9.13 Fixing issues
9.14 Live Data Streaming
9.15 Freeze Frame Data
9.16 Testing components and systems (e.g., activating solenoids, relays)

10 Digital Multimeter to test vehicle electric & electronic components/circuits. 6 Hours

10.1 Multimeter setting (Meter selection + Range setting)
10.2 Voltage testing/measurement AC, DCC)
10.3 Voltage drop tests/measurement
10.4 Current testing/measurement (AC, DC)
10.5 Open-circuit testing.

10.6 Short-circuit testing.
10.7 High resistance testing/measurement.
10.8 Intermittent breaks in a circuit.
10.9 Engine to chassis earth testing
10.10 Voltage drop test on earth strap
10.11 Lighting circuit tests
10.12 Continuity testing
10.13 Resistance tests/measurement

11 PC based Automotive Oscilloscope (Pico Scope) 3 Hours

11.1 Introduction and use of automotive Oscilloscope
11.2 Waveform analysis, signal patterns
11.3 Sensor and actuator tests
11.4 Air flow meter – hot wire waveform
11.5 Coolant temperature sensor waveform
11.6 Hall Effect distributor pick-up waveform
11.7 Throttle position potentiometer waveform
11.8 Multi-point injector waveform
11.9 Idle speed control valve waveform

12 Engine Exhaust Gas analyzer 3 Hours

12.1 Use of Engine Exhaust Gas Analyzer (Engine emission testing, Perform Engine Tuning, Engine Diagnostics/Maintenance)
12.2 Exhaust Gas Analysis
12.3 Common Emission System Faults
12.4 Causes of high emissions, poor fuel economy
12.5 Measure the quantity of CO, CO2, HC, O_2, and NOx in engine exhaust gasses.

13 Battery Tester 2 Hours

13.1 Measure cold cranking ampere (CCA)
13.2 Testing of overall charging system.

14 METALLURGY & HEAT TREATMENT 10 Hours

14.1 Metallurgy & classification of its types.
14.2 Ore & classification of its types.
14.3 Reduction and oxidation process.
14.4 Refractory materials & classification of its types.
14.5 Properties & applications of mild steel, medium steel and high carbon steel.
14.6 General & physical properties of metals (ductile, malleable, conductive, shiny, melting point, boiling point, density & tensile strength)
14.7 Alloy and give examples of alloys.
14.8 Rusting & corrosion, its causes & methods of prevention. i.e. Surface protection

(painting, oiling/greasing, plastic coating & metal plating)

14.9 Metal recycling & benefits of recycling metals.

14.10 Hot working processes (rolling, forging, heading, pressing, extrusion).

14.11 Cold working process (rolling, drawing, pressing).

14.12 Iron-carbide diagram.

14.13 Effect of heating & cooling on steel.

14.14 Annealing, normalizing, hardening, quenching & tempering.

14.15 Carburizing, nitriding & cyaniding.

Recommended Textbooks:

1. Automobile Technology by Dr. N.K. Giri
2. Automotive Excellence (Volume 1 & 2) by McGRAW Hill International
3. Modern Automotive Mechanics by James E. Duffy.
4. Automotive Technology A System Approach by Jack Erjavec
5. Automotive Electricity, Electronics & Computer Controls by Barry Hollembeak
6. Modern Automotive technology by James E. Duffy (10th edition)
7. Elements of Heat Treatment (Enos& Fontaine)
8. Engineering Materials (The testing of Materials) (AW Judge)

AM-354 WORKSHOP PRACTICE-III

Instructional Objectives:

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

1 Understand tune-up procedure and vehicle periodic maintenance charts.

1.1 Define Tune-up.
1.2 Differentiate between Major and Minor Tune-up.
1.3 State General Safety rules for engine Tune-up.
1.4 Describe the Tune-up Procedure of Petrol engine.
1.5 Describe the Tune-up Procedure of Diesel engine
1.6 Define Green Tuning.
1.7 Describe Vehicle General and Periodic Maintenance Chart.
1.8 Develop the Periodic Maintenance Charts for different local (assembled)brands of vehicles for 1000 Km, 5000 Km, 10000 Km, 20000 Km, 300000 Km,
1.9 Study the Service Charts of different local assembled brand of vehicles.
1.10 Enlist the steps for daily inspection of a vehicle.
1.11 Prepare a Periodic Lubricating chart for a vehicle.

2 Understand the lay-out and use of workshop & garage equipments.

2.1 Differentiate between auto workshop and garage.
2.2 Describe the types of garages (small, medium, large, service station).
2.3 Define Lay-out.
2.4 Prepare a comprehensive List of machines, equipments and tools for an automotive workshop and garage.
2.5 Explain rigging & grouting.
2.6 Enlist of techniques involved for the installation of automotive machines.
2.7 Describe the use of lifting tackle and salvage equipment.
2.8 Describe the equipments use for the lubricating and cleaning purposes.
2.9 Describe the use of battery charger.
2.10 Describe the use of air compressor.
2.11 Describe and enlist precautionary measures to be observed while shifting machinery.

3 Understand the preparation of documentation of automotive workshop & garage.

3.1 Enlists Different kinds of record /documentation of auto workshop and garage.
3.2 State the principles to maintain the record.
3.3 Describe workshop inventory stock register and consumption register.
3.4 Describe the procedure for reading of vehicle service manual.
3.5 Describe the procedure for reading of vehicle parts catalog manual.
3.6 Describe job card and time Sheet.
3.7 Estimate and compute repair cost of work from job card and time sheet.
3.8 Learn the following documents of an auto workshop and garage.

a. Technical Report writing.
b. Customer handling skill.
c. Warranty terms & conditions (policies).
d. Work shop operation / Flow of workshop.
e. Complain Handling skills.
f. Assessment of engine condition and report writing.
g. Assessment sheet for engine condition and report writing.

4 Understand maintenance of service station equipment.

4.1 Describe the purpose of maintenance.
4.2 State the purpose of jacks, cranes, and car lifts.
4.3 Describe the working and uses of different kinds of

a. Jacks.
b. Cranes.
c. Car Lifts.

4.4 Describe the periodic lubrication of jacks, cranes, and car lifts

5 Understand working environment of automotive fleet organization.

5.1 Describe the organization chart relating to automotive fleet.
5.2 State the functions of various sections of fleet.
5.3 Compare among metro bus corporation, Daewoo Bus Corporation, and PIA Organization.

6 Understand the function, construction and working of vehicle heating, ventilating and air-conditioning system.

6.1 Describe the purpose, construction & working of vehicle heating, ventilation and air conditioning system.
6.2 Describe the construction and working principle of automotive air conditioning system with dual zone climate control.
6.3 Describe evacuating of automotive air conditioning system.
6.4 Describe charging of automotive air conditioning system.
6.5 Describe refrigerants and their properties.
6.6 Introduction of vapor compression refrigeration system.

7 Understand euro standards, and international hydraulic and pneumatic codes & symbols

7.1 Explain the euro standards.
7.2 Identification of International hydraulic & pneumatic codes and symbols.

Automotive Fault Diagnostics

8 Importance of Diagnostics in Automotive Repair

8.1 Learn introduction & importance of automotive diagnostics
8.2 Learn reducing repair time and costs
8.3 Understand on-board vehicle diagnostics (OBD)
8.4 Understand off-board vehicle diagnostics

9 PC based Automotive Scanner (OBD-II)

9.1 Setting up diagnostic scanner
9.2 Selecting vehicle make, model, and year
9.3 Learn diagnostic Procedures
9.4 Understanding diagnostic trouble codes (DTCs)
9.5 Understand common DTCs and Their Meanings
9.6 Understand DTC Code structure and meaning
9.7 Understand Advanced Sensor Testing
9.8 Understand MIL Status
9.9 Understand Readiness Monitor Test Status
9.10 Understand Snap shot of the history of vehicle diagnostic
9.11 Understand Vehicle health monitoring
9.12 Understand fault codes and warning lights
9.13 Describe Fixing issues
9.14 Understand Live Data Streaming
9.15 Understand Freeze Frame Data
9.16 Understand testing components and systems (e.g., activating solenoids, relays)

10 Digital Multimeter to test Vehicle electric & electronic components/circuits.

10.1 Learn Multimeter setting (Meter selection + Range setting)
10.2 Understand Voltage testing/measurement (AC, DC)
10.3 Understand Voltage drop tests/measurement
10.4 Understand current testing/measurement (AC, DC)
10.5 Understand Open-circuit testing.
10.6 Understand Short-circuit testing.
10.7 Understand High resistance testing/measurement.
10.8 Understand Intermittent breaks in a circuit.
10.9 Understand Engine to chassis earth testing
10.10 Understand Voltage drop test on earth strap
10.11 Understand Lighting circuit tests
10.12 Understand Continuity testing
10.13 Understand Resistance tests/measurement

11 PC based Automotive Oscilloscope (Pico Scope)

11.1 Understand introduction and use of automotive Oscilloscope
11.2 Describe Waveform analysis, signal patterns
11.3 Understand Sensor and actuator tests
11.4 Describe Air flow meter – hot wire waveform
11.5 Understand Coolant temperature sensor waveform
11.6 Understand Hall Effect distributor pick-up waveform
11.7 Throttle position potentiometer waveform
11.8 Understand Multi-point injector waveform
11.9 Understand idle speed control valve waveform

12 Engine Exhaust Gas analyzer

12.1 Understand Use of Engine Exhaust Gas Analyzer (Engine emission testing, perform Engine Tuning, Engine Diagnostics/Maintenance)
12.2 Understand Exhaust Gas Analysis
12.3 Understand Common Emission System Faults
12.4 Understand Causes of high emissions, poor fuel economy
12.5 Understand Measure the quantity of CO, CO2, HC, O2, and NOx in engine exhaust gasses.

13 Battery Tester

13.1 Understand Measure cold cranking ampere (CCA)
13.2 Understand Testing of overall charging system.

14 Metallurgy& Heat Treatment

14.1 Define Metallurgy & describe classification of its types.
14.2 Understand Ore & classification of its types.
14.3 Understand Reduction and oxidation process.
14.4 Understand Refractory materials & classification of its types.
14.5 Understand Properties & applications of mild steel, medium steel and high carbon steel.
14.6 Understand General & physical properties of metals (ductile, malleable, conductive, shiny, melting point, boiling point, density & tensile strength)
14.7 Understand Alloy and give examples of alloys.
14.8 Understand Rusting & corrosion, its causes & methods of prevention. i.e. Surface protection (painting, oiling/greasing, plastic coating & metal plating)
14.9 Understand metal recycling & benefits of recycling metals.
14.10 Understand hot working processes (rolling, forging, heading, pressing, extrusion).
14.11 Understand Cold working process (rolling, drawing, and pressing).
14.12 Describe Iron-carbide diagram.
14.13 Understand Effect of heating & cooling on steel.
14.14 Understand Annealing, normalizing, hardening, quenching & tempering.
14.15 Understand Carburizing, nitriding & cyaniding.

AM-354 WORKSHOP PRACTICE-III

List of Practicals:

1. Perform tune-up of petrol engine.
2. Perform tune-up of diesel engine.
3. Develop the Periodic Maintenance Charts for different Local assembled vehicles.
4. Prepare Periodic Lubrication chart of a vehicle.
5. Practice the use of automotive cleaning equipment.
6. Practice the use of air-compressor.
7. Practice the use of jack, crane and car lift.
8. Make a Layout plan of automotive workshop.
9. Prepare stock register, consumption register, job card, time sheet and bill of repair services.
10. Prepare an organizational chart of an automotive Fleet.
11. Locate faults of Positive Crankcase Ventilation System (PCV system).
12. Replace and identify the faults of Catalytic Converter.
13. Practice the use of Automotive Diagnostic Scanner for finding vehicle faults.
14. Practice the use of Exhaust Gas Analyzer to find out the value of exhaust gas emissions.
15. Perform the procedure for Reading of Vehicle Service Manual & parts catalog.
16. Prepare a chart of Euro Standards.
17. Prepare a Chart of International Hydraulic & Pneumatic Codes and Symbols.
18. Prepare the following documents of Automotive Workshop.
19. Technical Report writing, Customer handling skill, Warranty terms & conditions (policies), Workshop operation / Flow of workshop, Complaint Handling skills, Assessment Sheet for engine condition and report writing
20. Prepare the chart of Automotive Fault Diagnostic terminology.
21. Connect Automotive (OBD-II) scanners to the vehicle DLC connector and set the scanner for diagnostic faults
22. Practice the use of automotive scanner to diagnose vehicle trouble codes (DTCs)
23. Practice the use of automotive scanner to analyses the vehicle live data
24. Practice the use of automotive scanner to perform active tests on different actuators.
25. Perform the multimeter setting (analogue & digital): Menu selection + Range setting
26. Practice the use of multimeter to test Voltage, current & resistance of different electric & electronic components and circuits
27. Practice the use of automotive Pico-scope for Waveform analysis, signal patterns
28. Practice the use of automotive Pico-scope to learn vehicle Sensors & actuators waveform Analysis
29. Practice the use of Engine Exhaust Gas Analyzer to Measure quantity of CO, CO2, HC, O2 and NOx in engine exhaust gasses
30. Visit to Modern Automotive Workshop/Fleet for demonstration of working environment and submit report.
31. Visit to Diesel engine Power Plant for the demonstration of working and testing of Power Plant / Generator and submit report
32. Perform Hardening process & Perform Tempering process
33. Perform Annealing process.
34. Perform Case Hardening process.
35. Visit at modern steel manufacturing factory for the demonstration of steel manufacturing processes and submit report.

LIST OF TOOLS, EQUIPMENT & MACHINERY
MECHANICAL TECHNOLOGY (POWER)
WITH SPECIALIZATION IN AUTOMOTIVE

S.NO	Name OF LAB/WORKSHOP	Quantity
1.	Engine & Transmission Lab	1 NO
2.	Suspension, Steering & Brakes Lab	1 NO
3.	Automotive Denting, Painting & Detailing Lab	1 NO
4.	Drivers Training Lab	1 NO
5.	Electric Vehicles (EVs) Lab	1 NO
6.	Automotive Electronics Lab	1 NO
7.	Automotive Testing & Diagnostics Lab	1 NO
8.	Machine Shop	1 NO
9.	Drawing Hall	1 NO
10.	CAD Lab	1 NO

PERMANENT STOCK ITEMS

LIST OF Teaching Aids

(For DAE class of 50 students)

S.NO	Name of teaching Aids	Quantity
1.	Smart WIFi TV LED (screen display range 65 inch -85 inch)	05 No's
2.	Lap Top (Core i 5 , 15 inch screen display)(minimum 8th Gen)	05 No's
3.	Wi-Fi Modem	05 No's

LIST OF SAFETY & PROTECTION EQUIPMENT

(For DAE class of 50 students)

S.NO	Name of Machinery /Equipments	Quantity
1.	Fire Extinguishers (DCP 6-8kg, CO2 8kg,FOAM)	05 No each
2.	Fire Blanket	05 No's
3.	Safety goggles	10 No's
4.	Respiratory Gas Mask (Air Anti-Dust & Chemical fumes, double filter	10 No's
5.	Safety Helmet	10 No's
6.	First Aid Box	10 No's
7.	Apron/ Proper uniform	50 No's
8.	Dust Mask	50 No's
9.	Safety shoes	50 No's
10.	Ear Muff	10 No's
11.	Safety Gloves set(Leather, rubber & Cotton)	50 No's
12.	Sand Storage buckets for fire fighting	10 No's
13.	Water Storage buckets for fire fighting	10 No's

LIST OF GENERAL BASIC HAND TOOLS

(For DAE class of 50 students)

S.NO	Name of Tool	Quantity
1.	Flat Screw driver (4", 6", 8", 12") & offset Screw driver (4", 6", 8", 12")	10 each
2.	Philips Screw driver (4", 6", 8", 12") & clutch type, torx type, read type and prince type	10 each
3.	Impact Screw driver set	10 set
4.	Hammers (Ball peen, Straight peen, cross peen) sledge, Brass or lead, plastic tipped, rubber mallet.	10 each
5.	Special screw drivers(stubby, scratch awl, Socket head driver, clip screw driver.	10 each
6.	Pliers(needle nose, High leverage cutter, vise grip, diagonal cutting,Battery Plier, tin snip,snap ring, rib joint, slip joint, crimper)	10 each
7.	Adjustable Wrench (6", 12")	10 each
8.	Pipe Wrench(8",10",12")	10 each
9.	strap wrenches(universal,Big range/Adjustable fuel filter and oil filter)	10 each
10.	Open end spanner set (8-32 mm)	10 set
11.	Ring Spanner set (off set) 8-32mm	10 set
12.	Box end spanner set (8-32 mm)	10 set
13.	Socket set (8-32 mm)	10 set
14.	Special wrenches(sludge wrench, ratchet wrench,flex combination, half moon).	10 each
15.	spark plug spanner.	10 No's
16.	Torque Wrench(flex bar,dialindicator,snap or click, digital)	10 each
17.	Allen Key set (1.5- 10 mm)	10 set
18.	Socket set complete(8-32 mm with all accessories).	10 set
19.	wheel spanner cross type	10 No's
20.	Pullers (Gears, Bearings, Pulleys, Steering,slide hammer)	10 each
21.	Oil Seal extractors and installers	10 No's
22.	Oil cane (pressure type).	10 No's
23.	Tube bender , Tube cutter and Flaring tools set	10 set
24.	Valve Spring Compressor	10 No's

25.	Piston Ring Compressor	10 No's
26.	Piston Ring Expander	10 No's
27.	Grease Gun (400cc capacity)	10 No's
28.	Pop Rivet Plier	5 No's
29.	Scraper (blade width 2",4",6")	15 No's each
30.	Scissor (10")	5 No's
31.	Centre Punch	10 No's
32.	Punches (Hollow punch set)	10 set
33.	Adjustable Hand Hacksaw frame (300 mm)	10No's
34.	Bench vice (6",8")	05 No's each
35.	Magnetic pickup tool(prob pick up tool set)	10 set
36.	Magnifying glass	10 No's
37.	Hand brushes (wire type)	10No's
38.	Pry bars set (20", 25", 30")	10 set
39.	File (Flat, round, triangle, square)10"	05 No's each
40.	Hand Hacksaw	05 No's
41.	Anvil (50 kg)	05 No's
42.	Chisels (Flat, cross-cut, round nose)	25 No's each
43.	Calipers (Internal & external)2mm-100mm	10 set
44.	V-Blocks (magnetic type)	10 No's
45.	S.S.T tools wide range	2 set
46.	Stud extractor set	5 set
47.	Lettering Punch set	02 No's
48.	Numbers punch set	02 No's
49.	Magnetic pick tool	05 No's
50.	Tyre Lever (Pry Bars) Size 16"	05 No's
51.	Bolt Cutter Size 14"	05 No's
52.	Troch Light	10 No

LIST OF MEASURING TOOLS/EQUIPEMENT

(For DAE class of 50 students)

S.NO	Name of Tool	Quantity
1.	Steel Foot rule.	10 No's
2.	Steel tape (50 ")	10 No's
3.	Spring Scale (5 kg)	10 No's
4.	Vernier Caliper (250mm , Least count 0.05)	25 No's
5.	Vernier Caliper (250mm , Least count 0.02)	10 No's
6.	Digital Vernier Caliper (250mm)	10 No's
7.	Dial Vernier Caliper (250mm)	10 No's
8.	Micrometer (inside) 0-25mm, 0-50mm, 0-75mm, 0-100mm	10 No's
9.	Micrometer (out side) 0-25mm, 0-50mm, 0-75mm, 0-100mm	10 Nos. (each)
10.	Dial Gauge (Leas count 0.001" 0.01-10mm)	05No's
11.	Depth gauge	05No's
12.	Feeler gauge (6 / 8 inches)	05No's
13.	Thread pitch gauge (inches and mm)	05No's (each)
14.	Wire gauge	05No's
15.	Belt tension gauge	02 No's
16.	Belt tension gauge (electronic)	01 No's
17.	Telescopic gauge	05No's
18.	Tire Pressure gauge	05No's
19.	Angle measuring gauge (combination set)	05No's
20.	Thermometer	10 No's
21.	Tri Square	10 No's

LIST OF INSTRUMENT / EQUIPMENT &
AUTOMOTIVE DIAGNOSTICS TOOLS
(For DAE class of 50 students)

S.NO	Name of Machinery /Equipments	Quantity
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.	Digital Multimeter	20No's
7.	Digital Clamp meter (AC/DC up to- 400A)	5 No's
8.	Analogue Multimeter	5 No's
9.	Infrared Temperature Gun	2 No's
10.	Automotive Picoscope (Oscilloscope)	1 No
11.	Growler Tester	1 No's
12.	PC Based Universal Automotive Diagnostic Scanner(OBD-II) With Lap Top •Operating system=Android operating system • CPU(Min.)=1.5 GHz Quad core (minimum) • Ram(min.)=2GB Ram & 32GB SSD • Display(Min.)=8.0 "touch screen. • Communication Mode= Wireless Bluetooth • Battery type= lithium-polymer . • Perform activation tests(ABS, Immobilizer, SRS, ISC) • Operating Manual	05 No's
13.	Battery Health Tester	02 No
14.	Digital Multimeter Meters	50 No's
15.	Automotive Peco scope (Osiloscop)	01 No
16.	Exhaust Gas Analyzer (5-Gases)	5 No's
17.	Computerized Wheel balancer machine(with all accessories)	1 No
18.	Computerized Wheel alignment apparatus 3D (with all accessories)	1 No
19.	Automatic Tyre Changer	1 No
20.	Universal Injector Cleaner kit	2 No's
21.	Ultrasonic Electronic injector tester machine	1 No
22.	Universal Diesel Fuel Injection pump Phasing & Calibration Machine.	1 No

LIST OF WORKSHOP MACHINERY / EQUIPMENT

(For DAE class of 50 students)

S.NO	Name of Machinery /Equipments	Quantity
1.	Chain Pulley Block hoist (3-5 ton)	01 No's
2.	Hydraulic Car Scissor Lift (0.5 to 2 ton)	1 No
3.	Hydraulic Crane	1 No
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 (5 - 10 tons)	1 No
15.	Portable Electric Drill Machine (helti type)	05 No
16.	Radiator Pressure Cap tester	1 No
17.	Hydraulic Jack (3-5 ton)	5 No each
18.	Mechanical Jack (3-5 ton)	5 No's
19.	Gear box repairing stand (Mechanical type)	10 No's
20.	Engine repairing stand (Mechanical type)	10 No's
21.	Service Creeper trolleys with Led lights	5 No's
22.	Creeper stool type	5 No's
23.	Air Compressor (500- 700L)	1 No
24.	Car Pressure Washer(1500-2000 psi)	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.	Platform truck	5 No’s
33.	Oval shape Hydrometer	10 No’s
34.	Battery Post terminal cleaner	5 No’s
35.	Automotive Stethoscope	5 No’s
36.	Soldering gun	5 No’s
37.	Battery Fast Charger with digital display (1 -50A)	1 No
38.	Battery Health tester	2 No’s
39.	Cleaning tank	2 No’s
40.	Portable Tyre inflator	2 No’s
41.	Ramp & Pit .	2 No’s
42.	Differential repair stands	2 No’s
43.	Parts tray	20 No’s
44.	V-blocks set	3 No’s
45.	SST Board	5 No’s
46.	Torch light	2 No’s
47.	Series Test lamp	5 No’s
48.	Circuit tester	5 No’s
49.	Air blower gun	3 No’s

LIST OF ENGINES/TRANSAXLES &VEHICLES

(For DAE class of 50 students)

S.NO	Name of Machinery /Equipments	Quantity
1.	Petrol engine(4-cylinder VVT-I &i-VTech) complete Assembly	5 NO'S
2.	Diesel engine (multi cylinder, CRDF type)complete Assembly	5 NO'S
3.	Petrol engine (Multi cylinder, carburetor type) complete Assembly	1 NO'S
4.	Generator (10 to 20KVA)	01 No's
5.	Petrol engine (70-80 cc)	5 NO'S
6.	Petrol engine (100cc, 125cc)	5 NO'S
7.	Manual Transaxle(Synchromesh type)	10 NO'S
8.	AGS Transaxle	10 NO'S
9.	Prosmatec Transaxle	5 NO'S
10.	ECT Automatic planetary gear transaxle	5 NO'S
11.	CVT-I Transaxle	5 NO'S
12.	Complete vehicle Chassis equipped with automatic transmission	1 NO
13.	Car equipped with manual transmission	1 NO
14.	Plug in Hybrid car	1 NO
15.	Electric Bike/Scooter	1 NO
16.	Motorcycle (minimum 70cc)	1 NO
17.	Motorcycle (minimum 125cc)	1 NO

LIST OF AUTOMOTIVE MODELS

(For DAE class of 50 students)

S.NO	Name of Machinery /Equipments	Quantity
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 TOOLS/EQUIPMENTS FOR ELECTRIC VEHICLES (EVs) LAB

(For DAE class of 50 students)

S.NO	Name of Tools/Equipments	Quantity
1.	Digital Multimeter	25No's
2.	Analog Multimeter	25No's
3.	Digital Clamp meter (AC/DC up to- 400A)	05 No's
4.	Soldering Station	10 No's
5.	Insulation resistance tester(Megger)	05 No's
6.	Torque wrenches	05 No's
7.	High Voltage insulated tools kit(Screw drivers, pliers, cutters)	10 No's
8.	Power Supply(DC regulated, 0-60v)	10 No's
9.	Safety PPE complete kit (Insulated gloves, face shields, fire extinguisher Class D for Battery fires)	10 No's
10.	First aid & Emergency shut-off system	05 No's
11.	Oscilloscope(Digital storage, 2/4 channels)	02 No's
12.	EV Diagnostic Scanner Tool(Commercial type)	03 No's
13.	OBD-II & CAN Bus Analyzer Kit(for EV communication protocols)	1 NO
14.	Simulation Software(MATALAB/Simulink, Labview ,Proteus,ETAP for EV Systems)	1 NO
15.	EV Car (preferably Sedan type)	1 NO
16.	Cutaway Model of EV Chasis with powertrain	1 NO
17.	Electric vehicle Driving trainer	1 NO
18.	EV Motor Trainers(BLDC,PMSM Induction Motor setups with controller)	1 NO
19.	Motor Controller (Inverter+Driver circcuit demonstration kits)	1 NO
20.	Charging Station Model(with smart meter)	1 NO
21.	Hybrid vehicle trainer (for comparison with EVs)	1 NO
22.	Regenerative braking demonstration unit	1 NO
23.	Gearbox & differential cutaway model (For EV integration)	1 NO
24.	Battery Pack trainer(Lithium-ion with BMS demonstration)	1 NO
25.	Battery Management System(BMS) training kits.	1 NO

26.	Thermal manegement system trainer(cooling/heating systems for batteries)	1 NO
27.	DC-DC converter trainer	1 NO
28.	Inverter trainer(single phase & 3-phase)	1 NO
29.	Rectifier & charger circuits trainer)	1 NO

LIST OF TOOLS/MACHINERY & EQUIPMENT FOR

AUTOMOTIVE DENTING, PAINTING & DETAILING LAB

(For DAE class of 50 students)

S.NO	Name of Tools /Equipments	Quantity
1.	**Hammers** (Heavy Duty roughing, combination or pick, light dinging, combination dinging, heavy dinging, dinging hammer with short curved pick, offset dinging, Shrinking hammer, dinging hammer with long curved pick, Magnatic trim hammer,nylon mallet.	10 No's each type
2.	**Dollies** (High crown dollyblock, Low crown, heavy duty roughing, shrinking, rail type, All-purpose Heel dolly block.	10 No's each type
3.	**Spoons** (Double-end lower back panel,Double-end door and side apron spoon,Heavy-duty drivinbgspoon,Double-end heavy duty driving and fender-beading tool,Highcrown surfacing spoon,Low crown surfacing spoon, Edging tool.	10 No's each type
4.	**Pick Tools** (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.	**File's Holder** (Adjustable file holder)	10 No's each type
6.	**Files** (Long Blocking file, short blocking file,Specialcontour 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.	Reamer (hand operated)	10 No's
10.	Burr cutter	10 No's
11.	Buffing pad	10 No's
12.	Portable Arc Welding Plant	05 No
13.	Portable Spot welding plant	01 No

14.	Portable Plasma welding plant	01 No
15.	Tig & Mig welding Plant	01 No
16.	Soldering Gun	10 No's
17.	Buffer & Grinder (Bench & Portable) (6")	01 No's
18.	Reveal molding	10 No's
19.	Door and window handle clip remover	10 No's
20.	Vacuum lifter (wind sheild)	4 No's
21.	Wind sheild lacing tools	10 No's
22.	Blind nut installation tools	10 No's
23.	Heavy duty blind rivet window regulator installation tool	10 No's
24.	Universal crease puller	10 No's
25.	pneumatic panel edge roll tool	10 No's
26.	Grease gun	10 No's
27.	Flange tool	10 No's
28.	Bumper Bracket tool	10 No's
29.	Body pull rod	10 No's
30.	Paint spraying equipment	05No's
31.	Jigs for car frame straightening (for recommended car)	1 No
32.	Jigs for car straightening jacks (for recommended car)	1 No
33.	Safety Guard For working on machine	30 No's
34.	Axle Stand (Safety Stands)	10 No's
35.	Service creeper	02 No's
36.	Face shield	05 No's
37.	Pressure Washer	02 No's
38.	Dual Action Vacuum Cleaner	02 No's
39.	Dual Action (DA) Polisher	05 No's
40.	Rotary Polisher	05 No's
41.	Air Blower	05 No's
42.	Detailing Inspection Lights	05 No's

LIST OF MACHINERY FOR MACHINE SHOP

(For DAE class of 50 students)

S.NO	Name of Machinery /Equipments	Quantity
30.	Lathe Machine (7-10ft)	5 No
31.	Power Hacksaw	1 No
32.	Mechanical Arbor press (3 ton)	1 No
33.	Hydraulic Press Machine	1 No
34.	Cylinder boring machine	1 No
35.	Valve grinding & facing machine	1 No
36.	Pedestal Drill Machine (Drill Chuck size :13 mm)	1 No
37.	Padestle Grinding Machine (Gringing wheel 250x30x25 mm,)	1 No
38.	Surface Plate	2 No's
39.	Die & tap set (2,4,6,8,10mm)	01 set each
40.	Gas welding Plant	1 No
41.	Arc welding Plant	1 No
42.	Lockers (Mild Steel Made lockers, (w=300mm D=400 H=1900), consist of 8 cabin. With additional lock on each cabin)	1 No
43.	Cabinets (Steel Made, Sheet Thickness=0.7mm, Lengh=100cm,Width=50cm, Hight=200cm)	1 No

LIST OF TOOLS/EQUPEMENT FOR CAD & ROBOTICS LAB

(For DAE class of 50 students)

S.NO	Name of Machinery /Equipments	Quantity
1.	Computer with complete accessories (Server PC for Instructor)	50 set &1Teacher
2.	Computer Table	50 set &1Teacher
3.	Computer Chair	50 set &1Teacher
4.	Smart wiFi TV LED (screen display range 65 inch -85 inch)	01 No's
5.	Multimeter	10 NO's
6.	Soldering Iron and solder wire	10 NO's
7.	Hot glue gun	05 NO's
8.	Screwdrivers set	10 NO's
9.	Mini drill / Dremel (for chassis and enclosures)	05 NO's
10.	Wire strippers and cutters	10 NO's

LIST OF FURNITURE & EQUIPMENT FOR DRAWING HALL

(For DAE class of 50 students)

S.NO	Name of Machinery /Equipments	Quantity
1.	Drawing Table	50 No's
2.	Student sitting stool	50 No's
3.	Smart wiFi TV LED (screen display range 65 inch -85 inch)	01 No's

CONSUMABLE STOCK ITEMS

LIST OF GENERAL CONSUMABLE MATERIAL/ ITEMS

(For DAE class of 50 students)

S.NO	Name of Consumable material	Quantity
4.	Engine Oil (SAE 20W-50) 4L Gallon	12 Gallons
5.	Grease (Lithium base)	10 kg
6.	Petrol	1000 L
7.	Diesel	1000 L
8.	CNG	10 Kg
9.	LPG	10kg
10.	Sulphuric Acid	10 L
11.	Kerosene Oil	100L
12.	Brake Oil (350ml)	20 tin
13.	Distilled Water	60 L
14.	Lead Acid Battery (80-100 AH)	10 No's
15.	Dry Battery (55-75 AH)	10 No's
16.	Lithium base battery	05 No's
17.	Battery terminals Clamp set (Copper made)	05 set
18.	Engine Over-hauling Kit	1 for each engine
19.	Emery Papers (0,1,2)	10 No's each
20.	Fan Belt(V-belts)	10 No's
21.	Oil Filter	20 No's
22.	Air Filter	20 No's
23.	Fuel Filter	30 No's
24.	Auto wire 3mm, 5mm	10 No's each coil
25.	Head Lights Beam	10 No's
26.	Auto Bulbs (different types)	24 No's each type
27.	Insulation Tape	30 No's

28.	Thimbles (male and female types) box	10 each
29.	Spark Plug High tension leads Set	5 set for each engine
30.	Cotton Rags	200 kg
31.	Malmal cloth	10kg
32.	Emery Past	5 tin
33.	WD-40 Rust Remover 400ml Bottle Paking	10 No's
34.	Spark Plugs	50 No's
35.	Engine Valve Cotter Pin	10 Dozen
36.	Thrust Bearing	10 No's
37.	Piston Rings (set)	10 set
38.	Shell Bearings set	5 for each engine
39.	Ignition Switch	10 No's
40.	Soldering wire	20 Roll's
41.	Fuses (various range)	50 dozen
42.	Wire brush	5 No's
43.	Sand paper sheet (0, 1, 2,3 no)	2 dozen each type
44.	Grinder disk	5 No's
45.	Gasket material(cork sheet)	10 No's
46.	Shallac Tube Paking	20 No's
47.	Washers (aluminum/copper/fiber) (Box)	1 box each type
48.	Assorted size of nuts & bolts	25 No's each size
49.	Screws deferent size (Box)	1 box each size
50.	Bearings (Ball type, Needle type, Bush type,Angular contact)	2 No's each type
51.	Engine timing belts	10 No's
52.	Hose pipe (set)	10 set
53.	Jubilee hose clips (different size)	2 dozen
54.	Tube vulcanizer solution (tin)	1 2 tin
55.	Tyre(Radial & Bias tyre. Size=10-22inch)	10 No's
56.	Tyre Alloy Rim (different size)	10 No's

57.	Jumper leads	6 No’s
58.	Drill bit set	5 No’s
59.	Oil drain Plugs(different types)	5 No’s
60.	Cup type core plugs	1 dozen
61.	Internal & External circlips	20 No’s each
62.	Splint pins (different size (box)	1 box each size
63.	Coil springs(different types)	1dozen each type
64.	Dust boot & seals (different types)	10 No’s each
65.	Wiper blades (set)	10 set
66.	Engine flush chemical (450ml)	10 Pack
67.	Throttle Body Cleaner	05 Bottle’s
68.	Wind Screen wash fluid (1000ml)	10 L
69.	Car Body detailing Cleaner	10 No’s
70.	Pop Rivets (different sizes) Box	1 box each
71.	Drill Bits	10 No’s
72.	Grinder Disk	10 No’s
73.	Cable ties	4 dozen
74.	Fire extinguisher filling powder (packet)	5 Packets
75.	Tire puncture kit	10 No’s
76.	Tire valve	1 dozen
77.	Mechanics mat	6 No’s
78.	Horn Relay	12 No’s
79.	Horn (set)	10 set
80.	Horn Button	10 No’s
81.	Dimmer Switch	10 No’s
82.	Wheel Balancing weights (5gm -100gm)	25 No’s each size
83.	Diode	2 dozen
84.	Capacitor	2 dozen
85.	Resistances (different range)	2 dozen

86.	Step down transformer (5A, 10A)	5 each type
87.	Transistor	2 dozen
88.	Battery post Cleaner	6 No's
89.	Carburetor service kit	6 No's
90.	Sand for Spark plug Cleaner machine	10 packets
91.	Wooden powder	20kg
92.	Fire Extingusher Filling gas	05 kg

LIST OF CONSUMABLE MATERIAL FOR AUTOMOTIVE DENTING, PAINTING & DETAILING LAB

1.	Paint	20 Gallon
2.	Kerosene Oil	100 Litter
3.	Thinner	10 Litter
4.	Steel Puteen	20 Tin
5.	Yellow Cloth	05 Dozn
6.	Cotton Rags SIZE 2X2 ft B- pairt cut piece	25 Kg
7.	Emery Paper Wet (No:1500 & NO:2000)	05 Dozn each
8.	Lacquer and clear coat	10 Ltr
9.	Primer for car paint	10 Gallon
10.	Masking Tape	5 Dozn
11.	Masking Paper	500 Nos
12.	Compound	10 Nos
13.	Polish	10 Nos
14.	Measuring jar 1000 ml	1 Nos
15.	Paint Mixing Strip	50 Nos
16.	Dent Pulling washer (diff shapes)	200 Piece
17.	EMRY PAPER DRY (12 number)	05 Dozn
18.	MICRO FIBER TOWELS EDGELESS	50 No's
19.	MICRO FIBER TOWELS 600 GSM	20 No's
20.	MICRO FIBER TOWELS 800 GSM	20 No's

21.	TIRE BRUSH	30 No's
22.	ENGINE CLEANING BRUSH	30 No's
23.	APPLICATOR PAD (YELLOW)	20 No's
24.	APPLICATOR PAD (RED)	12 No's
25.	DETAILING BRUSH PACK (YELLOW & BLACK)	24 No's
26.	POLISHER PAD 3 STEP 3 PIECES	05 No's
27.	POLISHER PAD WHOOL	05 No's
28.	DASHBOARD FINS CLEANING BRUSH	05 No's
29.	CHEMICAL RANGE (MPC,MPP,TTD,WCW,UCW,WSW, IGC,LIQUID WAX ,PLASTIC RESTORER	05 No's
30.	MULTI PURPOSE CLEANER (MOSTLY USED)	15 L
31.	MULTI PURPOSE PROTECTION(MOSTLY USED)	05 L
32.	TIRE AND TRIM DRESSING (MOSTLY USED)	05 L
33.	INVISIBLE GLASS CLEANER (MOSTLY USED)	05 L
34.	COMPOUND POLISH 3 STEP {Abrasive cutting polish, Normal cutting polish, Finishing polish(MOSTLY USED)	500ML

LIST OF CONSUMABLE MATERIAL FOR DRAWING HALL

S.NO	Name of Consumable material	Quantity
1.	Drawing Sheets(A2/A3) Cartrege or Bond paper, 100-200	12000 No's
2.	Masking Tape (1in or 0.5in width, for the fixing sheets	50 Roll
3.	Drawing Pencils (Grade HB, H, 2H, B, 2B)	50 Box
4.	Drawing Clips/Paper clips (for holding sheets on drawing board)	50 Pack
5.	Drafting Tape/Cellotape (transparent or matte fish	50Roll

LIST OF CONSUMABLE MATERIAL FOR MACHINE SHOP & ALLIED SHOPS

S.NO	Name of Consumable material	Quantity
6.	Ms Round Bar 1" Dia	60 Kg
7.	MS Sqare bar 1/ 2x1/2	10 Kg
8.	MS Sqare bar 2x2	40 Kg
9.	Cutting oil	10 L
10.	Mobil Oil	10 L
11.	Cotton Waste	20 Kg
12.	Hand hacksaw blade	2 Dozzen
13.	HSS Tool Bit (1/2*1/2*6)	30 No's
14.	Power Hacksaw blade	05 No'S
15.	diamond dresser	10 No'S
16.	Grinding wheel	06 No'S
17.	kerocen oil	10 L
18.	emry paper	2 Dozzen
19.	Cleaning Brush	12 No'S
METAL SHOP		
1.	G.I Pipe 3/4"	20 Kg
2.	M.S Flat 1"x1/8"	40 Kg
3.	Power Hacksaw blade	100 No'S
WELDING SHOP		
1.	M.S Round 1/2. (Kg).	
2.	M.S Electrode 3.2*350	15 Kg
3.	Hand Grander disc 9"	05 No's
4.	MS Flat 1'*1/8'	35 Kg
5.	MS Flat 1'*3/16	40 Kg
6.	MS Flat 1'1/2*3/16	60 Kg
7.	Cut Of Mechine Disk	04 No's
8.	Apran	10 No's

FOUNDARY SHOP		
1.	Alminam Ingot	20 Kg
2.	Lead Ingot	20 Kg
3.	Safety Material (cap)	10 No''s
4.	Shoes	10 No's
5.	Apran	10 No's
6.	Safety Goggles	10 No's
7.	Safety Helmets	10 No's
8.	Leather Slaves	10 No's
9.	Leather Leggies	10 No's
10.	Long Shoes	10 No's
11.	First Aid Box	01 No's
12.	Sehira gurh	20 Kg
13.	Mask	10 No's
14.	Narieal Brush	10 No's
15.	Stone Powder	02 Kg
16.	Green Sand	50 Feet

LIST OF CONSUMABLE MATERIAL FOR CAD & ROBOTICS LAB

1.	Bread Board(Medium & Large size)	10 NO's each
2.	Resistors(Assorted types(e.g 1 ohm, 1 Maga ohm)	10 NO's each
3.	Capacitors(Electrolytic and Ceramic typesAssorted types)	10 NO's each
4.	LEDs(Assorted Colors)	10 NO's each
5.	Sensor(IR, Ultrasonic, Temperature, etc)	10 NO's each
6.	Arduino UNO / NanoMicrocontroller board)	10 NO's each
7.	Breadboard(For prototyping circuits)	10 NO's
8.	Jumper wires(Male-male, male-female, female-female)	10 NO's each
9.	USB Cable (A-B / micro)For programming Arduino	10 NO's
10.	Resistors (1Ω – 1MΩ) Common values: 220Ω, 1kΩ, 10kΩ	10 NO's each
11.	LEDs (Red, Green, Blue, etc.)	10 NO's each

12.	Potentiometer (10kΩ) Analog input / control knob	10 NO’s
13.	Push buttons (For input control)	10 NO’s
14.	Capacitors(Ceramic and electrolytic)	10 NO’s each
15.	Diodes (Zener) For voltage regulation / protection	10 NO’s each
16.	PIR Sensor (Motion detection)	10 NO’s
17.	Ultrasonic Sensor (Distance measurement)	10 NO’s
18.	IR Sensor Module (Obstacle or object detection)	10 NO’s
19.	Sound Sensor Module(Detecting sound or claps)	10 NO’s
20.	Water Level Sensor(Liquid level detection)	10 NO’s
21.	Vibration Sensor(Detecting movement or shocks)	10 NO’s
22.	Servo Motor (SG90 / MG996R) Precision control (robotics, arms)	10 NO’s
23.	DC Motor + Motor Driver (For robotic movement)	10 NO’s
24.	Relay Module (Controlling AC appliances)	10 NO’s
25.	Buzzer (Active / Passive) Sound output for alerts	10 NO’s
26.	LCD Display (16x2 / 20x4) Text display	10 NO’s
27.	Bluetooth (HC-05 / HC-06) Wireless control via mobile apps	10 NO’s
28.	WiFi for IoT applications	01 NO’s
29.	9V Battery / Battery Pack (Portable power)	10 NO’s
30.	5V Regulator (Voltage regulation)	10 NO’s
31.	SD Card Module(Data logging and storage)	10 NO’s
32.	RTC Module (Real-time clock)	10 NO’s
33.	Keypad (User input interface)	10 NO’s
34.	Joystick Module (Gamepad or robotic control)	10 NO’s

LIST OF REFERENCE BOOKS FOR AUTOMOTIVE TECHNOLOGY REVISED CURRICULUM -2025

Sr.No	Book Name	Author Name
1.	Automotive Technology A System Approach	Jack Erjavec
2.	Modern Automotive Mechanics (1oth Edition)	James E. Duffy
3.	Automotive Electricity & Electronics	James E. Duffy.
4.	Advance Automotive Fault Diagnoses (4th Edition)	Tom Denton
5.	Automotive Excellence (Volume 1 & 2)	McGRAW Hill International
6.	Automotive Electrical and Electronic systems	Frank C. Derato
7.	Automotive Electricity & Electronics	Barry Hollembeak
8.	Automotive Chassis Systems	James D. Helderman
9.	Suspension & Steering Systems	Clifton Owen
10.	Automotive Brake Systems	Clifton Owen
11.	Automotive Diagnostic fault codes manual	Haynes Techbook
12.	Automotive Tools manual	Haynes Techbook
13.	Automotive Mechanics	Willium H. Crouse
14.	Auto fundamentals	Martin W. Stockal
15.	Automotive Engine Management System	Jeff Hartmen
16.	Automotive Diagnostic Scanner	Martin
17.	AutoCAD	Alf Yarwood
18.	Performance Automotive Math	John
19.	A Practical Approach to Motor Vehicle Engineering & maintenance	Allan Bonnick
20.	Advance Automotive Electronics Systems	Barry Hollembeak
21.	Automotive Control Systems	A. GalipUlsoy
22.	Automotive Body Work and Rust Repair	M. Joseph
23.	Auto Body Repair	Duenk-Williams-Brooks
24.	Auto Repair & Service	Martin W. Stockal
25.	Automobile Engineering	K K Jain
26.	Automotive Engine Theory & Servicing	James D. Helderman
27.	Automobile Technology	Dr. N.K. Giri
28.	Automotive Mechanics (Volume 1 & 2)	Ed May
29.	A Text Book of Automobile Engineering	R.K. Rajput
30.	Automotive Electricity, Electronics & Computer Controls	Barry Hollembeak
31.	Internal Combustion Engine	V Ganesan
32.	Automobile Engineering	Er. A.K. Babu
33.	Book of Driving	Automobile association
34.	Team Training Manuals (Step-1,2,& 3)	Toyota Motor Japan

Minimum Qualification of Teacher / Instructor (Technical)

- M.Sc. in Automotive Engineering

OR

- B.Sc. in Automotive Engineering

OR

- B.Sc. Engineering Tech. / B-Tech (Hons) in Automotive with 2-Years of relevant experience in teaching/industry

Minimum Qualification of Junior Instructor / Lab Technician

- DAE Mechanical Technology (Power) Automobile & Diesel / Automotive Technology with 3-Years of relevant experience in teaching / industry

OR

- DAE Mechanical Technology (Power) Auto & Farm with 3-Years of relevant experience in teaching / industry

For Subjects pertaining to Humanities / Related Studies /Management / IT

- M.A degree in English/ Islamiat / Pak Studies with 2 years of teaching experience
- M.Sc. degree in IT / Computer Sciences or BE in Computer Engineering/ Sciences with 2-years of teaching experience
- M.Sc. degree in Mathematics with 2-years of teaching experience
- M.Sc. degree in Physics / Chemistry with 2-years of teaching experience
- MBA/ MBE-con./ BBA (Hons.) degree with 2-years of teaching experience

Employability of the Pass-outs/Graduates

The pass outs of this course may find job / employment opportunities in the following areas / sectors:

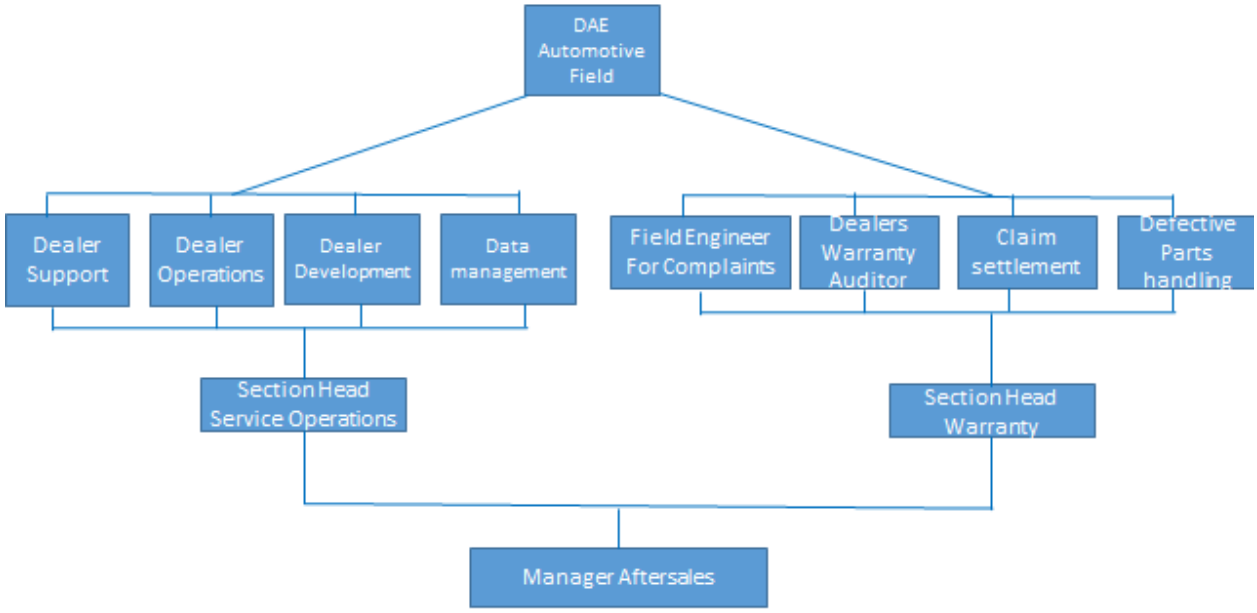
- Manufacturing Industry
- Automobile Industry
- Tractor manufacturing units Packages.

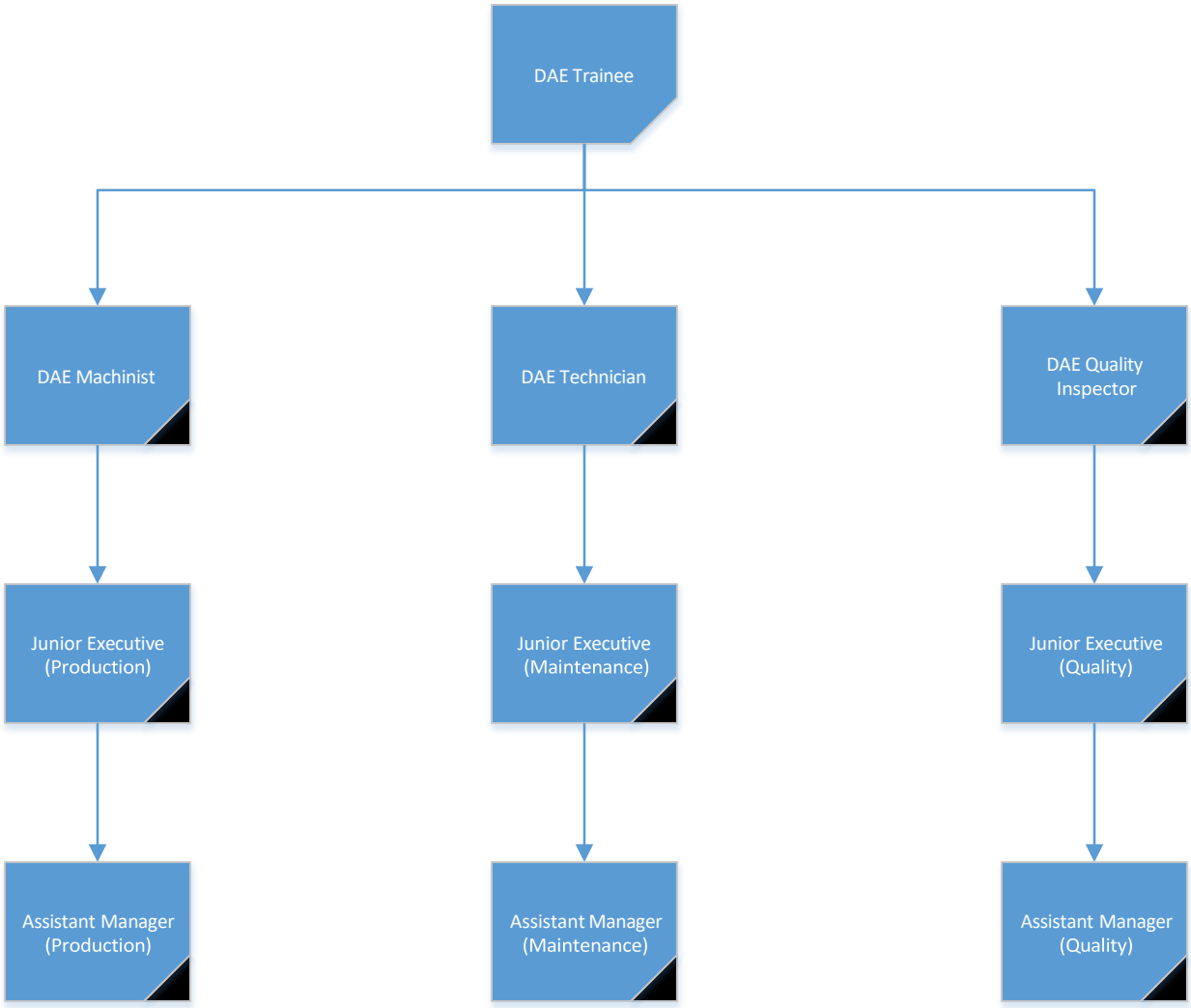
1. Service technician in private / government organization as under:-
    a. Petrol mechanics
    b. Diesel mechanics
    c. Engine overhauling mechanic
    d. Wheel alignment and wheel balancing mechanic
    e. Store man auto
    f. Mechanic / foreman in government organization
    g. Auto mobile assembler in assembly plants

ORGANIZATIONS

1. Auto Mobile Manufacturing units
2. Petrol pump and service stations
3. Power generation plants
4. Earth-moving machinery manufacturing units
5. Auto repair workshops.

DAE Automotive Career in Aftersales Department





CURRICULUM REVISION COMMITTEE

1. **Dr. Saad Jahangir,**
   Assistant Professor, Automotive Engineering Center, University of Engineering & Technology (UET) Lahore. **Convener**

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6. **Mr. Muhammad Zafar Iqbal**
   Chief Instructor Auto & Diesel, GCT Railway Road Lahore. Member

7. **Mr. Muhammad Azhar Khan**
   Senior Instructor, GCT Bahawalpur. Member

8. **Engr. Shaheryar Khan,**
   Instructor, GCT Rawalpindi. Member

LIST OF TOOLS, EQUIPMENT & MACHINERY
MECHANICAL TECHNOLOGY (POWER)
WITH SPECIALIZATION IN AUTOMOTIVE

S.NO	Name OF LAB/WORKSHOP	Quantity
1.	Engine & Transmission Lab	1 NO
2.	Suspension, Steering & Brakes Lab	1 NO
3.	Automotive Denting, Painting & Detailing Lab	1 NO
4.	Drivers Training Lab	1 NO
5.	Electric Vehicles (EVs) Lab	1 NO
6.	Automotive Electronics Lab	1 NO
7.	Automotive Testing & Diagnostics Lab	1 NO
8.	Machine Shop	1 NO
9.	Drawing Hall	1 NO
10.	CAD Lab	1 NO

PERMANENT STOCK ITEMS

LIST OF Teaching Aids

(For DAE class of 50 students)

S.NO	Name of teaching Aids	Quantity
1.	Smart WIFi TV LED (screen display range 65 inch -85 inch)	05 No's
2.	Lap Top (Core i 5 , 15 inch screen display)(minimum 8th Gen)	05 No's
3.	Wi-Fi Modem	05 No's

LIST OF SAFETY & PROTECTION EQUIPMENT

(For DAE class of 50 students)

S.NO	Name of Machinery /Equipments	Quantity
1.	Fire Extinguishers (DCP 6-8kg, CO2 8kg,FOAM)	05 No each
2.	Fire Blanket	05 No's
3.	Safety goggles	10 No's
4.	Respiratory Gas Mask (Air Anti-Dust & Chemical fumes, double filter	10 No's
5.	Safety Helmet	10 No's
6.	First Aid Box	10 No's
7.	Apron/ Proper uniform	50 No's
8.	Dust Mask	50 No's
9.	Safety shoes	50 No's
10.	Ear Muff	10 No's
11.	Safety Gloves set(Leather, rubber & Cotton)	50 No's
12.	Sand Storage buckets for fire fighting	10 No's
13.	Water Storage buckets for fire fighting	10 No's

LIST OF GENERAL BASIC HAND TOOLS

(For DAE class of 50 students)

S.NO	Name of Tool	Quantity
1.	Flat Screw driver (4", 6", 8", 12") & offset Screw driver (4", 6", 8", 12")	10 each
2.	Philips Screw driver (4", 6", 8", 12") & clutch type, torx type, read type and prince type	10 each
3.	Impact Screw driver set	10 set
4.	Hammers (Ball peen, Straight peen, cross peen) sledge, Brass or lead, plastic tipped, rubber mallet.	10 each
5.	Special screw drivers(stubby, scratch awl, Socket head driver, clip screw driver.	10 each
6.	Pliers(needle nose, High leverage cutter, vise grip, diagonal cutting,Battery Plier, tin snip,snap ring, rib joint, slip joint, crimper)	10 each
7.	Adjustable Wrench (6", 12")	10 each
8.	Pipe Wrench(8",10",12")	10 each
9.	strap wrenches(universal,Big range/Adjustable fuel filter and oil filter)	10 each
10.	Open end spanner set (8-32 mm)	10 set
11.	Ring Spanner set (off set) 8-32mm	10 set
12.	Box end spanner set (8-32 mm)	10 set
13.	Socket set (8-32 mm)	10 set
14.	Special wrenches(sludge wrench, ratchet wrench,flex combination, half moon).	10 each
15.	spark plug spanner.	10 No's
16.	Torque Wrench(flex bar,dialindicator,snap or click, digital)	10 each
17.	Allen Key set (1.5- 10 mm)	10 set
18.	Socket set complete(8-32 mm with all accessories).	10 set
19.	wheel spanner cross type	10 No's
20.	Pullers (Gears, Bearings, Pulleys, Steering,slide hammer)	10 each
21.	Oil Seal extractors and installers	10 No's
22.	Oil cane (pressure type).	10 No's
23.	Tube bender , Tube cutter and Flaring tools set	10 set

24.	Valve Spring Compressor	10 No’s
25.	Piston Ring Compressor	10 No’s
26.	Piston Ring Expander	10 No’s
27.	Grease Gun (400cc capacity)	10 No’s
28.	Pop Rivet Plier	5 No’s
29.	Scraper (blade width 2",4",6")	15 No’s each
30.	Scissor (10")	5 No’s
31.	Centre Punch	10 No’s
32.	Punches (Hollow punch set)	10 set
33.	Adjustable Hand Hacksaw frame (300 mm)	10No’s
34.	Bench vice (6”,8”)	05 No’s each
35.	Magnetic pickup tool(prob pick up tool set)	10 set
36.	Magnifying glass	10 No’s
37.	Hand brushes (wire type)	10No’s
38.	Pry bars set (20”, 25”, 30”)	10 set
39.	File (Flat, round, triangle, square)10"	05 No’s each
40.	Hand Hacksaw	05 No’s
41.	Anvil (50 kg)	05 No’s
42.	Chisels (Flat, cross-cut, round nose)	25 No’s each
43.	Calipers (Internal & external)2mm-100mm	10 set
44.	V-Blocks (magnetic type)	10 No’s
45.	S.S.T tools wide range	2 set
46.	Stud extractor set	5 set
47.	Lettering Punch set	02 No’s
48.	Numbers punch set	02 No’s
49.	Magnetic pick tool	05 No’s
50.	Tyre Lever (Pry Bars) Size 16"	05 No’s
51.	Bolt Cutter Size 14"	05 No’s
52.	Troch Light	10 No

LIST OF MEASURING TOOLS/EQUIPEMENT

(For DAE class of 50 students)

S.NO	Name of Tool	Quantity
1.	Steel Foot rule.	10 No's
2.	Steel tape (50 ")	10 No's
3.	Spring Scale (5 kg)	10 No's
4.	Vernier Caliper (250mm , Least count 0.05)	25 No's
5.	Vernier Caliper (250mm , Least count 0.02)	10 No's
6.	Digital Vernier Caliper (250mm)	10 No's
7.	Dial Vernier Caliper (250mm)	10 No's
8.	Micrometer (inside) 0-25mm, 0-50mm, 0-75mm, 0-100mm	10 No's
9.	Micrometer (out side) 0-25mm, 0-50mm, 0-75mm, 0-100mm	10 Nos. (each)
10.	Dial Gauge (Leas count 0.001" 0.01-10mm)	05No's
11.	Depth gauge	05No's
12.	Feeler gauge (6 / 8 inches)	05No's
13.	Thread pitch gauge (inches and mm)	05No's (each)
14.	Wire gauge	05No's
15.	Belt tension gauge	02 No's
16.	Belt tension gauge (electronic)	01 No's
17.	Telescopic gauge	05No's
18.	Tire Pressure gauge	05No's
19.	Angle measuring gauge (combination set)	05No's
20.	Thermometer	10 No's
21.	Tri Square	10 No's

LIST OF INSTRUMENT / EQUIPMENT &
AUTOMOTIVE DIAGNOSTICS TOOLS
(For DAE class of 50 students)

S.NO	Name of Machinery /Equipments	Quantity
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.	Digital Multimeter	20No's
7.	Digital Clamp meter (AC/DC up to- 400A)	5 No's
8.	Analogue Multimeter	5 No's
9.	Infrared Temperature Gun	2 No's
10.	Automotive Picoscope (Oscilloscope)	1 No
11.	Growler Tester	1 No's
12.	PC Based Universal Automotive Diagnostic Scanner(OBD-II) With Lap Top •Operating system=Android operating system • CPU(Min.)=1.5 GHz Quad core (minimum) • Ram(min.)=2GB Ram & 32GB SSD • Display(Min.)=8.0 "touch screen. • Communication Mode= Wireless Bluetooth • Battery type= lithium-polymer . • Perform activation tests(ABS, Immobilizer, SRS, ISC) • Operating Manual	05 No's
13.	Battery Health Tester	02 No
14.	Digital Multimeter Meters	50 No's
15.	Automotive Peco scope (Osiloscop)	01 No
16.	Exhaust Gas Analyzer (5-Gases)	5 No's
17.	Computerized Wheel balancer machine(with all accessories)	1 No
18.	Computerized Wheel alignment apparatus 3D (with all accessories)	1 No
19.	Automatic Tyre Changer	1 No
20.	Universal Injector Cleaner kit	2 No's
21.	Ultrasonic Electronic injector tester machine	1 No
22.	Universal Diesel Fuel Injection pump Phasing & Calibration Machine.	1 No

LIST OF WORKSHOP MACHINERY / EQUIPMENT

(For DAE class of 50 students)

S.NO	Name of Machinery /Equipments	Quantity
1.	Chain Pulley Block hoist (3-5 ton)	01 No's
2.	Hydraulic Car Scissor Lift (0.5 to 2 ton)	1 No
3.	Hydraulic Crane	1 No
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 (5 - 10 tons)	1 No
15.	Portable Electric Drill Machine (helti type)	05 No
16.	Radiator Pressure Cap tester	1 No
17.	Hydraulic Jack (3-5 ton)	5 No each
18.	Mechanical Jack (3-5 ton)	5 No's
19.	Gear box repairing stand (Mechanical type)	10 No's
20.	Engine repairing stand (Mechanical type)	10 No's
21.	Service Creeper trolleys with Led lights	5 No's
22.	Creeper stool type	5 No's
23.	Air Compressor (500- 700L)	1 No
24.	Car Pressure Washer(1500-2000 psi)	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.	Platform truck	5 No's
33.	Oval shape Hydrometer	10 No's
34.	Battery Post terminal cleaner	5 No's
35.	Automotive Stethoscope	5 No's
36.	Soldering gun	5 No's
37.	Battery Fast Charger with digital display (1 -50A)	1 No
38.	Battery Health tester	2 No's
39.	Cleaning tank	2 No's
40.	Portable Tyre inflator	2 No's
41.	Ramp & Pit .	2 No's
42.	Differential repair stands	2 No's
43.	Parts tray	20 No's
44.	V-blocks set	3 No's
45.	SST Board	5 No's
46.	Torch light	2 No's
47.	Series Test lamp	5 No's
48.	Circuit tester	5 No's
49.	Air blower gun	3 No's

LIST OF ENGINES/TRANSAXLES &VEHICLES

(For DAE class of 50 students)

S.NO	Name of Machinery /Equipments	Quantity
1.	Petrol engine(4-cylinder VVT-I &i-VTech) complete Assembly	5 NO'S
2.	Diesel engine (multi cylinder, CRDF type)complete Assembly	5 NO'S
3.	Petrol engine (Multi cylinder, carburetor type) complete Assembly	1 NO'S
4.	Generator (10 to 20KVA)	01 No's
5.	Petrol engine (70-80 cc)	5 NO'S
6.	Petrol engine (100cc, 125cc)	5 NO'S
7.	Manual Transaxle(Synchromesh type)	10 NO'S
8.	AGS Transaxle	10 NO'S
9.	Prosmatec Transaxle	5 NO'S
10.	ECT Automatic planetary gear transaxle	5 NO'S
11.	CVT-I Transaxle	5 NO'S
12.	Complete vehicle Chassis equipped with automatic transmission	1 NO
13.	Car equipped with manual transmission	1 NO
14.	Plug in Hybrid car	1 NO
15.	Electric Bike/Scooter	1 NO
16.	Motorcycle (minimum 70cc)	1 NO
17.	Motorcycle (minimum 125cc)	1 NO

LIST OF AUTOMOTIVE MODELS

(For DAE class of 50 students)

S.NO	Name of Machinery /Equipments	Quantity
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 TOOLS/EQUIPMENTS FOR ELECTRIC VEHICLES (EVs) LAB

(For DAE class of 50 students)

S.NO	Name of Tools/Equipments	Quantity
1.	Digital Multimeter	25No's
2.	Analog Multimeter	25No's
3.	Digital Clamp meter (AC/DC up to- 400A)	05 No's
4.	Soldering Station	10 No's
5.	Insulation resistance tester(Megger)	05 No's
6.	Torque wrenches	05 No's
7.	High Voltage insulated tools kit(Screw drivers, pliers, cutters)	10 No's
8.	Power Supply(DC regulated, 0-60v)	10 No's
9.	Safety PPE complete kit (Insulated gloves, face shields, fire extinguisher Class D for Battery fires)	10 No's
10.	First aid & Emergency shut-off system	05 No's
11.	Oscilloscope(Digital storage, 2/4 channels)	02 No's
12.	EV Diagnostic Scanner Tool(Commercial type)	03 No's
13.	OBD-II & CAN Bus Analyzer Kit(for EV communication protocols)	1 NO
14.	Simulation Software(MATALAB/Simulink, Labview ,Proteus,ETAP for EV Systems)	1 NO
15.	EV Car (preferably Sedan type)	1 NO
16.	Cutaway Model of EV Chasis with powertrain	1 NO
17.	Electric vehicle Driving trainer	1 NO
18.	EV Motor Trainers(BLDC,PMSM Induction Motor setups with controller)	1 NO
19.	Motor Controller (Inverter+Driver circcuit demonstration kits)	1 NO
20.	Charging Station Model(with smart meter)	1 NO
21.	Hybrid vehicle trainer (for comparison with EVs)	1 NO
22.	Regenerative braking demonstration unit	1 NO
23.	Gearbox & differential cutaway model (For EV integration)	1 NO
24.	Battery Pack trainer(Lithium-ion with BMS demonstration)	1 NO
25.	Battery Management System(BMS) training kits.	1 NO

26.	Thermal manegement system trainer(cooling/heating systems for batteries)	1 NO
27.	DC-DC converter trainer	1 NO
28.	Inverter trainer(single phase & 3-phase)	1 NO
29.	Rectifier & charger circuits trainer)	1 NO

LIST OF TOOLS/MACHINERY & EQUIPMENT FOR
AUTOMOTIVE DENTING, PAINTING & DETAILING LAB
(For DAE class of 50 students)

S.NO	Name of Tools /Equipments	Quantity
1.	**Hammers** (Heavy Duty roughing, combination or pick, light dinging, combination dinging, heavy dinging, dinging hammer with short curved pick, offset dinging, Shrinking hammer, dinging hammer with long curved pick, Magnatic trim hammer,nylon mallet.	10 No's each type
2.	**Dollies** (High crown dollyblock, Low crown, heavy duty roughing, shrinking, rail type, All-purpose Heel dolly block.	10 No's each type
3.	**Spoons** (Double-end lower back panel,Double-end door and side apron spoon,Heavy-duty drivinbgspoon,Double-end heavy duty driving and fender-beading tool,Highcrown surfacing spoon,Low crown surfacing spoon, Edging tool.	10 No's each type
4.	**Pick Tools** (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.	**File's Holder** (Adjustable file holder)	10 No's each type
6.	**Files** (Long Blocking file, short blocking file,Specialcontour 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.	Reamer (hand operated)	10 No's
10.	Burr cutter	10 No's
11.	Buffing pad	10 No's
12.	Portable Arc Welding Plant	05 No
13.	Portable Spot welding plant	01 No

14.	Portable Plasma welding plant	01 No
15.	Tig & Mig welding Plant	01 No
16.	Soldering Gun	10 No's
17.	Buffer & Grinder (Bench & Portable) (6")	01 No's
18.	Reveal molding	10 No's
19.	Door and window handle clip remover	10 No's
20.	Vacuum lifter (wind sheild)	4 No's
21.	Wind sheild lacing tools	10 No's
22.	Blind nut installation tools	10 No's
23.	Heavy duty blind rivet window regulator installation tool	10 No's
24.	Universal crease puller	10 No's
25.	pneumatic panel edge roll tool	10 No's
26.	Grease gun	10 No's
27.	Flange tool	10 No's
28.	Bumper Bracket tool	10 No's
29.	Body pull rod	10 No's
30.	Paint spraying equipment	05No's
31.	Jigs for car frame straightening (for recommended car)	1 No
32.	Jigs for car straightening jacks (for recommended car)	1 No
33.	Safety Guard For working on machine	30 No's
34.	Axle Stand (Safety Stands)	10 No's
35.	Service creeper	02 No's
36.	Face shield	05 No's
37.	Pressure Washer	02 No's
38.	Dual Action Vacuum Cleaner	02 No's
39.	Dual Action (DA) Polisher	05 No's
40.	Rotary Polisher	05 No's
41.	Air Blower	05 No's
42.	Detailing Inspection Lights	05 No's

LIST OF MACHINERY FOR MACHINE SHOP

(For DAE class of 50 students)

S.NO	Name of Machinery /Equipments	Quantity
30.	Lathe Machine (7-10ft)	5 No
31.	Power Hacksaw	1 No
32.	Mechanical Arbor press (3 ton)	1 No
33.	Hydraulic Press Machine	1 No
34.	Cylinder boring machine	1 No
35.	Valve grinding & facing machine	1 No
36.	Pedestal Drill Machine (Drill Chuck size :13 mm)	1 No
37.	Padestle Grinding Machine (Gringing wheel 250x30x25 mm,)	1 No
38.	Surface Plate	2 No's
39.	Die & tap set (2,4,6,8,10mm)	01 set each
40.	Gas welding Plant	1 No
41.	Arc welding Plant	1 No
42.	Lockers (Mild Steel Made lockers, (w=300mm D=400 H=1900), consist of 8 cabin. With additional lock on each cabin)	1 No
43.	Cabinets (Steel Made, Sheet Thickness=0.7mm, Lengh=100cm,Width=50cm, Hight=200cm)	1 No

LIST OF TOOLS/EQUPEMENT FOR CAD & ROBOTICS LAB

(For DAE class of 50 students)

S.NO	Name of Machinery /Equipments	Quantity
1.	Computer with complete accessories (Server PC for Instructor)	50 set &1Teacher
2.	Computer Table	50 set &1Teacher
3.	Computer Chair	50 set &1Teacher
4.	Smart wiFi TV LED (screen display range 65 inch -85 inch)	01 No's
5.	Multimeter	10 NO's
6.	Soldering Iron and solder wire	10 NO's
7.	Hot glue gun	05 NO's
8.	Screwdrivers set	10 NO's
9.	Mini drill / Dremel (for chassis and enclosures)	05 NO's
10.	Wire strippers and cutters	10 NO's

LIST OF FURNITURE & EQUIPMENT FOR DRAWING HALL

(For DAE class of 50 students)

S.NO	Name of Machinery /Equipments	Quantity
1.	Drawing Table	50 No's
2.	Student sitting stool	50 No's
3.	Smart wiFi TV LED (screen display range 65 inch -85 inch)	01 No's

CONSUMABLE STOCK ITEMS

LIST OF GENERAL CONSUMABLE MATERIAL/ ITEMS

(For DAE class of 50 students)

S.NO	Name of Consumable material	Quantity
4.	Engine Oil (SAE 20W-50) 4L Gallon	12 Gallons
5.	Grease (Lithium base)	10 kg
6.	Petrol	1000 L
7.	Diesel	1000 L
8.	CNG	10 Kg
9.	LPG	10kg
10.	Sulphuric Acid	10 L
11.	Kerosene Oil	100L
12.	Brake Oil (350ml)	20 tin
13.	Distilled Water	60 L
14.	Lead Acid Battery (80-100 AH)	10 No's
15.	Dry Battery (55-75 AH)	10 No's
16.	Lithium base battery	05 No's
17.	Battery terminals Clamp set (Copper made)	05 set
18.	Engine Over-hauling Kit	1 for each engine
19.	Emery Papers (0,1,2)	10 No's each
20.	Fan Belt(V-belts)	10 No's
21.	Oil Filter	20 No's
22.	Air Filter	20 No's
23.	Fuel Filter	30 No's
24.	Auto wire 3mm, 5mm	10 No's each coil
25.	Head Lights Beam	10 No's
26.	Auto Bulbs (different types)	24 No's each type
27.	Insulation Tape	30 No's

28.	Thimbles (male and female types) box	10 each
29.	Spark Plug High tension leads Set	5 set for each engine
30.	Cotton Rags	200 kg
31.	Malmal cloth	10kg
32.	Emery Past	5 tin
33.	WD-40 Rust Remover 400ml Bottle Paking	10 No's
34.	Spark Plugs	50 No's
35.	Engine Valve Cotter Pin	10 Dozen
36.	Thrust Bearing	10 No's
37.	Piston Rings (set)	10 set
38.	Shell Bearings set	5 for each engine
39.	Ignition Switch	10 No's
40.	Soldering wire	20 Roll's
41.	Fuses (various range)	50 dozen
42.	Wire brush	5 No's
43.	Sand paper sheet (0, 1, 2,3 no)	2 dozen each type
44.	Grinder disk	5 No's
45.	Gasket material(cork sheet)	10 No's
46.	Shallac Tube Paking	20 No's
47.	Washers (aluminum/copper/fiber) (Box)	1 box each type
48.	Assorted size of nuts & bolts	25 No's each size
49.	Screws deferent size (Box)	1 box each size
50.	Bearings (Ball type, Needle type, Bush type,Angular contact)	2 No's each type
51.	Engine timing belts	10 No's
52.	Hose pipe (set)	10 set
53.	Jubilee hose clips (different size)	2 dozen
54.	Tube vulcanizer solution (tin)	1 2 tin
55.	Tyre(Radial & Bias tyre. Size=10-22inch)	10 No's
56.	Tyre Alloy Rim (different size)	10 No's

57.	Jumper leads	6 No’s
58.	Drill bit set	5 No’s
59.	Oil drain Plugs(different types)	5 No’s
60.	Cup type core plugs	1 dozen
61.	Internal & External circlips	20 No’s each
62.	Splint pins (different size (box)	1 box each size
63.	Coil springs(different types)	1dozen each type
64.	Dust boot & seals (different types)	10 No’s each
65.	Wiper blades (set)	10 set
66.	Engine flush chemical (450ml)	10 Pack
67.	Throttle Body Cleaner	05 Bottle’s
68.	Wind Screen wash fluid (1000ml)	10 L
69.	Car Body detailing Cleaner	10 No’s
70.	Pop Rivets (different sizes) Box	1 box each
71.	Drill Bits	10 No’s
72.	Grinder Disk	10 No’s
73.	Cable ties	4 dozen
74.	Fire extinguisher filling powder (packet)	5 Packets
75.	Tire puncture kit	10 No’s
76.	Tire valve	1 dozen
77.	Mechanics mat	6 No’s
78.	Horn Relay	12 No’s
79.	Horn (set)	10 set
80.	Horn Button	10 No’s
81.	Dimmer Switch	10 No’s
82.	Wheel Balancing weights (5gm -100gm)	25 No’s each size
83.	Diode	2 dozen
84.	Capacitor	2 dozen
85.	Resistances (different range)	2 dozen

86.	Step down transformer (5A, 10A)	5 each type
87.	Transistor	2 dozen
88.	Battery post Cleaner	6 No's
89.	Carburetor service kit	6 No's
90.	Sand for Spark plug Cleaner machine	10 packets
91.	Wooden powder	20kg
92.	Fire Extingusher Filling gas	05 kg

LIST OF CONSUMABLE MATERIAL FOR AUTOMOTIVE DENTING, PAINTING & DETAILING LAB

1.	Paint	20 Gallon
2.	Kerosene Oil	100 Litter
3.	Thinner	10 Litter
4.	Steel Puteen	20 Tin
5.	Yellow Cloth	05 Dozn
6.	Cotton Rags SIZE 2X2 ft B- pairt cut piece	25 Kg
7.	Emery Paper Wet (No:1500 & NO:2000)	05 Dozn each
8.	Lacquer and clear coat	10 Ltr
9.	Primer for car paint	10 Gallon
10.	Masking Tape	5 Dozn
11.	Masking Paper	500 Nos
12.	Compound	10 Nos
13.	Polish	10 Nos
14.	Measuring jar 1000 ml	1 Nos
15.	Paint Mixing Strip	50 Nos
16.	Dent Pulling washer (diff shapes)	200 Piece
17.	EMRY PAPER DRY (12 number)	05 Dozn
18.	MICRO FIBER TOWELS EDGELESS	50 No's
19.	MICRO FIBER TOWELS 600 GSM	20 No's

20.	MICRO FIBER TOWELS 800 GSM	20 No's
21.	TIRE BRUSH	30 No's
22.	ENGINE CLEANING BRUSH	30 No's
23.	APPLICATOR PAD (YELLOW)	20 No's
24.	APPLICATOR PAD (RED)	12 No's
25.	DETAILING BRUSH PACK (YELLOW & BLACK)	24 No's
26.	POLISHER PAD 3 STEP 3 PIECES	05 No's
27.	POLISHER PAD WHOOL	05 No's
28.	DASHBOARD FINS CLEANING BRUSH	05 No's
29.	CHEMICAL RANGE (MPC,MPP,TTD,WCW,UCW,WSW, IGC,LIQUID WAX ,PLASTIC RESTORER	05 No's
30.	MULTI PURPOSE CLEANER (MOSTLY USED)	15 L
31.	MULTI PURPOSE PROTECTION(MOSTLY USED)	05 L
32.	TIRE AND TRIM DRESSING (MOSTLY USED)	05 L
33.	INVISIBLE GLASS CLEANER (MOSTLY USED)	05 L
34.	COMPOUND POLISH 3 STEP {Abrasive cutting polish, Normal cutting polish, Finishing polish(MOSTLY USED)	500ML

LIST OF CONSUMABLE MATERIAL FOR DRAWING HALL

S.NO	Name of Consumable material	Quantity
1.	Drawing Sheets(A2/A3) Cartrege or Bond paper, 100-200	12000 No's
2.	Masking Tape (1in or 0.5in width, for the fixing sheets	50 Roll
3.	Drawing Pencils (Grade HB, H, 2H, B, 2B)	50 Box
4.	Drawing Clips/Paper clips (for holding sheets on drawing board)	50 Pack
5.	Drafting Tape/Cellotape (transparent or matte fish	50Roll

LIST OF CONSUMABLE MATERIAL FOR MACHINE SHOP & ALLIED SHOPS

S.NO	Name of Consumable material	Quantity
6.	Ms Round Bar 1" Dia	60 Kg
7.	MS Sqare bar 1/ 2x1/2	10 Kg
8.	MS Sqare bar 2x2	40 Kg
9.	Cutting oil	10 L
10.	Mobil Oil	10 L
11.	Cotton Waste	20 Kg
12.	Hand hacksaw blade	2 Dozzen
13.	HSS Tool Bit (1/2*1/2*6)	30 No's
14.	Power Hacksaw blade	05 No'S
15.	diamond dresser	10 No'S
16.	Grinding wheel	06 No'S
17.	kerocen oil	10 L
18.	emry paper	2 Dozzen
19.	Cleaning Brush	12 No'S
METAL SHOP		
1.	G.I Pipe 3/4"	20 Kg
2.	M.S Flat 1"x1/8"	40 Kg
3.	Power Hacksaw blade	100 No'S
WELDING SHOP		
1.	M.S Round 1/2. (Kg).	
2.	M.S Electrode 3.2*350	15 Kg
3.	Hand Grander disc 9"	05 No's
4.	MS Flat 1'*1/8'	35 Kg
5.	MS Flat 1'*3/16	40 Kg
6.	MS Flat 1'1/2*3/16	60 Kg
7.	Cut Of Mechine Disk	04 No's
8.	Apran	10 No's

FOUNDARY SHOP		
1.	Alminam Ingot	20 Kg
2.	Lead Ingot	20 Kg
3.	Safety Material (cap)	10 No’’s
4.	Shoes	10 No’s
5.	Apran	10 No’s
6.	Safety Goggles	10 No’s
7.	Safety Helmets	10 No’s
8.	Leather Slaves	10 No’s
9.	Leather Leggies	10 No’s
10.	Long Shoes	10 No’s
11.	First Aid Box	01 No’s
12.	Sehira gurh	20 Kg
13.	Mask	10 No’s
14.	Narieal Brush	10 No’s
15.	Stone Powder	02 Kg
16.	Green Sand	50 Feet

LIST OF CONSUMABLE MATERIAL FOR CAD & ROBOTICS LAB

1.	Bread Board(Medium & Large size)	10 NO’s each
2.	Resistors(Assorted types(e.g 1 ohm, 1 Maga ohm)	10 NO’s each
3.	Capacitors(Electrolytic and Ceramic typesAssorted types)	10 NO’s each
4.	LEDs(Assorted Colors)	10 NO’s each
5.	Sensor(IR, Ultrasonic, Temperature, etc)	10 NO’s each
6.	Arduino UNO / NanoMicrocontroller board)	10 NO’s each
7.	Breadboard(For prototyping circuits)	10 NO’s
8.	Jumper wires(Male-male, male-female, female-female)	10 NO’s each
9.	USB Cable (A-B / micro)For programming Arduino	10 NO’s
10.	Resistors (1Ω – 1MΩ) Common values: 220Ω, 1kΩ, 10kΩ	10 NO’s each
11.	LEDs (Red, Green, Blue, etc.)	10 NO’s each

12.	Potentiometer (10kΩ) Analog input / control knob	10 NO’s
13.	Push buttons (For input control)	10 NO’s
14.	Capacitors(Ceramic and electrolytic)	10 NO’s each
15.	Diodes (Zener) For voltage regulation / protection	10 NO’s each
16.	PIR Sensor (Motion detection)	10 NO’s
17.	Ultrasonic Sensor (Distance measurement)	10 NO’s
18.	IR Sensor Module (Obstacle or object detection)	10 NO’s
19.	Sound Sensor Module(Detecting sound or claps)	10 NO’s
20.	Water Level Sensor(Liquid level detection)	10 NO’s
21.	Vibration Sensor(Detecting movement or shocks)	10 NO’s
22.	Servo Motor (SG90 / MG996R) Precision control (robotics, arms)	10 NO’s
23.	DC Motor + Motor Driver (For robotic movement)	10 NO’s
24.	Relay Module (Controlling AC appliances)	10 NO’s
25.	Buzzer (Active / Passive) Sound output for alerts	10 NO’s
26.	LCD Display (16x2 / 20x4) Text display	10 NO’s
27.	Bluetooth (HC-05 / HC-06) Wireless control via mobile apps	10 NO’s
28.	WiFi for IoT applications	01 NO’s
29.	9V Battery / Battery Pack (Portable power)	10 NO’s
30.	5V Regulator (Voltage regulation)	10 NO’s
31.	SD Card Module(Data logging and storage)	10 NO’s
32.	RTC Module (Real-time clock)	10 NO’s
33.	Keypad (User input interface)	10 NO’s
34.	Joystick Module (Gamepad or robotic control)	10 NO’s