CURRICULUM FOR

DIPLOMA OF ASSOCIATE ENGINEER

IN

PRESCISION MECHANICAL AND

INSTRUEMENT TECHNOLOGY

(3 – Years Course)

ADVANCED DIPLOMA OF ASSOCIATE ENGIEER IN MECHANICAL TECHNOLOGY WITH SPECIALIZATION IN PRECISION MACHINING & INSTRUMENT TECHNOLOGY (3 Years Course)

IST YEAR			T	P	C	Page
Gen	111	Islamiat and Pak. Studies	1	0	1	
ENG	112	English	2	0	2	
Math	113	Applied Mathematics-I	3	0	3	
Phy	122	Applied Physics	1	3	2	
Ch	112	Applied Chemistry	1	3	2	
Comp	142	Computer Applications	1	3	2	
WT	156	Workshop Technology-I	2	12	6	
MT	141	Health Safety and Environment	1	0	1	
TD	153	Technical Drawing	1	6	3	
		T O T A L	**13**	**27**	**22**	
2ND YEAR						
Gen	211	Islamiat and Pak Studies	1	0	1	
Phy	212	Applied Mechanics	1	3	2	
Math	212	Applied Mathematics-II	2	0	2	
MGM	211	Business Communication	1	0	1	
ET	202	Applied Electricity and Electronics	1	3	2	
Mech.	252	Metrology	1	3	2	
MS	212	Material Science	2	0	2	
WT	227	Workshop Technology-II	2	15	7	
TD	253	Technical Drawing and CAD-I	1	6	3	
		T O T A L	**12**	**30**	**22**	
3RD YEAR						
Gen	311	Islamiat and Pak Studies	1	0	1	
Mech.	323	Applied Thermodynamics	2	3	3	
Mech.	343	Machine Design	2	3	3	
Mech.	362	Materials Testing & Heat Treatment	1	3	2	
TD	352	CAD-II / CAM	1	3	2	
DM	312	Tool Technology-I	1	3	2	
DM	322	Tool Technology-II	1	3	2	
DM	335	Workshop Technology-DM1	3	6	5	
DM	342	Special Purpose Machines-I	1	3	2	
		T O T A L	**13**	**27**	**22**	
4TH YEAR						
DM	414	Special Purpose Machines -II	2	6	4	
DM	425	Tool Design and Making	2	9	5	
DM	433	Tool Technology-III	2	3	3	
DM	443	Tool Technology-IV	2	3	3	
DM	455	Workshop Technology-DM2	3	6	5	
DM	462	Production Planning-DM	2	0	2	
		TOTAL	**13**	**27**	**22**	

Gen-111
ISLAMIAT AND PAK STUDIES

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 اللہ جمیعا ولا تفرقوا

3- ولا یجرمنکم شنان قوم علی ان لا تعدلوا

4- ان اللہ یامرکم ان تودوا الامانات الی اہلھا

5- ان اللہ یامر بالعدل والاحسان

6- ان الصلوۃ تنھی عن الفحشاء والمنکر

7- لقد کان لکم فی رسول اللہ اسوۃ حسنۃ

8- ان اکرمکم عند اللہ اتقاکم

9- وما آتاکم الرسول فخذوہ وما نھاکم عنہ فانتھو

10- واوفوا بالعہد

11- وعاشروھن بالمعروف

12- یمحق اللہ الربوٰ ویربی الصدقات

13- واصبر علی ما اصابک

14- وقولوا قولا سدیدا

15- ان الدین عند اللہ الاسلام

4

(ب) سنت

1- **سنت کی اہمیت**

1- انما الاعمال بالنیات

2- انما بعثت لاتمم مکارم الاخلاق

3- لایومن احدکم حتی یحب لاخیہ الا یحب ما لنفسہ

4- المسلم من سلم المسلمون من لسانہ ویدہ

5- قل امنت باللہ ثم استقم

6- خیرکم خیرکم لاھلہ

7- سباب المسلم فسوق وقتالہ کفر

8- المومن اخو المومن

9- کل المسلم علی المسلم حرام دمہ ومالہ 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 پر ان کے اثرات

1- توحید

2- رسالت

3- آخرت

4- ملائکہ

5- آسمانی کتب

2.2 **عبادات** (5)

1- نماز   2- روزہ   3- حج   4- زکوٰۃ

مندرجہ بالا عبادات کی اہمیت وفضیلت، حکمتیں اور انسان کی انفرادی ومعاشرتی زندگی پر اس کے اثرات

حصہ اول

حصہ اسلامیات   تدریسی مقاصد

1-   قرآن مجید

عمومی مقصد۔   طالب علم یہ سمجھنے کے قابل ہو کہ اسلام کی تعلیمات کا اصل سرچشمہ قرآن مجید ہے۔

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

1-   قرآن مجید کی تعریف کر سکے گا۔

2-   قرآن مجید کے نزول کی صورت بیان کر سکے

3-   قرآن مجید کی مکی و مدنی سورتوں کی پہچان کر سکے

4-   منتخب آیات کا ترجمہ و تشریح کر سکے

عمومی مقصد۔   یہ سمجھنے کے قابل ہو جائے گا کہ منتخب قرآنی آیات کے ذریعے اسلامی تعلیمات کا مفہوم کیا ہے۔

خصوصی مقصد۔   طالب علم اس قابل ہو جائے کہ:

1-   قرآنی آیات کا ترجمہ و تشریح کر سکے

2-   قرآنی تعلیمات کی روشنی میں اپنی اور معاشرتی اصلاح کر سکے

2-   سنت

عمومی مقصد۔   طالب علم حدیث نبوی کی اہمیت اور ضرورت کو اچھی طرح سمجھنے کے قابل ہو جائے گا۔

خصوصی مقاصد

☆   سنت کی تعریف بیان کر سکے

☆   سنت کی اہمیت و ضرورت کی وضاحت کر سکے

☆   سنت کی روشنی میں اسوۂ حسنہ پر عمل کر سکے

3-   منتخب احادیث نبویہ

عمومی مقصد۔   احادیث کی روشنی میں اخلاقی اقدار سے آگاہی حاصل کر سکے

خصوصی مقاصد۔   احادیث کا ترجمہ و تشریح کر سکے

محمد رسول اللہ صلی اللہ علیہ وسلم کے اسوۂ حسنہ کی پیروی کا جذبہ پیدا ہو سکے۔

‎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

سی	پی	ٹی
1	0	1

حصہ دوم مطالعہ پاکستان   کل وقت: 20 گھنٹے

موضوعات

اخلاقیات کی تعریف اور اہمیت

اخلاقیات کا معیار (قانون ۔ عقل ۔ الہامی کتب)

مندرجہ ذیل اخلاق کی وضاحت

- دیانت داری
- وفاداری
- نظم و ضبط
- راست گوئی
- صبر و استقلال
- حوصلہ مندی
- وقت کی پابندی
- صفائی
- اعتماد
- باہمی احترام
- مصلحت

نصاب اخلاقیات سال اول

تدریسی مقاصد

عمومی مقصد ۔ اعلیٰ اخلاق کی وجہ سے ملکی ترقی میں قابلِ قدر اضافہ کر سکے۔

خصوصی مقاصد ۔ طالبِ 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 قائد اعظم کے فرمودات کے 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

حصہ دوم   مطالعہ پاکستان   کل وقت: 12 گھنٹے

موضوعات

- حریت فکر

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

- نظریہ پاکستان

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

- نظریہ پاکستان کا تاریخی پہلو

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

- تعلیمی تحریکیں

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

- محمد بن قاسم کے ہندوستان پر حملے کی وجہ بیان کر سکے

- محمد بن قاسم کے ہندوستان پر حملے 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۔

Eng-112
ENGLISH

Eng-112   ENGLISH

Total contact hours
Theory   64   T   P   C
Practical   0   2   0   2

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

COURSE CONTENTS

ENGLISH PAPER "A"

1.   PROSE/TEXT   16 hrs
1.1   First eight essays of Intermediate. English Book-II

2.   CLOZE TEST   4 hrs
1.2   A passage comprising 50-100 words will be selected from the text. Every 11thword 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.

ENGLISH PAPER "B"

3.   GRAMMAR   26 hrs
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   8 hrs
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.   **4 hrs**

5.   TRANSLATION   6 hrs
5.1   Translation from Urdu into English.
For Foreign Students: A paragraph or a dialogue.

RECOMMENDED BOOKS
1.   Intermediate English Book-II.
2.   An English Grammar and Composition of Intermediate Level.
3.   A Hand Book of English Students by Gatherer

Eng-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 PRACTICALSITUATIONS
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

Math-113   APPLIED MATHEMATICS-I

Total contact hours   96   **T**   **P**   **C**
Theory   3   0   3

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

AIMS After completing the course the students will be able to
1. Solve problems of Algebra, Trigonometry, vectors. Menstruation, 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.

COURSE CONTENTS
1   QUADRATIC EQUATIONS   6 Hrs
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   3Hrs
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   3Hrs
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 Hrs
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 Hrs
5.1   Introduction

11.2   Addition & Subtraction
11.3   The unit Vectors I, j, k
11.4   Direction Cosines
11.5   Sealer or Dot Product
11.6   Deductions
11.7   Dot product in terms of orthogonal components
11.8   Deductions
11.9   Analytic Expression for a x b.
11.10 Problems.

12   MATRICES AND DETERMINANTS   **9 Hrs**
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

REFERENCE BOOKS
1. Ghulam Yasin Minhas - Technical Mathematics Vol-I, Ilmi Kitab Khana Lahore.
2. Prof. Riazali Khan - Polytechnic Mathematic Series Vol I & II, Majeed Sons, Faisalabad
3. Prof. Sana Ullah Bhatti - A Text Book of Algebra and Trigonometry, Punjab Text Book Board, Lahore.

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 discriminant
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 a binomial of a given index. -
4.6   Extract the specified roots
4.7   Compute the approximate value to a given decimal place.
4.8   Solve problems involving binomials.

5   RESOLVE A SINGLE FRACTIONINTO PARTIALFRACTIONS USINGDIFFERENT 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 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 TRIGONOMETRICFUNCTIONS

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 TECHNOLOGICALPROBLEMS

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 sins 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 MENSTRUATION IN FINDING SURFACES, VOLUMEAND WEIGHTS OF SOLIDS.**

10.1	Define menstruation of plane and solid figures

10.2	List formulas for perimeters & areas of plane figure.

10.3	Define pyramid and cone.

10.4	Define frusta of pyramid and cone.

10.5	Define a sphere and a shell.

10.6	Calculate the total surface and volume of each type of solid.

10.7	Compute weight of solids.

10.8	Solve problems of these solids.

**11.	USE	THE CONCEPT AND	PRINCIPLES	OF	VECTORS	IN SOLVINGTECHNOLOGICAL 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 onsides of a vector.

11.6	Derive analytic expression for dot product and cross product of two vectors.

11.7	Deduce conditions of perpendicularly and parallelism of two vectors.

11.8	Solve problems

**12.	USE THE CONCEPT OFMATRICES & DETERMINANTS IN SOLVING TECHNOLOGICAL PROBLEMS**

12.1	Define a matrix and a determinant.

12.2	List types of matrices.

12.3	Define transpose, ad joint 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

Phy-122   APPLIED PHYSICS

Total Contact Hours

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

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

COURSE CONTENTS

1   MEASUREMENTS.   **2 Hrs**
1.1   Fundamental units and derived units
1.2   Systems of measurement and S.I. units
1.3   Concept of dimensions, dimensional formula
1.4   Conversion from one system to another
1.5   Significant figures

2.   SCALARS AND VECTORS.   **4 Hrs**
2.1   Revision of head to tail rule
2.2   Laws of parallelogram, triangle and polygon of forces
2.3   Resolution of a vector
2.4   Addition of vectors by rectangular components
2.5   Multiplication of two vectors, dot product and cross product

3.   MOTION   **4 Hours**
3.1   Review of laws and equations of motion
3.2   Law of conservation of momentum
3.3   Angular motion
3.4   Relation between linear and angular motion
3.5   Centripetal acceleration and force
3.6   Equations of angular motion

4.   TORQUE, EQUILIBRIUM AND ROTATIONAL INERTIA
4.1   Torque
4.2   Centre of gravity and centre of mass
4.3   Equilibrium and its conditions
4.4   Torque and angular acceleration
4.5   Rotational inertia

5.   WAVE MOTION   **5 Hrs**
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 Hrs
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 Hrs
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 Hrs
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 Hrs
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 BOOKS
1.	Tahir Hussain, Fundamentals of Physics Vol-I and II
2.	Farid Khawaja, Fundamentals of Physics Vol-I and II
3.	Wells and Slusher, Schaum's Series Physics.
4.	Nelkon and Oyborn, Advanced Level Practical Physics
5.	MehboobIlahi Malik and Inam-ul-Haq, Practical Physics
6.	Wilson, Lasers - Principles and applications
7.	M. Aslam Khan and M. Akram Sandhu, Experimental Physics Note Book

Phy-122   APPLIED PHYSICS

INSTRUCTIONAL OBJECTIVES
1   USE CONCEPTS OF MEASUREMENT TO PRACTICAL SITUATIONS AND TECHNOLOGICAL PROBLEMS
1. 1   Write dimensional formulae for physical quantities
1.2   Derive units using dimensional equations
1.3   Convert a measurement from one system to another
1.4   Use concepts of measurement and significant figures in problem solving.

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 centre of mass
4.3   Explain rotational Equilibrium, and its conditions
4.4   Explain. Rotational Inertia giving examples
4.5   Use the above concepts in solving technological problems.

5   USE CONCEPTS OR 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 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 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) $y = l/x$
2. Find the volume of a given solid cylinder using verniercalipers.
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.
II. Find the weight of a given body using principle ofmoments.
12. Locate the centre 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 columnin resonance tube and find velocity of sound.
18. Find the frequency of the given tuning fork using resonance tube.
19. Find 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 centre 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:

Ch-112
APPLIED CHEMISTRY

Ch-112　　　　　　　　**APPLIED CHEMISTRY**

	T	P	C
	1	3	2

Total Contact Hours
Theory　　　**32**
Practical　　**64**

Pre-requisite: The student must have studied the subject of elective chemistry at secondary, school level.

AIMS 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 the scientific methods for production, properties and use of materials of industrial & .technological significance.
4.　　Gains skill for the efficient conduct of practical's in a Chemistry lab.

COURSE CONTENTS

1　　INTRODUCTION AND FUNDAMENTAL CONCEPTS　　　　　2 Hrs
1.1　　Orientation with reference to this technology
1.2　　Terms used & units of measurements in the study of chemistry
1.3　　Chemical Reactions & their types

2　　ATOMIC STRUCTURE　　　　　　　　　　　　　　　2 Hrs
2.1　　Sub-atomic particles
2.2　　Architecture of atoms of elements, Atomic No. & Atomic Weight
2.3　　The periodic classification of elements periodic law
2.4　　General characteristics of a period and group

3　　CHEMICAL BOND　　　　　　　　　　　　　　　　2 Hrs
3.1　　Nature of chemical Bond
3.2　　Electrovalent bond with examples
3.3　　Covalent Bond (Polar and Non-polar, sigma & Pi Bonds with examples
3.4　　Co-ordinate Bond with examples

4　　WATER　　　　　　　　　　　　　　　　　　　2 Hrs
4.1　　Chemical nature and properties.
4.2　　Impurities
4.3　　Hardness of water (types, causes & removal)
4.4　　Scales of measuring hardness (Degrees Clark
4.5　　Boiler feed water, scales & treatment
4.6　　Sea-water desalination, sewage treatment

5　　ACIDS, BASES AND SALTS　　　　　　　　　　　2 Hrs
5.1　　Definitions with examples
5.2　　Properties, their strength, basicity & Acidity

| 5.3 | Salts and their classification with examples | |
| 5.4 | pH-value and scale | |

6	**OXIDATION & REDUCTION**	**2 Hrs**
6.1	The process, definition& examples	
6.2	Oxidizing and reducing agents	
6.3	Oxides and their classifications	

7	**NUCLEAR CHEMISTRY**	**2 Hrs**
7.1	Introduction	
7.2	Radioactivity (alpha, beta and gamma rays)	
7.3	Half life process	
7.4	Nuclear reaction & transformation of elements	

8	**CEMENT**	**2 Hrs**
8.1	Introduction	
8.2	Composition and manufacture	
8.3	Chemistry of setting and hardening	
8.4	Special purpose cements	

9	**GLASS**	**2 Hrs**
9.1	Composition and raw material	
9.2	Manufacture	
9.3	Varieties and uses	

10	**PLASTICS AND POLYMERS**	**2 Hrs**
10.1	Introduction and importance	
10.2	Classification	
10.3	Manufacture	
10.4	Properties and uses	

11	**PAINTS, VARNISHES AND DISTEMPER**	**2 Hrs**
11.1	Introduction	
11.2	Constituents	
11.3	Preparation and uses	

12	**CORROSION**	**2 Hrs**
12.1	Introduction with causes	
12.2	Types of corrosion	
12.3	Rusting of iron	
12.4	Protective measures against-corrosion	

13	**REFRACTORY MATERIALS AND ABRASIVE**	**2 Hrs**
13.1	Introduction to Refractories	
13.2	Classification of Refractories	
13.3	Properties and Uses	
13.4	Introduction to Abrasives	
13.5	Artificial and Natural Abrasives and their uses	

14	**ALLOYS**	**2 Hrs**

14   **ALLOYS**   **2 Hrs**
14.1   Introduction with need
14.2   Preparation and Properties
14.3   Some Important alloys and their composition
14.4   Uses

15   **FUELS AND COMBUSTION**   **2 Hrs**
15.1   Introduction of fuels
15.2   Classification of fuels
15.3   Combustion
15.4   Numerical Problems of Combustion

16   **LUBRICANTS**   **1 Hr**
16.1   Introduction.
16.2   Classification.
16.3   Properties of lubricants.
16.4   Selection of lubricants:

17   **POLLUTION**   **1 Hr**
17.1   The problem and its dangers.
17.2   Causes of pollution.
17.3   Remedies to combat the hazards of pollution.

BOOKS RECOMMENDED
1.   Text Book of Intermediate Chemistry (I & II)
2.   Ilmi Applied Science by Sh. Atta Muhammad
3.   Polytechnic Chemistry by J. N. Reedy Tata McGraw Hill (New Delhi)
4.   Chemistry for Engineers by P.C. Jain (New Delhi, India)

Ch-112   APPLIED CHEMISTRY

INSTRUCTIONAL OBJECTIVES

1   UNDERSTAND THE SCOPE, SIGNIFICANCE AND FUNDAMENTAL ROLE OF THE SUBJECT

1.1   Define chemistry and its important terms
1.2   State the units of measurements in the study of chemistry
1.3   Write chemical formula of common compounds
1.4   Describe types of chemical reactions with examples

2   UNDERSTAND THE STRUCTURE OF ATOMS AND ARRANGEMENT OF SUB ATOMIC PARTICLES IN THE ARCHITECTURE OF ATOMS

2.1   Define atom.
2.2   State the periodic law of elements.
2.3   Describe the fundamental sub atomic particles
2.4   Distinguish between atomic ho. and mass no.; isotopes and isobars
2.5   Explain the arrangements of electrons in different shells and sub energy levels
2.6   Explain the grouping and placing of ^elements' in the periodic table

3   UNDERSTAND THE NATURE OF CHEMICAL LBOUND

3.1   Define chemical bond
3.2   Describe the nature of chemical bond
3.3   Differentiate .between electrovalent an^ covalent bonding
3.4   Explain the formation of polar and non polar, sigma and pi-bond with examples
3.5   Describe the nature of coordinate bond with examples

4   UNDERSTAND THE CHEMICAL NATURE OF WATER

4.1   Describe the chemical nature of water with its formula
4.2   Describe the general impurities present in water
4.3   Explain the causes and methods to removing hardness of water
4.4   Express hardness .in different units like mg/Iiter, p.p.m, degrees Clark and degrees French
4.5   Describe the formation and nature of scales in boiler feed water
4.6   Explain the method for the treatment of scales
4.7   Explain the sewage treatment and desalination of sea water

5   UNDERSTAND THE NATURE OF ACIDS, BASES AND SALTS

5.1   Define acids, bases and salts with examples
5.2   State general properties of acids and bases
5.3   Differentiate between acidity and basicity and use the related terms
5.4   Define salts, state their classification with examples
5.5   Explain p-H value of solution and pH scale

6   UNDERSTAND THE PROCESS OF OXIDATION AND REDUCTION

6.1   Define oxidation
6.2   Explain the oxidation process with examples
6.3   Define reduction
6.4   Explain reduction process with examples
6.5   Define oxidizing and reducing-agents and give it least six examples of each

6.6   Define oxides
6.7   Classify the oxides and give example

7   UNDERSTAND THE FUNDAMENTALS OF NUCLEAR CHEMISTRY
7.1   Define nuclear chemistry and radio activity
7.2   Differentiate between alphas, Beta and Gamma particles
7.3   Explain hall-life process
7.4   Explain at least six nuclei reactions resulting in the transformation of some elements
7.5"   State important uses of isotopes

8   UNDERSTAND THE MANUFACTURE, SETTING AND   HARDENING CEMENT
8.1   Define port land cement and give its composition
8.2   Describe the method of manufacture
8.3   Describe the chemistry of setting and hardening of cement
8.4   Distinguish between ordinary and special purpose cement

9   UNDERSTAND THE PROCESS OF MANUFACTURE OF GLASS.
9.1   Define glass
9.2   Describe its composition and raw materials
9.3   Describe the manufacture of glass
9.4   explain its varieties and uses

10   UNDERSTAND THE NATURE AND IMPORTANCE OF PLASTICS POLYMERS
10.1.   Define plastics and polymers
10.2   Explain the mechanism of polymerization
10.3   Describe the preparation and uses of some plastics/polymers

11   KNOW   THE.CHEMISTRY   OF   PAINTS,   VARNISHES   AND DISTEMPERS
11.1   Define paints, varnishes and distemper
11.2   State composition of each
11.3   State methods of preparation of each and their uses

12   UNDERSTAND THE PROCESS OF CORROSION WITH ITS CAUSES AND TYPES
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 NATURE OF REFRACTORY MATERIALS AND ABRASIVE
13.1   Define refractory materials

13.2   Classify refractory materials
13.3   Describe properties and uses of refractories
13.4   Define abrasive.
13.5   Classify natural and artificial abrasives
13.6   Describe uses of abrasives

14   UNDERSTAND THE NATURE AND IMPORTANCE OF ALLOYS
14.1   Define alloy
14.2   Describe different methods for the preparation of alloys
14.3   Describe important properties of alloys
14 4   Enlist some important alloys with their composition, properties and uses

15   UNDERSTAND THE NATURE OF FUELS AND THEIR COMBUSTION
15.1   Define fuels
15.2   Classify fuels and make distinction of solid, liquid & gaseous fuels
15.3   Describe important Fuels
15.4   Explain combustion
15.5   Calculate air quantities in combustion, gases

16   UNDERSTAND THE NATURE OF LUBRICANTS.
16.1   Define a lubricant
16.2   Explain the uses of lubricants
16.3   Classify lubricants and cite examples
16.4   State important properties of oils, greases and solid lubricants
16.5   State the criteria for the selection of lubricant tor, particular purpose/job

17   UNDERSTAND THENATURE OF POLLUTION
17.1   Define Pollution (air. water, food)
17.2   Describe the causes of environmental pollution.
17.3   Enlist some common pollutants.
17.4   Explain methods to prevent pollution

COMP-142   **COMPUTER APPLICATIONS**

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

Pre-requisites: None

AIMS: This subject will enable the student to be familiar with the fundamental concepts of Computer Science. He will also learn Operating Systems, Office Applications, and Internet to elementary level.

Course Contents:

1. Electronic data processing (E.D.P.)	6 hrs
2. Operating Systems	2 hrs
3. Office applications (Word Processing)	8 hrs
4. Office applications (Spread Sheets)	9 hrs
5. Office applications (Presentations)	4 hrs
6. Internet& E-mail	3Hrs

1. ELECTRONIC DATA PROCESSING (E.D.P.)   6 Hrs
1.1   Basic Terms of Computer Science Data & its types, Information, Hardware, Software
1.2   Computer & its types
1.3   Block diagram of a computer system
1.4   BIT, Byte, RAM & ROM
1.5   Input &Output devices
1.6   Secondary storage devices
1.7   Types of Software
1.8   Programming Languages
1.9   Applications of computer in different fields
1.10 Application in Engineering, Education & Business

Operating System   2 Hrs
2.1   Introduction to Operating System
2.2   Loading & Shut down process
2.3   Introduction to Desktop items (Creation of Icons, Shortcut, Folder & modify Taskbar)
2.4   Desktop properties
2.5   Use of Control Panel
2.6   Searching a document

Office applications (Word Processing)   8 Hrs
3.1   Introduction to Word Processing Applications & their Screens
3.2   Creating a new document
3.3   Opening & Saving a document
3.4   Editing & formatting the text
3.5   Page setup (Set the Margins & Paper)
3.6   Spell Check & Grammar

3.7 Paragraph Alignment

3.8 Inserting Page numbers, Symbols, Text box, Picture and equations in the document

3.9 Use the different Format menu drop down commands(Drop Cap, Change Case, Bullet & Numbering and Border & Shading)

3.10 Insert the 'Table and its Editing

3.11 Printing the document

3.12 Saving a document file as PDF format

Office applications (Spread Sheet)   **9 Hrs**

4.1 Introduction to Spread Sheet application and their Screens.

4.2 Entering data & apply formulae in worksheet

4.3 Editing & Formatting the Cells, Rows and Columns

4.4 Insert Graphs in sheet

4.5 Types & Categories of Charts

4.6 Page setup, Print Preview & Printing

Office applications (Presentations)   **4 Hrs**

5.1 Introduction to Presentation applications and their screens.

5.2 Creating a presentation

5.3 Editing & formatting a Slide.

5.4 Adding pictures & colors to a slide

5.5 Making slide shows

5.6 Slide Transitions.

INTERNET&E-MAIL   **3Hrs**

6.1 Introduction to Internet & browser window

6.2 Searching, Saving and Printing a page from internet

6.3 Creating, Reading & Sending E-Mail

6.4 Explain some advance features over the internet and search engines

COMP-142 COMPUTER APPLICATIONS

INSTRUCTIONAL OBJECTIVES:

Instructors/Teachers must ensure to

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

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

3. **DEVELOP KNOWLEDGE OF OFFICE APPLICATIONS (WORD ROCESSING)**
   3.1 Introduction to Word Processing applications
   3.2 Introduction to Word Processing application Screens.
   3.3 Describe creating a new document
   3.4 Explain Editing & formatting the text
   3.5 Describe Opening & Saving 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 Use of different Format menu drop down commands(Drop Cap, Change Case, Bullet &Numbering and Border & Shading)
   3.11 Explain Inserting 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. **DEVELOP KNOWLEDGE OF OFFICE APPLICATIONS (SPREAD SHEET)**
   4.1 Introduction to Spread Sheet applications and their Screen
   4.2 Describe Entering data & apply formulae in worksheet
   4.3 Describe Editing &Formatting the, Cells, Rows & Columns
   4.4 Explain Insert Graphs in sheet

4.5   Describe Page setup, Print preview & Printing
4.6   Explain in details formulae for sum, subtract, multiply, divide, average
4.7   Explain in details the types of charts e.g pie chart, bar chart

5. DEVELOP KNOWLEDGE OF OFFICE APPLICATIONS (PRESENTATIONS)

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

6. DEVELOP KNOWLEDGE OF INTERNET & E-MAIL

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

Recommended Textbooks:

     I.   **Introduction to Computers**   **By Shelley Cashman Series**
     II.   **Introduction to Computers**   **By Peter Norton**

COMP-142   **COMPUTER APPLICATIONS**

List of Practical:

Identify key board, mouse, CPU, disks, disk drives, monitor and printer3Hrs

MS WINDOWS XP12 Hrs
1.1   Practice of loading and shutdown of operating system
1.2   Creating items (icons, shortcut, folders etc) and modifying taskbar
1.3   Changing of wallpaper, screensaver, and resolution
1.4   Practice of control panel items (add/remove, time and date ,mouse, and create user account)

MS OFFICE (MS-WORD)27 Hrs
1.5   Identifying the MS Word Screen and its menu
1.6   Practice of create a new document, saving and re-opening it from the location and spell check & grammar
1.7   Practice of Page Formatting (Borders, Character Spacing, Paragraph, Bullets & Numberings and Fonts)
1.8   Practice of different tool bars like standard, format& drawing tool bars
1.9   Practice of Insert pictures, clipart, and shapes
1.10   Practice of header and footer
1.11   Practice of insert table and also format of table
1.12   Practice of page setup, set the page margins, and printing documents

MS OFFICE (MS-EXCEL)27 Hrs
1.13   Identifying the MS EXCEL Screen and its menu
1.14   Practice of create a new sheet, saving and re-opening it from the location and spell check
1.15   Practice of insert and delete of row and columns (format of cell)
1.16   Practice of entering data and formulas in worksheet(Add, Subtract, Multiplying, and Divide & Average)
1.17   Repeating practical serial number04
1.18   Practice of insert chart and its types
1.19   Practice of page setup, set the page margins, and printing

MS OFFICE (MS-POWER POINT)15 Hrs
1.20   Identifying the MS POWER POINT Screen and its menu
1.21   Practice of create a new presentation and save
1.22   Practice of open saves presentations
1.23   Practice of inset picture and videos

INTERNET & E-MAIL12 Hrs
1.24   Identifying internet explorer
1.25   Practice of searching data from any search engine
1.26   Practice of create an E-Mail account and how to send and receive mails, download attachments

COMP-142　　　　　**COMPUTER APPLICATIONS**

Practical Objectives:

1. **Identify key board, mouse, CPU, disks, disk drives, monitor, and printer**

    1.1. Understand use and features of keyboard, CPU, disk drives, disks, monitor, and printer

2. **MS WINDOWS XP**

    2.1　Practice of loading and shutdown of operating system
        2.1.1 Students will be able to load and shutdown of operating system
    2.2　Creating items (icons, shortcut, folders etc) and modifying taskbar
        2.2.1 Student will be able to create, modify & delete icons, shortcuts, & folders
    2.3　Changing of wallpaper, screensaver, and resolution
        2.3.1 Student will be able to change wallpapers, screensavers, & resolution size
    2.4　Practice of control panel items (add/remove, time and date, mouse, and create user account)
        2.4.1 Student will be able to adjust control panel items (add/remove, time & date, Mouse, and configure the user account)

3. **MS OFFICE (MS-WORD)**

    1.1　Identifying the MS Word Screen and its menu
        1.1.1 Student will be able to identify the MS Word screen and its menus
    1.2　Practice of create a new document, saving and re-opening it from the location and spell check & grammar
        1.2.1 Student will be able to create new documents, save documents and reopen the saved documents and spell check and grammar
    1.3　Practice of Page Formatting (Borders, Character Spacing, Paragraph, Bullets & Numberings and Fonts)
        1.3.1 Student will be able to change the format of documents (Borders, Character Spacing, Paragraph, Bullets & Numberings and Fonts)
    1.4　Practice of different tool bars like standard, format & drawing tool bars
        1.4.1 Student will be able to use the standard, format and drawing tools
    1.5　Practice of Insert pictures, clipart, and shapes
        1.5.1 Student will be able to add pictures, clipart and different shapes into document
    1.6　Practice of header and footer
        1.6.1 Student will be able to make and adjust header & footer
    1.7　Practice of insert table and also format of table
        1.7.1 Student will be able to insert and format the table
    1.8　Practice of page setup, set the page margins, and printing documents
        1.8.1　Student will be able to adjust page setup, margin and print documents

4.   MS OFFICE (MS-EXCEL)

4.1   Identifying the MS EXCEL Screen and its menu
    4.1.1 Student will be able to identify the MS EXCEL screen and its menus
4.2   Practice of create a new sheet, saving and re-opening it from the location and spell check
    4.2.1   Student will be able to create new documents, save documents and reopen the saved documents and spell check and grammar
4.3   Practice of insert and delete of row and columns (format of cell)
    4.3.1 Student will be able to insert and delete row and columns
4.4   Practice of entering data and formulas in worksheet(Add, Subtract, Multiplying, and Divide & Average)
    4.4.1 Student will be able to use different formulas in worksheet(Add, Subtract, Multiplying, and Divide & Average)
4.5   Repeating practical serial number 04
4.6   Practice of insert chart and its types
    4.6.1 Student will be able to insert different types of chart into worksheet
4.7   Practice of page setup, set the page margins, and printing
    4.7.1 Student will be able to adjust page setup, margin and print worksheets

5.   MS OFFICE (MS-POWER POINT)

1.1   Identifying the MS POWER POINT Screen and its menu
    1.1.1 Student will be able to identify the MS POWER POINT screen and its menus
1.2   Practice of create a new presentation and save
    1.2.1 Student will be able to create a presentation and save it
1.3   Practice of open saves presentations
    1.3.1 Student will be able to open the saves presentations
1.4   Practice of inset picture and videos
    1.4.1 Students will be able to insert picture and video clips

2.   INTERNET & E-MAIL

2.1   Identifying internet explorer

    2.1.1   Students will be able to identify the Internet explorer screen

2.2   Practice of searching data from any search engine

    1.2.1   Students will be able to search information catalog, e-books etc from different search engine

2.3   Practice of create an E-Mail account and how to send and receive mails, download attachments

    2.3.1   Students will be able to create E-mail account, send and receive mails and download attachments

WT-156   <u>**WORKSHOP TECHNOLOGY-I**</u>

	T	**P**	**C**
Total contact Hours	2	12	6

Theory   64 Hours
Practical   384 Hours

AIMS: At the end of this course, the student will have good working knowledge of the different kinds of hand tools, measuring tools, instruments used in mechanical workshop and bench work.

<u>**COURSE CONTENTS**</u>

1. Holding devices
2. Files and saws
3. Hand tools
4. Impact/striking tools
5. Marking tools
6. Assembly tools
7. Holding and clamping tools
8. Instruments for checking surfaces
9. Measuring instruments
10. Metal cutting
11. Drilling

<u>**DETAIL OF COURSE CONTENTS**</u>

1.   <u>HOLDING DEVICES</u>   4 Hours

1.1   Leg vice
1.2   Pipe vice
1.3   Parallel Jaw vice
1.4   Soft jaws
1.5   Machine vice
1.6   Hand vice
1.7   Pin vice

2.   <u>FILES AND SAWS</u>   10Hours

2.1.   File and its parts
2.2.   Convexity of the file
2.3.   Cross section of files
2.4.   Cuts of files
2.5.   Coarseness of files
2.6.   Forms of file teeth
2.7.   Machine files
2.8.   Rotary file

2.9. Hacksaw
2.10. Types of Hacksaw Blade
2.11. Fitting of the blade
2.12. Coping saw
2.13. Fret saw

3.   **Hand Tools**   **4 Hours**

3.1. Chisel and its types
3.2. Scrapers and its types
3.3. Hand shear
3.4. Wire Cutter

4.   **Impact/Striking Tools**   **3 Hours**

4.1. Hammer and its Parts.
4.2. Ball peen, cross peen, straight peen, sledge hammer
4.3. Soft hammers types and uses.

5.   **Marking Tools**   **3 Hours**

5.1. Scriber
5.2. Spring divider
5.3. Center punch
5.4. Prick punch
5.5. Letter and number punches

6.   **Assembly Tools**   **4 Hours**

6.1. Use of Screw drivers
6.2. Standard screw driver
6.3. Offset screw driver
6.4. Watch maker screw driver
6.5. Philips head screw driver
6.6. Wrench and spanners
6.7. Open end wrenches
6.8. Ring spanners
6.9. Adjustable wrenches
6.10. Lock wrenches
6.11. Allen keys

7.   **HOLDING AND CLAMPING TOOLS**   **4 Hours**

7.1. Pliers
7.2. Snapping Pliers
7.3. Tweezers
7.4. Tool maker clamp
7.5. C – Clamp

8.   INSTRUMENTS FOR CHECKING SURFACES   4 Hours

8.1.   Surface plate
8.2.   Straight edge
8.3.   Back or Foot square and tri square
8.4.   Beveled edge square
8.5.   Adjustable square
8.6.   Auxiliary marking tools
8.7.   Spirit levels

9.   MEASURING INSTRUMENTS   12 Hours

9.1.   Rule and Scale
9.2.   Vernier calipers
9.3.   Use of Vernier calipers
9.4.   Vernier height gauge
9.5.   Protractor
9.6.   Vernier bevel protractor
9.7.   Construction of Outside micrometer
9.8.   Types of a Micrometer
  - Micrometer depth gauge
  - Micrometer head
  - Thread micrometer
  - Tube Micrometer
  - Bench micrometer
  - Inside Micrometer
9.9.   Tools for transferring measurements
  - Dividers
  - Calipers(Outside, Inside, Odd leg)

10.   METAL CUTTING   6 Hours

10.1.   Geometry of Single point cutting Tool
10.2.   Cutting tool Materials.
  - High speed steel
  - Carbides
  - Ceramics
  - Cermets
  - Diamond
10.3.   Cutting speed, feed , and depth of cut
10.4.   Machining time Calculations

11.   DRILLING   10 Hours

11.1.   Types of Drilling and Boring machines

- Portable drilling machine
- Table or pedestal drilling machine
- Pillar type drilling machine
- Multi spindle drilling machine
- Radial drilling machine
- Jig boring machine
- Horizontal boring machine

11.2.   Drilling and Boring operations
- Drilling
- Reaming
- Boring
- Counter boring
- Counter sinking
- Spot facing
- Tapping

11.3.   Types of drills
- Straight shank drill
- Taper shank drill

11.4.   Twist drill geometry
11.5.   Drilling speeds and feeds
11.6.   Types of Reamers
- Hand reamers
- Machine reamers
- Expansion reamers
- Adjustable reamers
- Taper reamer

11.7.   Types of Taps
- Hand taps
- Machine taps

11.8.   Types of Threading Dies and Die Stock/Holder
- Split die
- Solid die
- Loose die

11.9.   Cutting speed for Taps and Dies

WT-156   <u>**WORKSHOP TECHNOLOGY-I**</u>

<u>**INSTRUCTIONAL OBJECTIVE**</u>

Instructors/Teachers must ensure to

1.   <u>**DEVELOP KNOWLEDGE OF HOLDING DEVICES**</u>   **4 HOURS**

1.1.   Introduction to Leg vice
1.2.   Introduction to Pipe vice
1.3.   Introduction to Parallel Jaws vice
1.4.   Introduction to Soft jaws
1.5.   Introduction to Machine vice
1.6.   Introduction to Hand vice
1.7.   Introduction to Pin vice

2.   <u>**DEVELOP KNOWLEDGE OF FILES AND SAWS**</u>   **10 HOURS**

2.1.   Define file
2.2.   Describe the convexity of the file
2.3.   Describe cross section of files
2.4.   Describe the cuts of files
2.5.   Describe coarseness of files
2.6.   Describe forms of file teeth
2.7.   Define Machine files
2.8.   Define Rotary file
2.9.   Define hacksaw
2.10. Define types of hacksaw blade
2.11. Describe fitting of blade
2.12. Describe Cooping saw
2.13. Describe fret saw

3.   <u>**DEVELOP KNOWLEDGE OF HAND TOOLS**</u>   **4 HOURS**

3.1.   Define Chisel and its types
3.2.   Define Scrapers and its types
3.3.   Define Hand shear
3.4.   Define wire Cutter

4.   <u>**DEVELOP KNOWLEDGE OF IMPACT/STRIKING TOOLS**</u>   **3 HOURS**
4.1.   Describe Hammer and its Parts.
4.2.   Describe Ball peen, cross peen, straight peen, sledge hammer
4.3.   Describe Types and uses of Soft hammers.

5.   DEVELOP KNOWLEDGE OF Marking Tools   3 HOURS
5.1.   Define Scriber
5.2.   Define Spring divider
5.3.   Define Center punch
5.4.   Define Prick punch
5.5.   Define Letter and number punches

6.   DEVELOP KNOWLEDGE OF ASSEMBLY TOOLS   4 HOUR
6.1.   Describe uses of Screw drivers
6.2.   Define Standard screw driver
6.3.   Define Offset screw driver
6.4.   Define Watch maker screw driver
6.5.   Define Philips head screw driver
6.6.   Define Wrenched and spanners
6.7.   Define Open end wrenches
6.8.   Define Ring spanners
6.9.   Define Adjustable wrenches
6.10. Define Lock wrenches
6.11. Define Allen keys

7.   DEVELOP KNOWLEDGE OF HOLDING AND CLAMPING TOOLS
                                                                      4 Hour
7.1.   Define Pliers
7.2.   Define Snapping Pliers
7.3.   Define Tweezers
7.4.   Define Tool maker clamp
7.5.   Define C – Clamp

**8.   DEVELOP   KNOWLEDGE   OF   INSTRUMENTS   FOR   CHECKING
        SURFACES   4 Hours**

8.1.   Describe Surface plate
8.2.   Describe Straight edge
8.3.   Describe Squares
8.4.   Describe Back or Foot square and tri square
8.5.   Describe Beveled edge square
8.6.   Describe Adjustable square
8.7.   Describe Auxiliary marking tools
8.8.   Describe Spirit levels

9.   DEVELOP KNOWLEDGE OF MEASURING INSTRUMENTS
                                                                    12 Hours
9.1.   Describe Rules and scale
9.2.   Describe the Vernier caliper
9.3.   Describe Functions of a Vernier caliper
9.4.   Describe Vernier height gauge
9.5.   Describe Protractor
9.6.   Describe Vernier bevel protractor

9.7.   Describe the construction of a Outside micrometer
9.8.   Describe Types of a Micrometer
- Micrometer depth gauge
- Micrometer head
- Thread micrometer
- Tube Micrometer
- Bench micrometer
- Inside Micrometer

9.9. Describe tools for transferring measurements
- Dividers
- Calipers(Outside, Inside, Odd leg)

10.   DEVELOP KNOWLEDGE OF METAL CUTTING   6 HOURS

10.1.   Describe geometry of single point cutting Tool
10.2.   Describe the cutting tool Materials
- High speed steel
- Carbides
- Ceramics
- Cermets
- Diamond

10.3.   Define Cutting speed, feed , and depth of cut
10.4.   Describe Machining time calculations.

11.   DEVELOP KNOWLEDGE OF DRILLING   10 Hours

11.1.   Describe types of Drilling and Boring machines
- Portable drilling machine
- Table or pedestal drilling machine
- Pillar drilling machine
- Multi spindle drilling
- Radial drilling machine
- Jig boring machine
- Horizontal boring machine

11.2.   Describe Drilling and Boring operations
- Drilling
- Reaming
- Boring
- Counter boring
- Counter sinking
- Spot facing
- Tapping
11.3.   Describe Twist drills

- Straight shank drill
- Taper shank drill

11.4. Describe geometry of Twist drill
11.5. Define Drilling speeds and feeds
11.6. Describe types of Reamers
- Define Hand reamers
- Define Machine reamers
- Define Expansion reamers
- Define Adjustable reamers
- Define Taper reamer

11.7. Describe types of Taps
- Define Hand taps
- Define Machine taps
- State procedure for Tapping with drilling machine

11.8. Describe threading Dies and Die Stock/Holders
- Define Split dies
- Define Solid die nut
- Define Loose die
- Define Die head

11.9. Define Cutting speed for taps and dies

Recommended Books

I.	**Workshop Technology (Part – 1)**	**By W. A. J. Chapman**
II.	**Technology of Machine Tools**	**By Steve F. Krar, Albert F. Check**
III.	**Workshop Technology (Vol-1)**	**By Mr. Rudalph Brunner**
		Published by PSTC, PCSIR

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WT-156 **Workshop Technology-I**
                    List of Practical   384 Hours

Bench Fitting Exercises

1.   Filing exercise on U-Channel Exercise
2.   Step Filling Exercise
3.   Sawing Exercise
4.   Marking exercise
5.   Marking with Height gauge
6.   Stamping Exercise
7.   Chipping Exercise
8.   Counter Filling Exercise
9.   Drilling Exercise
10.   Debarring Exercise
11.   Tapping Exercise
12.   Internal Filling Exercise
13.   Reaming Exercise
14.   Counter Sinking Exercise
15.   Counter boring Exercise
16.   Wire Bending Exercise
17.   Sheet Metal Bending Exercise
18.   Internal/External Round Filling
19.   Riveting Exercise
20.   External Threading with Die
21.   Push Fit Exercise
22.   Sheet Metal Fits Exercise
23.   Doweling Exercise
24.   Introduction to Lathe and Simple Step Turning

MT-141   <u>HEALTH SAFETY AND ENVIRONMENT</u>

Total Contact Hours		T	P	C
Theory:	**32Hrs**	**1**	**0**	**1**

Pre-requisites: None

AIMS: At the end of this course, the students will be able to:-
1. Adopt safety standards, codes, rules, etc., to be desired in Mechanical Workshop / Labs of Industries.
2. Understand methods of prevention of accident.
3. Provide first aid and rescue in case of any accident.

Course Contents:

1.	**Introduction and Importance of Safety**	**1 Hr**
2.	**Accident in Chemical Industry**	**2 Hrs**
3.	**Accidents in Mechanical Industry**	**3 Hrs**
4.	**Accidents in Process Industry**	**2 Hrs**
5.	**Accidents in other Industries**	**2 Hrs**
6.	**Electric shocks (Prevention and its remedies)**	**2 Hrs**
7.	**Fire Accidents and their preventions**	**3 Hrs**
8.	**Safety in Plant layout**	**2 Hrs**
9.	**Personal Protective Equipments (PPE)**	**2 Hrs**
10.	**Environmental Safety**	**3 Hrs**
11.	**Pollution**	**2 Hrs**
12	**First Aid**	**2 Hrs**
13.	**Analyzing Causes of Accidents**	**3 Hrs**
14.	**Promoting Safety Culture**	**1 Hr**
15.	**Safety Regulations & adherence to International Safety Standards**	**2 Hrs**

Detail of Contents:

1.	**Introduction and Importance of Safety**	**1Hr**

    1.1   Introduction to safety and House keeping
    1.2   Importance in Institute workshops /labs
    1.3   Importance in industry
    1.4   Accident cost

2.	**Accidents in Chemical Industry**	**2 Hrs**

    2.1   Accidents in petroleum, paint and fertilizer industry
    2.2   Explosive vapors and gases

3.	**Accidents in Mechanical Industry**	**3 Hrs**

    3.1   Due to material handling and transportation
    3.2   Accidents due to hand tools
    3.3   Accidents in machines shop
    3.4   Accidents in Metal workshop
    3.5   Accidents in wood working shop
    3.6   Accidents in foundry, welding and forging shop

3.7   Safety in CNC machines operation

4.   Accidents in Flow Production Industry   **2 Hrs**
   4.1   Accidents in textile mills, paper mills & food Industries

5.   Accidents in other Industries   **2Hrs**
   5.1   Accidents in mines
   5.2   Accidents in leather industries
   5.3   Accidents in power plant

6.   Electric shocks & Earthing (Prevention and its remedy)   **2Hrs**
   6.1   Electricity as danger
   6.2   Electric shock phenomena
   6.3   Reasons of electric shock
   6.4   Prevention of electric shock
   6.5   First aid in electric shock

7.   Fire accidents and their prevention   **3 Hrs**
   7.1   Fire accidents and their prevention
   7.2   Fire hazard and their types
       7.2.1   Causes of fire hazard
   7.3   Fire fighting equipments, and fire extinguishers
   7.4   Plant lay out for fire safety

8.   Safety in plant Lay-out   **2 Hrs**
   8.1   Safety in Plant lay out
   8.2   Housekeeping for safety
   8.3   Safety instruction during maintenance
   8.4   Safety instruction in use of electricity

9.   Personal Protective Equipment (PPE)   **2 Hrs**
   9.1   Useful protective device
   9.2   Personal protective device and its importance
   9.3   Protection from chemicals and gases

10. Environmental Safety   **3 Hrs**
   10.1 Environmental Safety
   10.2 Industrial ventilation
   10.3 Exhaust systems
   10.4 Industrial noise
   10.5 Illumination for safety and comfort
   10.6 Industrial hygiene and plant sanitation
   10.7 Thermal radiation
   10.8 Waste Disposal, Dust and fumes, Over Crowding
   10.9 The Artificial humidification
   10.10 Drinking water

11. Pollution   **2 Hrs**
   11.1 Atmosphere
   11.2 Water pollution
   11.3 Solid waste management

12. First Aid   **2 Hours**

12.1 Importance
12.2 Procedure and training
12.3 Extended medical services

13. Analyzing Causes of Accidents   **3 Hrs**
13.1 Accident prevention fundamentals
13.2 Plant inspections and accidents investigation
13.3 Safety inventory, auditing, records and annual reports

14. Promoting Safety Culture   **1 Hr**
14.1 Employees training culture
14.2 Displays
14.3 Guidance

15. Safety Regulations & adherence to International Safety Standards   **2Hrs**
15.1 Safety Regulations & adherence to International Safety Standards
15.2 Pakistan Factory Act (laws concerning to safety)
15.3 Workman compensation act
15.4 Industrial insurance and social security
15.5 Legal aspects of safety

MT-141 **HEALTH SAFETY AND ENVIRONMENT**

Instructional Objectives:

1. **Know importance of safety practices and its necessity in the industry**
   1.1 Describe importance of housekeeping, Safety and accidents
   1.2 Describe the importance of safety practices in Institute shops/labs
   1.3 Describe the hazards for not observing safety
   1.4 State necessity/importance of observing safety in the industry at the Cost of accident

2. **Know causes and preventions of accident in chemical based industry**
   2.1 State the type and causes of accidents in petroleum, fertilizer, plaint and chemical based industry
       2.1.1 Enlist causes and preventions of chemical based industrial accidents
   2.2 Describe accidental causes and effects of explosive gases and vapors
       2.2.1 Describe toxic chemicals and their effects on human
       2.2.2 List of preventions for accidental causes due to explosive gases and vapors

3. **Know causes and prevention of accidents in mechanical industry**
   3.1 List of accidents in material handling and transportation in industry
       3.1.1 Describe the methods of prevention of accident due to material and machine handling in manufacturing Industry
   3.2 Explain proper use of hand tools to prevent accident
   3.3 Describe accidents in machines shop
   3.4 Describe accidents in Metal workshop
   3.5 Describe accidents in wood working shop
   3.6 Describe accidents in foundry, welding and forging shop
   3.7 Describe Safety in CNC machines operation

4. **Know causes and methods of prevention of accident in flow process industry**
   4.1 State the types of accident in flow process industry
       4.1.1 List the accident in textile mills, paper and board mills and food industry
       4.1.2 Describe the methods of prevention of accidents in above listed industries

5. **Describe accidents and their remedy**
   5.1 Describe accidents in Mines
   5.2 Describe accidents in Leather industries
   5.3 Describe accidents in Power plant (Steam)

6. **Electric shocks & Earthling (Prevention and its remedy)**
   6.1 Describe Electricity as danger
   6.2 Describe Electric shock phenomena
   6.3 Describe Reasons of electric shock
   6.4 Describe Prevention of electric shock
   6.5 Describe First aid in electric shock

7. **Fire Accidents and their prevention**
   7.1 Describe prevention of fire accidents on plant
   7.2 Know the causes of fire hazard
       7.2.1 Identify fire hazard and their types
       7.2.2 List the causes of accidents due to fire
   7.3 Know Steps to control fire/fire fighting
       7.3.1 Training of fire fighting with the help of Rescue 1122
       7.3.2 Know the types of fire extinguishers and their use
   7.4 Identify the fire safety points in plant layout

8. **Know the basic concept of safety in plant layout**
   8.1 Identify the safety aspect in plant layout
   8.2 Describe the house keeping procedure for safety
   8.3 Identify the procedure to lay out machines and equipments by considering safety aspect
   8.4 Explain the instructions use of electricity

9. **Know principle method and importance of personal protective device**
   9.1 State useful protective devices
   9.2 List personal protective devices and describe their importance
       9.2.1 Describe protection devices protecting Hand, faces, Ear, Leg, Foot and Eyes
       9.2.2 Describe protection
       9.2.3 Describe personal safety equipments
       9.2.4 Describe lather safety belt, fire ropes, chain, slings and other supports for precautions
   9.3 Describe use of protection devices for protecting from chemicals and gases

10. **Understands the environmental effect of accident and their remedies**
    10.1 Knows environmental effects on human beings and surroundings
    10.2 Explain importance and purpose of industrial ventilation
    10.3 Describe exhaust system in industry and their important
    10.4 Identify effect of noise on environment and its role in accidents
        10.4.1 Causes of audible (Noise) their control vibrations and vibration dampers and necessity of hearing protectors
    10.5 Identify the advantages of illumination for safety and comfort
    10.6 Explain necessity of plant hygiene for safety and comfort
    10.7 Explain causes of thermal radiation and its remedy
    10.8 Explain causes and remedy of spitting dust, fumes, improper light and overcrowding accidents
    10.9 Explain needs of artificial humidification
    10.10 Explain effects of polluted water

11. **Pollution**
    11.1 Describe different stages of Atmosphere i.e. stratosphere, mesosphere, ionosphere etc.
    11.2 Describe the international standards of pure water

        11.2.1   State how water get polluted

        11.2.2   Describe methods of purification of polluted water at different Level

    11.3   Describe the solid waste types and its management

        11.3.1   State different methods of solid waste collection

        11.3.2   Describe recycling and disposal of solid waste

12.   Know the methods of providing first aid

    12.1 Identify the importance of first aid

    12.2 Explain the methods of providing fist aid and their training may be arranged to train the students in first aid procedure (a video)

    12.3 Identify the step by step procedure of providing medical services

        12.3.1 Describe protection of respiration system and methods of artificial respiration

13.   Analyzing the causes of accidents

    13.1 Understand the procedure of analyzing the causes of accidents

        13.1.1   Identify the general causes of accident

        13.1.2   Explain step by step procedure to analyze the accidents

    13.2 Know the use of data for investigation and resident reports for analyzing the causes of accident

        13.2.1   Record safety inventory, accident report and investigation reports, annual reports

        13.2.2   Collect the data of accident for analyzing the root of accidents

    13.3   Identify safety rules procedures in the light of annual accidents report for safe guard

14.   Understand the methods and procedures for promoting safety culture

    14.1 Identify the importance of safety

    14.2 Describe methods of promoting safety concept by display charts, play cards, Banners and wall chalking; through guidance

    14.3 List methods of promoting safety concepts

15.   Understand Safety Regulations & adherence to International Safety Standards

    15.1 Explain safety Regulations & adherence to International Safety Standards

    15.2 Describe clauses of Pakistan Factory Act related to safety

    15.3 Describe Workman compensation Act

    15.4 Identify the procedure for industrial insurance and social security

    15.5   Describe legal procedure in case of serious accidents

Recommended Books:-

1.   ENVIRONMENTAL SAFETY AND HEALTH ENGINEERING
        BY GAYLE WOODSLDE, DIANNA K O CUREK

2.   SAFETY ENGINEERING PRINCIPLES AND PRACTICES
        BY FRANK R. SPELLMAN

3.   SAFETY ENGINEERING
        BY JAMES COVAN

TD-153   <u>**TECHNICAL DRAWING**</u>

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

Aims: At the end of this course, the student will be able to understand working knowledge of basic Engineering Drawing.

<u>**COURSE CONTENTS**</u>

1.   <u>**INTRODUCTION**</u>   **3 Hours**

1.1. Importance of engineering drawing
1.2. Standard sizes of sheets
1.3. Principle of sheet formation
1.4. Relation between the two sides
1.5. Designation of sizes
1.6. Drawing instruments and its uses
1.7. Procedure for Guiding the pencil and writing pen

2.   <u>**STANDARD LETTERING**</u>   **4 Hours**

2.1. Definition and importance
2.2. Types of lettering

3.   <u>**ELEMENTARY DRAWING PRINCIPLES**</u>   **6 Hours**
3.1. Classification of lines
3.2. Accuracy in drawing
3.3. Procedure for Drawing pencil lines
3.4. Fixing of the drawing sheet
3.5. Standard curves (Parabola, hyperbola, Archimedes spiral, involute & helix)
3.6. Types of Ellipse

4.   <u>**OTHOGRAPHIC PROJECTON**</u>   4 Hours

4.1. Introduction of Isometric projection
4.2. Principle of orthographic projection
4.3. First angle projection
4.4. Third angle projection
4.5. Missing views
4.6. Distinction symbols
4.7. Free hand sketching

Recommended Books & Notes :
i) Technical Drawing (Vol-I)   Published By PSTC, PCSIR
ii) A text book of 1st year Engineering Drawing   By A.C. Parkinsin

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TD-153   **Technical Drawing**
                                  <u>**List of Practical**</u>   192 Hours

Exercise   1   :   Standard lettering practice – 1
Exercise   2   :   Standard lettering practice – 11
Exercise   3   :   Standard lettering practice – 111 (Home task)
Exercise   4   :   Standard lettering practice – 1V (Home task)
Exercise   5   :   The meaning of lines in drawing
Exercise   6   :   Construction of geometrical figures – 1
Exercise   7   :   Construction of geometrical figures (Home task)
Exercise   8   :   Execution of curved lines
Exercise   9   :   Execution of standard curves (Home task)
Exercise   10   :   Application of curves
Exercise   11   :   Three views from isometric
Exercise   12   :   Three views from isometric (Home task)
Exercise   13   :   Sketching the missing view
Exercise   14   :   Dimensioning practice
Exercise   15   :   Dimensioning practice (Home task)
Exercise   16   :   Sketching the missing view
Exercise   17   :   Sketching the missing view (Home task)
Exercise   18   :   Missing Views

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ADVANCED DIPLOMA OF ASSOCIATE ENGIEER IN MECHANICAL TECHNOLOGY WITH SPECIALIZATION IN PRECISION MACHINING & INSTRUMENT TECHNOLOGY (3 YEARS COURSE) 2ND YEAR

IST YEAR			T	P	C	Page
Gen	111	Islamiat and Pak. Studies	1	0	1	
ENG	112	English	2	0	2	
Math	113	Applied Mathematics-I	3	0	3	
Phy	122	Applied Physics	1	3	2	
Ch	112	Applied Chemistry	1	3	2	
Comp	142	Computer Applications	1	3	2	
WT	156	Workshop Technology-I	2	12	6	
MT	141	Health Safety and Environment	1	0	1	
TD	153	Technical Drawing	1	6	3	
		T O T A L	**13**	**27**	**22**	
2ND YEAR						
Gen	211	Islamiat and Pak Studies	1	0	1	
Phy	212	Applied Mechanics	1	3	2	
Math	212	Applied Mathematics-II	2	0	2	
MGM	211	Business Communication	1	0	1	
ET	202	Applied Electricity and Electronics	1	3	2	
Mech.	252	Metrology	1	3	2	
MS	212	Material Science	2	0	2	
WT	227	Workshop Technology-II	2	15	7	
TD	253	Technical Drawing and CAD-I	1	6	3	
		T O T A L	**12**	**30**	**22**	
3RD YEAR						
Gen	311	Islamiat and Pak Studies	1	0	1	
Mech.	323	Applied Thermodynamics	2	3	3	
Mech.	343	Machine Design	2	3	3	
Mech.	362	Materials Testing & Heat treatment	1	3	2	
TD	352	CAD-II / CAM	1	3	2	
DM	312	Tool Technology-I (Injection moulds, Comp. moulds)	1	3	2	
DM	322	Tool Technology-II (Press tools, Bending tools)	1	3	2	
DM	335	Workshop Technology-DM1	3	6	5	
DM	342	Special Purpose Machines-I	1	3	2	
		T O T A L	**13**	**27**	**22**	
4TH YEAR						
DM	414	Special Purpose Machines -II	2	6	4	
DM	425	Tool Design and Making	2	9	5	
DM	433	Tool Technology-III (Jigs & Fixture, P. die casting)	2	3	3	
DM	443	Tool Technology-IV (Fine blanking, deep drawing)	2	3	3	
DM	455	Workshop Technology-DM2	3	6	5	
DM	462	Production Planning-DM	2	0	2	
		TOTAL	**13**	**27**	**22**	

Gen-211

ISLAMIAT AND PAK.STUDIES

اسلامیات/مطالعہ پاکستان

نصاب (سال دوم)

حصہ اول   اسلامیات   Gen 211   سی   پی   ٹی

1   0   1

حصہ دوم   مطالعہ پاکستان

موضوعات

کل وقت:20 گھنٹے

1۔ سورہ المومنوں   ایک تا گیارہ آیات معہ ترجمہ

2۔ **دس منتخب احادیث معہ ترجمہ وتشریح**

- خير كم من تعلم القران و علمه

- لاايمان لمن لا امانة له و لادين لمن عهدله

- اياكم والظن ان الظن اكذب الحديث

- من احدث فی امرنا هذا ما ليس منه فهورد

- من حمل علينا السلاح فليس منا

- انا و كافل اليتيم فی الجنة هكذا

- لا يومن احد كم حتی اكون احب اليه من والده و ولده و الناس اجمعين

- من بنی لله مسجد ابنی الله له بيتأ فی الجنة

- لاضرر ولا ضرار فی الاسلام

- كلكم راع و كلكم مسئول عن رعيته

3۔ **سیرت طیبہ**

- مکی زندگی، ولادت،   بعثت، ہجرت

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

خطبہ حجۃ الوداع

4۔ **حضورؐ علیہ السلام بحیثیت:**

معلم کامل ۔ سربراہ خاندان

5۔ **اسلامی معاشرہ**

نظام تعلیم اور اس کے مقاصد۔ عدل وانصاف۔ امر بالمعروف ونہی عن المنکر

جہاد، کسب حلال، مسجد (اہمیت وفضیلت)

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

تدریسی مقاصد

قرآن مجید   منتخب آیات قرآنی

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

خصوصی مقاصد

- قرآنی آیات کا ترجمہ بیان کر سکے۔
- قرآنی آیات کی تشریح کر سکے۔
- قرآنی آیات کی روشنی میں ایک مومن کے اوصاف بیان کر سکے۔
- قرآنی آیات میں بیان کردہ مومن کے اوصاف اپنے اندر پیدا کر سکے۔
- احادیث نبویہ

عمومی مقصد۔ احادیث کی روشنی میں اسلام کی اخلاقی اقدار (انفرادی و اجتماعی) سے آگاہ ہو سکے۔

خصوصی مقاصد

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

سیرت طیبہ

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

خصوصی مقاصد

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

اسلامی معاشرہ

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

خصوصی مقاصد

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

اسلامی ریاست

عمومی مقاصد، اسلامی ریاست کی خصوصیات بیان کر سکے۔

خصوصی مقاصد

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

نصاب اخلاقیات (غیر مسلم طلباء کیلئے)

ٹی پی سی

1 0 1

سال دوم   کل وقت 20 گھنٹے

موضوعات

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

- حقوق و فرائض
- قوت برداشت
- قوت ارادی
- لگن و جذبہ
- وسیع النظری
- بے غرضی
- انسان دوستی
- حفاظتی شعور
- پاس آزاری
- کامل آگاہی
- تغیرات کو قبول کرنا
- خود شناسی

نصاب اخلاقیات

سال دوم

تدریسی مقاصد

عمومی مقاصد   طالب علم

اخلاقیات کی اہمیت و ضرورت سے آگاہ ہو سکے اور بیان کر سکے۔

خصوصی مقاصد   طالب علم اس قابل ہو۔

- موضوعات کا مطلب بیان کر سکے۔
- عملی زندگی سے مثالوں کی نشاندہی کر سکے۔
- اپنی شخصیت اور معاشرے پر موضوعات کے مطابق مثبت اثرات پیدا کرنے کے طریقے بیان کر سکے۔
- اعلیٰ اخلاقی اقدار میں سے:

قوت برداشت، قوت ارادی، لگن جذبہ، وسیع النظری، بے غرضی، انسان دوستی حفاظتی شعور، پاس آزادی، کامل آگاہی اور خود شناسی کی اہمیت بیان کر سکے۔

- اخلاقیات سے متصف ہو کر قومی خدمت بہتر طور پر انجام دے سکے۔

66

نصاب مطالعہ پاکستان

سی   پی   ٹی

1   0   1

سال دوم   کل وقت 12 گھنٹے

حصہ دوم

<u>موضوعات</u>

-      دو قومی نظریہ

-      تحریک پاکستان

-      انڈین کانگرس

-      مسلم لیگ

-      تقسیم بنگال

-      میثاق لکھنؤ

-      تحریک خلافت

-      سندھی تحریک

-      تجاویز دہلی

-      نہرو رپورٹ

-      قائد اعظم کے چودہ نکات

-      خطبہ الہ آباد

-      انتخابات 1938 اور انتقال اقتدار

-      قرارداد پاکستان

حصہ دوم

مطالعہ پاکستان

<u>تدریسی مقاصد</u>

تحریک پاکستان

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

<u>خصوصی مقاصد</u>

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

Phy-212
APPLIED MECHANICS

Phy-212   **APPLIED MECHANICS**

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

AIMS

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.

COURSE 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 (Review)
    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.
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 Module 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 Hours**
    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 straight line
    13.6   Velocity of a link by relative velocity method

Phy. 212   APPLIED MECHANICS

INSTRUCTIONAL OBJECTIVES

1. **USE THE CONCEPTS OF MEASUREMENT IN PRACTICAL SITUATIONS/PROBLEMS**
   1.1   Explain Dimensional formulas
   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, and 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 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 the method of transmission of power
8.3.   Understand 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 formula to solve/problem on transmission of power
8.8.   Describe types and functions 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 rotary motion to simple vibratory motion.
10.4   State examples of conversion of rotary motion to vibratory motion and vice versa.

10.5 Derive formulae for position, velocity and acceleration of a body executing S.H.M.
10.6 Use the concept of S.H.M to helical springs.
10.7 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 modules 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 torsional stresses giving formula

12. UNDERSTAND SIMPLE MECHANISM

12.1 Define simple mechanism
12.2 Define kinematics
12.3 Explain kinematic links or elements
12.4 Explain kinematic chains
12.5 Distinguish between types of kinematic chains

13. UNDERSTAND THE METHOD OF FINDING VELOCITY IN MECHANISMS

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

Phy-212   APPLIED MECHANICS

LIST OF EXPERIMENTS

1. Find the weight of the given body using Law is theorem.
2. Find unknown forces in a given set of concurrent forces in equilibrium using Grave-sands apparatus
3. Set a jib crane and analyze forces in its members
4. Set a Derrick Crane and analyze 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
10. Find the Moment of Inertia of a Flywheel
11. Find the angle of reaction for a wooden block placed on an inclined plane
12. Find the B.H.P. of a motor
13. Find M.A. and Efficiency of worm and worm wheel
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 differential wheel and axle
19. Find the efficiency of a screw
20. Find the efficiency of a differential pulley
21. Verify Hooke's Law using Helical Spring
22. Study conversion of rotary motion to S.H.M using S.H.M Model/apparatus
23. Study conversion of rotary motion to vibratory motion of 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 Maxwell'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 cantilever (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

BOOKS RECOMMENDED:

1.   Applied Mechanics by R.S. Khurmi
2.   Applied Mechanics by A.P.S Sahihney & Prakash D. Manikpyny.
3.   Applied Mechanics by Inchley and Morley
4.   Theories of Machines by R.S. Khurmi and J.K. Gupta.
5.   Applied Mechanics by Junarker.
6.   Engineering Science Vol-I by Brown and Bryant
7.   Practical Physics by Mehboob Ilahi Malik &Ikram-ul-Haq
8.   Experimental Physics Note Book by M. Aslam Khan & M. Akram Sandhu
9.   Experimental Mechanics (Urdu Process) by M. Akram Sandhu

Math-212
Applied Mathematics-II

MATH-212   **Applied Mathematics-II**

	T	P	C
Total Contact Hours:	**2**	**0**	**2**

Theory: **64** Hours.

Aims & Objectives:

After completing the course the students will be able to: Solve the problems of calculus and analytical Geometry.

COURSE CONTENTS:

1.   FUNCTIONS & LIMITS.   **4 Hours**
   1.1   Constants and variables
   1.2   Functions & their types
   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   Different Coefficient or Derivative
   2.3   Differentiation ab-initio or by first principle
   2.4   Geometrical Interpretation of Differential Coefficient
   2.5   Differential Coefficient of Xa, (ax + b)a
   2.6   Three important rules
   2.7   Problems.

3.   DIFFERENTIATION OF ALGEBRIC FUNCTION.   **4Hours**
   3.1   Explicit function
   3.2   Implicit function
   3.3   Parametric forms
   3.4   Problems

4.   DIFFERENTATION OF TRIGNOMETRIC FUNCTION.   **4Hours**
   4.1   Differential coefficient of sin x, cos x, tang x from first principle.
   4.2   Differential coefficient of Cosec x, Sec x, Cot x.
   4.3   Differentiation of inverse trigonometric function.
   4.4   Problems.

5. DIFFERENTIATION OF LOGARITHIMIC & EXPONENTIAL FUNCTION. 4 Hours
    5.1   Differentiation of In x
    5.2   Differentiation of log ax
    5.3   Differentiation of ax
    5.4   Differentiation of ex
    5.5   Problems.

6.   RATE OF CHANGE OF VARIABLE.   **4 Hours**
    6.1   Increasing and decreasing function
    6.2   Maxima and Minima values
    6.3   Criteria for maximum and minimum values.
    6.4   Method of finding maxima and minima.
    6.5   Problems.

7.   INTEGRATION.   **8 Hours**
    7.1   Concept
    7.2   Fundamental Formulas
    7.3   Important Rules
    7.4   Problems.

8.   METHOD FOR 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.   EQUATION OF STRAIGHT LINE.   **6 Hours**
    11.1 Some Important Forms
    11.2 General form
    11.3 Angle formula
    11.4 Parallelism and perpendicularity
    11.5 Problems

12. THE EQUATION 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 & coordinate of the Centre
    12.5   Problems

REFREFNCE BOOKS

    1   Thomas finny –Calculus and analytic geometry
    2   Ghulam Yasin Minhas –Technical mathematics Vol II, Ilmi Kitab Khana, Lahore.
    3   Prof .Riaz Ali Khan –Poly technique mathematics series vol I & II, Majeed sons Faisal Abad .
    4   Prof. SanaUllah Bhatti –Calculus and analytic geometry , Punjab Text Book Board Lahore.

MATH -212   APPLIED MATHEMATICS –II

INSTRUCTIONAL OBJECTIVES

1. **USE THE CONCEPT OF FUNCTION AND THEIR LIMITS IN SOLVING SIMPLE PROBLEMS**
  1.1 Define a function
  1.2 List all types of function
  1.3 Explain the concept of limit and limit of a function
  1.4 Explain fundamental theorem 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 mathematics expression for a differential coefficient.
  2.2 Explain geometrical interpretation of differential coefficient.
  2.3 Differentiate a content, constant associated with a variable and the sum of finite number of function.
  2.4 Solved related problems.

3. **USE RULES OF DIFFERENTIAL TO SOLVE PROBLEMS OF ALGEBRIC FUNCTIONS.**
  3.1 Differentiate ab-initio Xn and (ax+b)n
  3.2 Derive product, quotient and chain rules.
  3.3 Find derivative of implicit function & explicit function.
  3.4 Differentiate parametric forms; function w.r.t another function and by Rationalization.
  3.5 Solve problems using these formulas.

4. **USE RULES OF DIFFERENTIATION TO SOLVE PROBLEMS OF ALGEBRIC FUNCTIONS.**

  4.1 Differentiate from first principle sin x ,cosx, tang x.
  4.2 Derive formula for derivation of sec x,cosec x, cot x.
  4.3 Find differential coefficient 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 VARRIABLE WITH RESPECT TO ANOTHER.**
  6.1 Write expression for velocity, acceleration, and slope of a line.
  6.2 Define an increasing and decreasing function, maxima and minima values, of inflection.
  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 TECHNOLOGICALPROBLEMS
7.1   Explain the concept of integration
7.2   Write basic theorem 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 METHOD OF SOLVING DEFENITE INTEGRALS.
9.1   Define definite integral
9.2   List properties of definite integrals using definite integrals.
9.3   Find areas under 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 formula
10.5   Derive slope formula
10.6   Solve problems 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.
11.4   Derive expression for angle between two straight lines
11.5   Derives conditions of perpendicularity and parallelism 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 standards, central and general forms of the equation of a circle.
12.3   Convert general forms to the central forms of equation of a circle.
12.4   Deduce formulas for the radius and the coordinates of the centre 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

MGM-211
BUSINESS COMMUNICATION

MGM-211   BUSINESS COMMUNICATION

	T	P	C
	1	0	1

Total contact hours
Theory   **32 Hrs**
Prerequisites: The students shall already be familiar with the language concerned.

AIMS The course has been designed to enable the students to.
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.

COURSE CONTENTS

1.   COMMUNICATION PROCESS.   **6 Hours**
   1.1   Purposes of communication
   1.2   Communication process
   1.3   Distortions in communication
   1.4   Consolidation of communication
   1.5   Communication flow
   1.6   Communication for self-development

2.   ORAL COMMUNICATION SKILLS.   **6 Hours**
   2.1   Significance of speaking.
   2.2   Verbal and non-verbal messages.
   2.3   Strategic steps of speaking.
   2.4   Characteristics of effective oral messages.
   2.5   Communication Trafficking.
   2.6   Oral presentation.

3.   QUESTIONING SKILLS.   **3 Hours**
   3.1   Nature of question.
   3.2   Types of questions.
   3.3   Characteristics of a good question.
   3.4   Questioning strategy

4.   LISTENING SKILLS.   **5 Hours**
   4.1   Principles of active listening.
   4.2   Skills of active listening.
   4.3   Barriers to listening.
   4.4   Reasons of poor listening.
   4.5   Giving Feedback.

5.   INTERVIEWING SKILLS.   **3 Hours**
   5.1   Significance of interviews.
   5.2   Characteristics of interviews.

5.3	Activities in an interviewing situation	
5.4	Types of interviews.	
5.5	Interviewing strategy.	

6.   REPORT WRITING.   **3 Hours**
6.1   Goals of report writing
6.2   Report format.
6.3   Types of reports.
6.4   Report writing strategy.

7.   READING COMPREHENSION.   **2 Hours**
7.1   Reading problems.
7.2   Four Reading skills.

8.   GROUP COMMUNICATION.   **4 Hours**
8.1   Purposes of conducting meetings.
8.2   Planning a meeting.
8.3   Types of meetings.
8.4   Selection f a group for meeting.
8.5   Group leadership skills.
8.6   Running a successful meeting.
8.7   Active participation techniques.

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

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 SKILL IN THE ORAL COMMUNICATION PROCESS.**
    4.1   State the principles of active listening.
    4.2   Identify skills of active listening.
    4.3   Identify barriers to active listening.
    4.4   State the benefits of active listening.
    4.5   Demonstrate listening skills.
    4.6   Explain the importance of giving and receiving 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 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 meeting and means to overcome these problems.
8.4   Distinguish between content and process at meetings.
8.5   Explain the key characteristics of a good group facilitator.

ET-202
APPLIED ELECTRICITY AND ELECTRONICS

Elect-202   APPLIED ELECTRICITY AND ELECTRONICS

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

Pre-requisites: Applied Physics (1st year)

AIMS: This course enables the students to understand the fundamental of electricity and electronics. Know how of the devices used for control of industrial equipment, their properties and uses. The course provides the knowledge of working principles and operation of A.C. and D.C. motors, transformers and generators, amplifier, DC power supplies, inverter and stabilizer, AC & DC motors control interpret connection diagrams of various electrical and electronics devices. Students will be able to observe safety rules and provide electric shock treatment. He will be able to design control circuit.

Course Contents:

1. FUNDAMENTALS OF ELECTRICITY	3Hrs
2. PROTECTION DEVICES AND ELECTRICAL SAFETY	5Hrs
3. MOTORS, GENERATORS AND TRANSFORMERS	5 Hrs
4. INSTRUMENTS AND WIRING	4 Hrs
5. FUNDAMENTALS OF ELECTRONICS	3 Hrs
6. TRANSISTORS/AND DIODES	4 Hrs
7. PROGRAMABLE LOGIC CONTROLER (PLC) AND GATES	5 Hrs
8. THYRISTORS	3 Hrs

Detail of Contents:

1. FUNDAMENTALS OF ELECTRICITY   3Hrs
  1.1 Current, (AC and DC Supply) voltage and resistance, their units, single phase   and three phase supply
  1.2 Ohm's law, simple calculations
  1.3 Laws of resistance, simple calculations
  1.4 Combination of resistances, simple calculations, capacitors and their combinations
  1.5 Electrical and mechanical power, their conversion, units, horse power
  1.6 Heating effect of current, joules law
  1.7 Electrical energy, units, energy bill
  1.8 Inductors
  1.9 RLC circuits
  1.10 Batteries and battery cells

2. PROTECTION DEVICES AND ELECTRICAL SAFETY   5 Hrs
  2.1 Fuse and their types
  2.2 Circuit breaker and their types
  2.3 Relay and their types
  2.4 Starter and their types
  2.5 Switches and types
  2.6 timers

3. MOTORS, GENERATORS AND TRANSFORMERS   5 Hrs
  3.1 Faraday's law
  3.2 Construction and working of AC and DC generators
  3.3 Construction and working of transformers, emf and current, equation, types
  3.4 Welding transformers, ratings
  3.5 Types and working of motors
    3.5.1 AC MOTORS
      3.5.1.1 1- Phase induction motor
      3.5.1.2 3- Phase induction motors
    3.5.2 DC MOTORS
      3.5.2.1 Stepper motors
      3.5.2.2 Servo motors

4. (A) MEASURING INSTRUMENTS & WIRING   4 Hrs
  4.1 Types of instruments
  4.2 Volt meter, Ampere meter, frequency meter, Resistance meter
  4.3 AVO meters, Oscilloscope
  4.4 Calibration of meters, Energy meter, Wattmeter

(B) DOMESTIC WIRING
  4.5 Wiring and their types
  4.6 Estimate of wiring

5. FUNDAMENTALS OF ELECTRONICS   3 Hrs
  5.1 Semi conductor theory, doping, P & N type materials
  5.2 PN Junction diode, potential barrier, forward and reverse bias
  5.3 Use of PN Diode as rectifier
  5.4 Half-wave, full-wave and bridge rectifiers and Filters
  5.5 Invertors and stabilizers
  5.6 Power supplies

6. TRANSISTORS AND DIODES   **4 Hours**
  6.1   PNP & NPN transistors, biasing, working principle
  6.2   Use of transistors as amplifiers, gains in CE, CB and CC amplifiers
  6.3   Zener diode
  6.4   Photo diode, Diac, Triac as a regulator, photovoltaic cells, LED

7. PROGRAMABLE LOGIC CONTROLER (PLC) and Logic Gates   **5 Hrs**
  7.1   PLC advantage and disadvantages and its types
  7.2   Basic PLC programming
  7.3   Gate and types, Relay logic
  7.4   k. maps, binary system
  7.5   Design a control circuit

8. THYRISTORS   **3 Hrs**
  8.1   SCR, working principle and its uses as control devices
  8.2   Phase control of SCR's
  8.3   Speed control of AC and DC motors

Recommended Textbooks:

  1.   Examples of Electrical Calculations, by Admiralty
  2.   Reed's Basic electro-technology for marine engineers, KRAAL
  3.   Electrical Technology, B.L. Theraja
  4.   AC & DC circuits   B. Grob
  5.   Basic Electronics B. Grob
  6.   Digital Electronics by Morse Moyno

Elect-202   APPLIED ELECTRICITY AND ELECTRONICS

INSTRUCTIONAL OBJECTIVES:

1. **UNDERSTAND BASIC CONCEPTS AND LAWS OF ELECTRICITY**
   1.1   Define units of current, voltage and resistance with respect to supply of single phase and three phase
   1.2   Explain Ohm's Law with simple calculations
   1.3   Solves simple problems on laws of resistance
   1.4   Substitute two of the three variables to find the third unknown in equation $V = I \times R$

        1.4.1   Calculate the equivalent resistances for resistors joined in series, parallel and combination
        1.4.2   Calculate the total capacitance in series and parallel
   1.5   Calculate electrical and mechanical power and the inter relation between the two systems
   1.6   Heating effect of current, Joule's Law
   1.7   Calculate the electrical energy consumption in an installation and prepare the energy bill
   1.8   Define the inductors and its uses
   1.9   Define RLC circuit and its uses
   1.10 Define the batteries and battery cell

        1.10.1   Define primary and secondary battery
        1.10.2   State the types of primary and secondary batteries

2. **UNDERSTAND PROTECTION DEVICES AND ELECTRICAL SAFETY**
   2.1   Define rating, fusing factor, rewire -able fuse, HRC type fuse
   2.2   Explain the working of circuit breaker, use of oil circuit breaker, gas circuit breaker
        2.2.1   Describe the types and construction of circuit breaker
   2.3   Explain construction and working of a relay
        2.3.1   State its types, working, construction and uses
   2.4   Describe starter and its types
        2.4.1   Explain the working of starter, 3Point, 4Point and star delta starter and soft starter
        2.4.2   Understand personal and devices safety
   2.5   Define the switches and their types
   2.6   Describe timers and its functions

3. **UNDERSTAND WORKING OF ELECTRIC MOTORS, AND GENERATORS AND TRANSFORMERS**
   3.1   Explain Faraday's law
   3.2   State the construction of alternator and D.C. generator with its parts and working
   3.3   Explain the working principal of transformers and emf equation
   3.4   State various parts of a welding transformer and settings
   3.5   Explain the working of single phase, three phase, and servo motors
   3.6   Explain the working of stepper motors

4. **INSTRUMENTS AND WIRING**
   4.1   Define primary and secondary types of instruments, calibration of instruments
   4.2   Define secondary analog digital and working effect
   4.3   Explain types of meters, uses and connection in a circuit (Watt Meter, Volt Meter, Ampere Meter, Energy meter maximum indicator oscilloscope) and methods of calibration

4.4　Define wiring and describe batten wiring, conduit PVC, casing capping wiring and there uses

　　4.4.1　Describe advantages and disadvantages of each

4.5　Prepare the estimate sheet for wiring(Take of Sheet)

5.　UNDERSTAND THE FUNDAMENTALS OF ELECTRONICS

5.1　State the Semi conductor theory

　　5.1.1.　　State how P type and N type material is produced

5.2　State the action of potential barrier in a PN junction and the effect of forward and reverse bias on the junction

5.3　Describe the use of PN junction diode as rectifier

5.4　Draw and explain the circuit diagram for half wave and full wave rectifier

5.5　Draw and explain the Bridge Rectifier circuit with filter circuit, invertors and stabilizer and its circuits

5.6　Explain types of Power supplies

6.　UNDERSTAND THE WORKING OF BIPOLAR JUNCTION TRANSISTOR AND F.E.T. TRANSISTOR

6.1　State the biasing working of N.P.N. and P.N.P. type of transistor

　　6.1.1　Draw the circuit indicating the method of biasing the NPN and PNP transistors

6.2　Draw the different types of amplifier connections (C.E., C.B., C. C.)

6.3　State the biasing working of zenor diodes

6.4　State the construction working and uses of photo diodes, Diac, Triac as a regulator

7.　PROGRAMABLE LOGIC CONTROLER (PLC) AND GATES

7.1　Define PLC, working, advantages and disadvantages

7.2　Describe Basic PLC programming

7.3　Explain Gate and Types

　　7.3.1　Define symbols truth table logic diagram (AND, OR, NOT, NAND, NOR, XOR, NXOR)

7.4　Define binary system decimal to binary, Hexa, octal system, K maps SOP,POS,

7.5　Explain pneumatic cylinder control, basic operation, charging control operation, connection of I/O devices

8.　UNDERSTAND THE APPLICATION OF THYRISTORS IN CONTROL CIRCUITS

8.1　Explain the construction, working, biasing and uses of SCR

8.2　Explain the phase control with the help of SCR for A.C. Loads

8.3　Explain the speed control of AC and DC motors with the help of SCR

Elect-202   APPLIED ELECTRICITY AND ELECTRONICS

List of Practical:

1.   FUNDAMENTALS OF ELECTRICITY
1.1   Study of electrical measuring instruments, handling precautions, methods of connection and identification of AC & DC Meter
1.2   Verification of Ohm's law
1.3   Verification laws of combination; of resistance
1.4   Measurement of power by Volt-ammeter and wattmeter
1.5   Measurement of electrical energy
1.6   Use of primary and secondary batteries

2.   PROTECTION DEVICES AND ELECTRICAL SAFETY
2.1   Application of various fuses in wiring
2.2   Study of connection of circuit breaker 2 pole, 3 pole with time setting

3.   MOTORS, GENERATORS AND TRANSFORMERS
3.1   Verification of Faraday's laws of electro-magnetic induction
3.2   Connection of star delta starter and timer
3.3   Study of AC and DC generators
3.4   Study of welding transformers
3.5   Starting single-phase induction motors, reversal and forward
3.6   Starting 3-phase induction motors, reversal and forward
3.7   Connections of magnetic starters with motors

4.   INSTRUMENTS AND WIRING
4.1   Current carrying capacity of cables
4.2   Wiring, PVC, casing Capping and Batten
4.3   Use of oscilloscope
4.4   Study of calibration of instruments using bridge circuits
4.5   Study of using AVO meter and meggar analog and digital

5.   FUNDAMENTALS OF ELECTRONICS
5.1   Study and connections of PN diodes as rectifiers
5.2   Connecting PN Diode as half-wave and full-wave rectifier
5.3   Connecting PN Diode as bridge Rectifiers with filter
5.4   Study of Power Supplies

6.   TRANSISTORS AND DIODES
6.1   Connections and biasing of PNP and NPN transistors
6.2   Study and connections of zenor diode as voltage regulator
6.3   Study and connections of Photodiode as light sensing device
6.4   Study and connections of DIAC's and TRIAC's as switch circuits

7.   PROGRAMABLE LOGIC CONTROLER (PLC) AND GATES
7.1   Study of PLC system

      7.2   Study and connection of gate AND, OR, NOT, NAND, NOR, XOR, NXOR

      7.3   Study how to execute PLC

          7.3.1   Basic commands and how to design control circuit

          7.3.2   working of relays

8. THYRISTORS

      8.1   Study and connections of SCR as a power switches

Elect-202   APPLIED ELECTRICITY AND ELECTRONICS

PRACTICAL OBJECTIVES:

1. FUNDAMENTALS OF ELECTRICITY

      1.1   Study of electrical measuring instruments, handling precautions, methods of connection

          1.1.1 Develop the skill of Scale reading

          1.1.2 Connection in parallel and series

          1.1.3 Identification of linear and square law scale

          1.1.4 Understand Parallax errors in instruments

          1.1.5 Adjustment of pointer

          1.1.6 Develop the skill of identification of AC & DC

      1.2   Verification of Ohm's law

          1.2.1 Students will be able to verify the Relation b/w voltage and current

          1.2.2   Verify the relation b/w current and resistance

          1.2.3   Draw the relation b/w current, voltage and resistance

      1.3   Verification of laws of combination of resistance

          1.3.1 Develop the skill to connect the load in series

          1.3.2 Understand the current equal at all loads in series

          1.3.3 To calculate the voltage drop at every resistance

          1.3.4 To calculate the total resistance in series and parallel load

          1.3.5 To calculate the total capacitance charge and voltage in series and parallel

      1.4   Measurement of power by Volt-ammeter and wattmeter

          1.4.1 Develop the skill to connect the load with voltmeter

          1.4.2 Students will be able to verify the power with voltmeter and ampere meter

          1.4.3 Understand the internal connection of watt meter

      1.5   Measurement of energy

          1.5.1 Develop the skill to connect the energy meter with load

          1.5.2 To calculate the energy bill taking the unit consumed

      1.6   Batteries

          1.6.1 Develop the skill of identification of primary and secondary cell

          1.6.2 Understand the types of Batteries w.r.t primary and secondary

2 PROTECTION DEVICESAND ELECTRICAL SAFETY

      2.1   Use a fuse in wiring

          2.1.1 Students will be able to connect the fuse with proper phase

          2.1.2 Calculate the fusing factor

          2.1.3 Understand the material of fuse material

      2.2   Study of connection of circuit breaker 2 pole, 3 pole with time setting.

          2.2.1 Develop the skill of connection of circuit breaker 2 pole, 3 poles, with setting

          2.2.2 Choose the proper circuit breaker

          2.2.3 Understand the function of breaker

2.3   Connection of start delta starter
        2.3.1 Develop the skill of connection
        2.3.2 Start motor
        2.3.3 Develop the skill of personal and devices safety
2.4   Develop the skill to select the switches according to their rating
2.5   Develop the skill to understand the connection of timer according to the circuit

3.   MOTORS, GENERATORS AND TRANSFORMERS
        3.1   Verification of Faraday's laws of electro-magnetic induction
          3.1.1 Students will be able to understand the working principal of generator
          3.1.2 To understand the EMF induced in AC & DC generators
3.2   Study of AC and DC generators
        3.2.1 Develop the skill to identify the AC and DC generator
        3.2.2 Able to understand the parts of generator
        3.2.3 Able to understand the function of each part
3.3   Study of welding transformers
        3.3.1 Develop the skill of current setting according to welding materials
        3.3.2 Connection and precautions
3.4   Starting single-phase induction motors, reversal and forward
        3.4.1 Develop the skill of connection with starting and running coil
        3.4.2 Other method to start the motor
3.5   Starting 3-phase induction motors, reversal and forward
        3.5.1 Develop the skill to understand the method of starting 3 phase motor
        3.5.2 Connection with star delta starter with magnetic contactors
        3.5.3 Connection with reverse forward switch
3.6   Connections of magnetic starters with motors
        3.6.1 Draw the circuit diagram with magnetic contactors of three phase motor
        3.6.2 Develop the skill to use magnetic contactor for safety purpose

4.   INSTRUMENTS AND WIRING
4.1   Measurement of size of cable
        4.1.1 Develop the skill of Choice of cable
        4.1.2 To measure the gauge of wire
        4.1.3 To understand the core of cable
4.2   Wiring, PVC, casing Capping and Batten
        4.2.1 Able to identify the wiring
        4.2.2 Develop the skill of wiring
        4.2.3 Wiring according to cable
        4.2.4 Estimate the wiring
4.3   Study of oscilloscope
        4.3.1 Develop the skill of adjustment and to use the function of oscilloscope
        4.3.2 Reading of CRT graph
4.4   Study of calibration of instruments
        4.5.1 Develop the skill of comparison with absolute instruments
        4.5.2 Understand the errors
        4.5.3 adjustment accuracy and remove error
        4.5.4 Develop the skill, calibrate the instruments with using bridge and standard instruments
4.6   Study using of AVO meter and meggar
        4.6.1 Develop the skill to use of multi meter

4.6.2 Measure current voltage and resistance
4.6.3 Check emitter base collector
4.6.4 Understand cathode anode diode

5. FUNDAMENTALS OF ELECTRONICS

5.1 Study and connections of PN diodes as rectifiers
5.1.1 Develop the skill understand the cathode and anode
5.1.2 Connection of diode forward and reverse bias
5.1.3 Connect the diode with transformers

5.2 Connecting PN Diode as half-wave and full-wave
5.2.1 Develop the skill to connect the two diode with transformer
5.2.2 Understand full wave rectification
5.2.3 Understand the forward and reverse bias

5.3 Connecting PN Diode as bridge Rectifiers with filter
5.3.1 Develop the skill of connecting diodes
5.3.2 Connect the diode without transformer central tap
5.3.3 Connect with filter for pure DC

5.4 Study of Power Supplies
5.4.1 Develop the skill use of power supply
5.4.2 Understand the parts of power supply
5.4.3 Repair maintenance of power supply

6. TRANSISTORS AND DIODES

6.1 Study connections and biasing of PNP and NPN transistors
6.1.1 Develop the skill to identify emitter, base, collector
6.1.2 Biasing of transistor
6.1.3 To measure emitter base collector current

6.2 Study and connections of zener diode as voltage regulator
6.2.1 Develop the skill to understand the use of zener diode
6.2.2 Connection of zener diode
6.2.3 Connection as regulator.

6.3 Study and connections of Photodiode as light sensing device
6.3.1 Develop the skill to understand the function of photo diode
6.3.2 Connect the diode with optocoplur
6.3.3 Biasing

6.4 Study and connections of DIAC's and TRIAC's as switch circuits
6.4.1 Develop the skill to understand the connection
6.4.2 Anode cathode and gate
6.4.3 Using as a switch

7. PROGRAMABLE LOGIC CONTROLER (PLC) AND GATES

7.1 Study of PLC system
7.1.1 Develop the skill to understand the use of PLC
7.1.2 To identify the each parts of PLC
7.1.3 To prepare ladder diagram
7.1.4 Students will be able to understand the types of PLC

7.2 Study and connection of gate AND, OR, NOT, NAND, NOR, XOR, NXOR
7.2.1 Develop the skill to prepare the truth table
7.2.2 Use logic diagrams

7.2.3 Verify the truth table
7.3   Study how to execute PLC
    7.3.1 Develop the skill to understand the mode
    7.3.2 Use function
    7.3.3 Identify the step of execution
    7.3.4 Method of execution
7.4   Basic commands and how to design control circuit
    7.4.1 Develop the skill to understand the commands
    7.4.2 Identify the basic commands
    7.4.3 How to design a control
    7.4.4 Develop the skill to control the logic delay using truth table

8. THYRISTORS
8.1   Study and connections of SCR as a power switch
    8.1.1 Develop the skill use of anode, cathode and gate with biasing
    8.1.2 Use as a phase control
    8.1.3 Use a speed control

Mech-252
METROLOGY

Mech-252 METROLOGY

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

Pre-requisites: MT-117 (Workshop Practice I)

AIMS: The subject is connected with the methods of measurements based on agreed International Standards and units. The practice in the subject requires the use of apparatus and equipment which include measuring instruments, laying-out Tools, Supporting Tools, necessary to adjust at the degree of accuracy required.

Course Contents:

1. INTRODUCTION TO MEASUREMENT AND QUALITY CONTROL	4Hrs
2. LINEAR MEASUREMENTS SUPPORTING TOOLS	2Hrs
3. GAUGES	2 Hrs
4. ADJUSTABLE MEASURING TOOLS	3 Hrs
5. ANGLE MEASURING TOOLS	3 Hrs
6. PRECISION MEASURING INSTRUMENTS	3 Hrs
7. ACCURACY IN MEASUREMENTS	2 Hrs
8. DIAL INSTRUMENTS	2 Hrs
9. TAPER MEASUREMENTS	1 Hr
10. OPTICAL MEASUREMENTS	2 Hrs
11. COMPARATORS	2 Hrs
12. DIGITAL INSTRUMENTS	1 Hr
13. COORDINATE MEASURING MACHINE	3Hrs
14. GEAR MEASUREMENTS	2 Hrs

Detail of Contents:

1. INTRODUCTION TO MEASUREMENT AND QUALITY CONTROL 4Hrs
1.1 History of measurements
1.1 Importance and purpose of measurements
1.2 Quality control and its Importance in metrology
1.3 S.I Units
1.4 ISO Standards
1.5 Fits, Tolerance & Allowance
1.6 Geometric Tolerance

2. LINEAR MEASUREMENTS SUPPORTING TOOLS 2Hrs
2.1 Cast iron surface plate
2.2 Granite Surface plate
2.3 Glass surface plate
2.4 Straight edges
2.5 Spirit levels
2.6 Engineer's parallels
2.7 Universal Surface gauge

3. GAUGES 2 Hrs
3.1 Ring gauge
3.2 Plug gauge
3.3 Snap gauge
3.4 Radius gauge
3.5 Angle gauge
3.6 Screw-pitch gauge
3.7 Standard wire gauge
3.8 Feeler gauge

4. ADJUSTABLE MEASURING TOOLS 3 Hrs
4.1 Vernier Caliper
4.2 Micrometer
4.3 Dial indicator

5. ANGLE MEASURING TOOLS 3 Hrs
5.1 Fixed angle measuring tool
5.2 Angle gauges
5.3 Adjustable angle measuring tools
   5.3.1 Without graduations
   5.3.2 With graduations

6. PRECISION MEASURING INSTRUMENTS 3 Hrs
6.1 Vernier height gauge
6.2 Vernier depth gauge
6.3 Inside Micrometer
6.4 Depth Micrometer
6.5 Thread Micrometer
6.6 Hot gauge Micrometer
6.7 Vernier Micrometer

7. ACCURACY IN MEASUREMENTS 2 Hrs
7.1 Elements of Metrology

7.2   Classification of Errors
   7.2.1Controllable errors
   7.2.2Random errors
7.3   Calibration
7.4   Repeatability

8. DIAL INSTRUMENTS   2 Hrs
8.1   Dial Caliper
8.2   Dial thickness gauge
8.3   Dial bore gauge

9. TAPER MEASUREMENTS   1 Hr
4.1.   Gauge Block
4.2.   Sine Bar

10. OPTICAL MEASUREMENT   2 Hrs
10.1   Tool Makers Micro Scope
10.2   Profile Projector/Shadow Graph (50 X)
10.3   Optical Flats

11. COMPARATORS   2 Hrs
11.1   Mechanical Comparator
11.2   Electrical Comparator
11.3   Electronic Comparator

12. DIGITAL INSTRUMENTS   1 Hr
12.1   Digital Micrometer
12.2   Digital Caliper
12.3   Digital Indicator
12.4   Digital Depth Gauge
12.5   Digital Height Gauge
12.6   Digital Read Out (DRO)

13. COORDINATE MEASURING MACHINE   3Hrs
13.1   Working principle of CMM and its coordinates
13.2   Part and Accessories
13.3   Use of CMM
13.4   Digital 3D Scanner

14. GEAR MEASUREMENT   2 Hrs
14.1Gear Testing machine
14.2Backlash Measurement

Recommended Textbooks:
1. Shop Theory by Anderson
2. Engineering Metrology by R.K Jain
3. Production Technology by R.J Gupta
4. Dimensional Metrology by Ted. Busch, Roger Horlow
5. Engineering Metrology by Hume K.J.

Mech-252   **METROLOGY**

INSTRUCTIONAL OBJECTIVES:

1. **INTRODUCTION TO MEASUREMENTS**
    1.1   State history of measurements
    1.2   Describe importance and purpose of measurements
    1.3   Describe quality control and its importance in metrology
    1.4   Describe S.I units
    1.5   Describe ISO standard
    1.6   Describe fits , tolerance, allowances
    1.7   Describe geometric tolerance

2. **UNDERSTAND LINEAR MEASUREMENT SUPPORTING TOOL**
    2.1   Describe Cast-iron Surface plate
    2.2   Describe Granite Surface plate
    2.3   Describe Glass Surface plate
    2.4   Describe Straight edges
    2.5   Describe Spirit levels
    2.6   Describe Engineers parallels
    2.7   Explain Universal Surface gauge

3. **KNOW ABOUT GAUGES**
    3.1   Describe the ring gauge and its uses
    3.2   Describe the plug gauge and its uses
    3.3   Describe the snap gauge and its uses
    3.4   Describe the radius gauge and its uses
    3.5   Describe the angle gauge and its uses
    3.6   Describe screw pitch gauge
    3.7   Describe the use of standard wire gauge
    3.8   Describe the use of feeler gauge

4. **UNDERSTAND ADJUSTABLE MEASURING TOOLS**
    4.1   Explain the construction and use of Vernier Caliper
    4.2   Explain the construction and use of Micrometer
    4.3   Explain the construction and use of Dial Indicator

5. **UNDERSTAND ANGLE MEASURING TOOLS**
    5.1   Describe the use of following fixed angle Measuring Tools
        5.1.1   Centre Square
        5.1.2   Combination square
        5.1.3   Try Square
        5.1.4   Double Square
        5.1.5   Die maker Square
        5.1.6   Engineer Square
    5.2   Describe the use of following angle gauges
        5.2.1   Thread gauges

11. DESCRIBE THE USE OF FOLLOWING COMPARATORS
    11.1   Mechanical comparator
    11.2   Electronic comparator
    11.3   Electrical comparator

12. DESCRIBE THE USE OF FOLLOWING DIGITAL INSTRUMENTS
    12.1   Digital Micrometer
    12.2   Digital Caliper
    12.3   Digital indicator
    12.4   Digital Depth gauge
    12.5   Digital height gauge
    12.6   Digital Readout

13. COORDINATE MEASURING MACHINE
    13.1   Describe the coordinates of CMM
    13.2   Describe the accessories of CMM
    13.3   Describe the use of CMM
    13.4   Describe the use of 3-D scanner

14. GEAR MEASUREMENT
    14.1   Describe about gear testing machine
    14.2   Describe about backlash measurement

Mech-252   METROLOGY

List of Practical:

1. PRACTICE OF FOLLOWING GRADUATED TOOLS   **3Hrs**
1.1   Steel Rule
1.2   Hook Rule
1.3   Folding Rule
1.4   Trammels

2. PRACTICE OF COMBINATION SET   **3Hrs**

3. PRACTICE OF FOLLOWING SUPPORTING TOOLS   **3Hrs**
3.1   Cast Iron, Granite, and Glass Surface Plates
3.2   Straight Edge
3.3   Spirit level
3.4   Engineer's level
3.5   Engineer's parallel

4. PRACTICE OF FOLLOWING GAUGES   **6 Hrs**
5.1   Fixed gauges
5.2   Adjustable gauges
5.3   Small hole gauges
5.4   Telescope gauges

5. PRACTICE AND USE OF FOLLOWING PRECISION INSTRUMENTS-12 Hrs
5.1   Outside Micrometer
5.2   Inside Micrometer
5.3   Depth Micrometer
5.4   Thread Micrometer
5.5   Vernier Micrometer

6. PRACTICE AND USE OF VERNIER TOOLS   **9Hrs**
6.1   Vernier caliper
6.2   Vernier Height gauge
6.3   Vernier depth gauge

7. PRACTICE AND USE OF FOLLOWING ANGLE MEASURING TOOLS 6 Hrs
7.1   Bevel protractor
7.2   Vernier Bevel protractor
7.3   Dial protractor
7.4   Steel protractor
7.5   Sine bar

8. CALCULATION RELATING TO TOLERANCE AND ALLOWANCE 3 Hrs

9. PRACTICE AND USE OF FOLLOWING DIAL INSTRUMENTS   **3 Hrs**
9.1   Dial Caliper
9.2   Dial Thickness gauge
9.3   Dial Indicator

10. PRACTICE AND USE OF GAUGE BLOCKS   **6 Hrs**

11. PRACTICE OF TOOL MAKERS MICROSCOPE   **6 Hrs**

12. PRACTICE OF PROFILE PROJECTOR   **3 Hrs**

13. PRACTICE AND USE OF FOLLOWING COMPARATORS   **9Hrs**
13.1   Mechanical comparator
13.2   Electronic comparator
13.3   Electrical comparator

14. PRACTICE AND USE OF DIGITAL INSTRUMENTS   **6 Hrs**
14.1   Digital Micrometer
14.2   Digital Caliper
14.3   Digital Indicator
14.4   Digital Depth Gauge
14.5   Digital Height Gauge

15. PRACTICE OF MEASUREMENT ON CMM   **9 Hrs**
15.1   Point to point/linear measurement
15.2   Profile measurement (2D, 3D)

16. PRACTICE OF THREAD AND GEAR MEASUREMENT   **9 Hrs**
16.1   Thread gauges
16.2   Gear Tooth Caliper
16.3   Gear Testing Machine

Note:-Quarterly Industrial visit must be arranged for observing physically, the use of above inspection tools/instruments in quality control lab.

Mech-252   METROLOGY

PRACTICAL OBJECTIVES:

After performing the following practical's students will be able to use the instruments and take measurements of different types on different jobs.

1. **PRACTICE OF FOLLOWING GRADUATED TOOLS**
   1.1   PRACTICE OF STEEL RULE
        1.1.1 Read steel rule correctly
        1.1.2 Measure linear lines with steel rule
   1.2   PRACTICE OF HOOK RULE
        1.2.1 Set hook rule with work piece correctly
        1.2.2 Measure the size using hook rule
   1.3   PRACTICE OF FOLDING RULE
        1.3.1   Unfold the folding rule correctly
        1.3.2   Measure the job size accurately
   1.4   PRACTICE OF TRAMMELS
        1.4.1   Mount the trammels with beam
        1.4.2 Set the points with work piece accurately
        1.4.3 Measure the size with steel rule

2. **PRACTICE OF COMBINATION SET**
   2.1   PRACTICE OF COMBINATION SET
        2.1.1   Set the blade with other parts
        2.1.2   Set work piece with parts
        2.1.3 Locate the centre of round objects
        2.1.4 Measure different sizes
        2.1.5 Measure different angles

3. **PRACTICE OF FOLLOWING SUPPORTING TOOLS**
   3.1   PRACTICE OF SURFACE PLATES (Cast Iron, Granite, and Glass)
        3.1.1 Know about the use of surface plates
        3.1.2 Know about the selection of surface plates as per work
        3.1.3 Know about the care of surface plates
   3.2   PRACTICE OF STRAIGHT EDGE
        3.2.1 Know about the care of straight edge
        3.2.2 Use straight edge in different exercises
   3.3   PRACTICE OF SPIRIT LEVEL
        3.3.1 Know about setting of spirit level on work-piece
        3.3.2 Use to check horizontal and vertical surfaces job properly
        3.3.3 Know about the use and care of spirit level
   3.4   ENGINEERS LEVEL
        3.4.1 Know about bubble setting of level
        3.4.2 Check level of worktable of any machine tool
        3.5   PRACTICE OF ENGINEERS PARALLELS
        3.5.1 Select the engineers parallels properly
        3.5.2 Use the engineers parallels to support job

4. **PRACTICE OF FOLLOWING GAUGES**
   4.1   PRACTICE OF FIX GAUGES
        4.1.1   Measure the job for upper and lower limit

4.1.2 Calculate maximum and minimum size
4.1.3 Calculate tolerance and allowance
4.1.4 Understand representation of tolerance
4.2 PRACTICE OF ADJUSTABLE GAUGES
4.2.1 Know about setting of adjustable gauges
4.2.2 Use adjustable gauges properly
4.3 PRACTICE OF SMALL HOLE GAUGES
4.3.1 Select proper size small hole gauge
4.3.2 Use the small hole gauge properly
4.3.3 Read the size on micrometer
4.4 PRACTICE OF TELESCOPE GAUGES
4.4.1 Select proper size telescope gauge
4.4.2 Set the gauge in work piece
4.4.3 Read the size on micrometer

5. PRACTICE AND USE OF FOLLOWING PRECISION INSTRUMENTS
5.1 PRACTICE OF OUTSIDE MICROMETER
5.1.1 Calculate least count
5.1.2 Remove zero error
5.1.3 Measure the size of job accurately
5.2 PRACTICE OF INSIDE MICROMETER
5.2.1 Remove zero error
5.2.2 Set the instruments on work piece
5.2.3 Read the size correctly
5.3 PRACTICE OF DEPTH MICROMETER
5.3.1 Remove the zero error
5.3.2 Set the instruments on work pieces properly
5.3.3 Read the size accurately
5.4 PRACTICE OF THREAD MICROMETER
5.4.1 Set the thread micrometer on work piece
5.4.2 Read the scale properly
5.4.3 Measure the size accurately
5.5 PRACTICE OF VERNIER MICROMETER
5.5.1 Remove zero error
5.5.2 Set the instruments on work piece
5.5.3 Read the Vernier scale
5.5.4 Measure the size accurately

6. PRACTICE AND USE OF VERNIER TOOLS
6.1 PRACTICE OF VERNIER CALIPER
6.1.1 Check weather zero error exits or not
6.1.2 Read the Vernier scale correctly
6.1.3 Measure different sizes accurately

6.2 PRACTICE OF VERNIER HEIGHT GAUGE
6.2.1 Set scriber in height gauge
6.2.2 Set zero properly
6.2.3 Set the scriber on work piece correctly
6.2.4 Measure the size accurately

6.3   PRACTICE OF VERNIER DEPTH GAUGE
      6.3.1 Set the base of depth gauge on work piece properly
      6.3.2 Read the Vernier scale correctly
      6.3.3 Measure the depth accurately

7.   PRACTICE AND USE OF FOLLOWING ANGLE MEASURING TOOLS
7.1   PRACTICE OF BEVEL PROTRACTOR
      7.1.1 Set the blade in protractor properly
      7.1.2 Set the protractor on work piece accurately
      7.1.3 Read the angle correctly

7.2   PRCTICE OF VERNIER BEVEL PROTRACTOR
      7.2.1 Set the blade properly
      7.2.2 Set the protractor on work piece correctly
      7.2.3 Read the Vernier scale
      7.2.4 Measure the angle accurately for clock wise and counter clock wise directions

7.3   PRACTICE OF DIAL PROTRACTOR
      7.3.1 Set the blade properly
      7.3.2 Set the protractor on work piece correctly
      7.3.3 Read the dial scale
      7.3.4 Measure the angle accurately
7.4   PRACTICE OF STEEL PROTRACTOR
      7.4.1 Set the protractor on work piece
      7.4.2 Measure the angle

7.5   PRACTICE OF SINE BAR
      7.5.1 Select proper size Sine Bar
      7.5.2 Set the Sine Bar with gauge block to measure taper
      7.5.3 Calculate tapper angle accurately

8.   CALCULATION OF TOLERANCE AND ALLOWANCES
8.1   Measure the job for upper and lower limits
8.2   Calculate the maximum and minimum size
8.3   Calculate tolerance and allowance
8.4   Understand representation of tolerance

9.   PRACTICE AND USE OF FOLLOWING DIAL INSTRUMENTS
9.1   PRACTICE OF DIAL CALIPER
      9.1.1 Set the pointer on zero properly
      9.1.2 Set the work piece correctly
      9.1.3 Read the dial scale accurately
9.2   PRACTICE OF DIAL THICKNESS GAUGE
      9.2.1 Remove zero error
      9.2.2 Set the work piece properly
      9.2.3 Measure the size accurately
9.3   Practice of Dial Indicator
      9.3.1 Set the Indicator on magnetic stand
      9.3.2 Set the pointer on zero

9.3.3 Set the pointer on work piece
9.3.4 Read the dial scale

10. PRACTICE OF GAUGE BLOCKS
10.1 Set the gauge block as per desired size
10.2 Hold the job in position
10.3 Use sine bar to measure the angle of job accurately with the help of gauge blocks

11. PRACTICE OF TOOL MAKERS MICROSCOPE
11.1 Set the microscope properly
11.2 Hold the job on anvil
11.3 Observe the size and profile of the job by setting eye piece

12. PRACTICE OF PROFILE PROJECTOR
12.1 Make complete setting of work piece on Profile Projector
12.2 Set the axis
12.3 Observe the size

13. PRACTICE AND USE OF FOLLOWING COMPARATORS
13.1 PRACTICE OF MECHANICAL COMPARATOR
    13.1.1 Make complete setup for mechanical comparator
    13.1.2 Set the dial at zero
    13.1.3 Compare the size of job with standard

13.2 PRACTICE OF ELECTRONICS COMPARATOR
    13.2.1 Make complete setting of electronic comparator
    13.2.2 Set the dial at zero
    13.2.3 Compare the size with standard

13.3 PRACTICE OF ELECTRICAL COMPARATOR
    13.3.1 Make complete setting of electrical comparator
    13.3.2 Set the dial at zero
    13.3.3 Compare the size with standards

14. PRACTICE OF DIGITAL INSTRUMENTS
14.1 Use of digital instruments
14.2 Explain the care of digital instruments

15. PRACTICE ON COORDINATE MEASURING MACHINE
15.1 Hold the job properly
15.2 Set and locate zero point
15.3 Measure the size for different coordinates properly
15.4 Make point to point/linear measurements
15.5 Make Profile measurements 2D and 3D

16. PRACTICE OF THREAD AND GEAR MEASUREMENT

16.1   PRACTICE OF THREAD GAUGES
    16.1.1   Know the use of thread gauges
    16.1.2   Measure the number of threads according to standards

16.2   PRACTICE OF GEAR TOOTH CALIPER
    16.2.1   Understand the working of gear tooth caliper
    16.2.2   Measure the chordal thickness of spur gear

16.3 PRACTICES ON GEAR TESTING MACHINE
    16.3.1   Make following gear measurements with gear testing machine Spur, Helical, Bevel

MS-212
Material Science

MS-212   # Material Science

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

AIMS: At the end of this course the student will be able to understand about manufacturing process of iron and their applications and will also be familiarized with the common ferrous and non-ferrous metals and alloys.

COURSE CONTENTS

1.	IRON AND STEEL MANUFACTURE OF PIG IRON	**6 Hour**
2.	MANUFACTURE OF STEEL	**6 Hours**
3.	MANUFACTURE OF STEEL PRODUCTS	**3 Hours**
4.	CASTING	**3 Hours**
5.	NON-FERROUS METALS AND ITS ALLOYS	**6 Hours**
6.	MOST COMMON HEAVY METAL ALLOYS	**6 Hours**
7.	MOST COMMON NON – FERROUS LIGHT METALS	**4 Hours**
8.	MOST COMMON LIGHT METAL ALLOYS	**3 Hours**
9.	METHOD OF MANUFACTURING OF SINTERED MATERIALS	**3 Hours**
10.	CEMENTED CARBIDES	**3 Hours**
11.	SINTERED OF SELF – LUBRICATING BEARING	**3 Hours**
12.	PLASTICS	**8 Hours**
13.	FOUNDRY PRACTICES	**10 Hours**

1. IRON AND STEEL
MANUFACTURE OF PIG IRON
Define   **6 Hour**

Basic Raw Materials

- Iron Ores
- Coke
- Limestone
- Blast furnace and products
- Layout and products of blast furnace
- Process of blast furnace
- Grey and white Pig iron
- Gases from blast furnace or Converter Gas
- Slag

2. MANUFACTURE OF STEEL

Define   **6 Hours**

- Structure ,working and products of converter
- Structure ,working and products of Siemens –Martin Open Hearth Furnace
- The layout ,process and products of Basic Oxygen Furnace
- Structure ,working and products of electric arc Furnace

3. MANUFACTURE OF STEEL PRODUCTS

Define   **3 Hours**

- Hot rolling and cold rolling operations
- Continuous Casting
- The Finishing Mills For sheets ,Bars and structural steels
- Processes For Tubes and pipes
- Cold-Drawing operations

4. CASTING
Define

3 Hours

- Cast iron and its types (grey, chilled, white & nodular cast iron)
- **Steel castings**
- Composition of carbon steel castings
- Malleable cast iron
- White hearth malleable iron
- Black hearth malleable iron
- Foundry and foundry practice
- Pattern making
- Core mouldry
- Sand mouldry
- Casting bay
- Dressing or cleaning section

5. NON-FERROUS METALS AND ITS ALLOYS
Define

6 Hours

- Most common non-ferrous heavy metals alloy (copper, zinc, tin, lead, nickel, chromium, tungsten, molybdenum, vanadium, cobalt, manganese, tantalum, titanium, antimony, cadmium, bismuth, mercury, silver, gold, platinum etc.)

6. MOST COMMON HEAVY METAL ALLOYS
Define

6 Hours

- Copper – Zinc alloys
- Brass

- Casting brass
- Forging brass
- Rolling brass
- Brass table
- German silver
- Drawing solders
- Brazing drawing solders
- Silver drawing solders
- Copper – Tin and related Alloys (Bronzes)
- Tin bronze
- Aluminum bronzes
- Zinc alloys
- Pressure die casting
- Tin alloys
- Solders
- Fusible materials
- White metals (Babbitt Metals)
- Nickel alloys
- Monel metal
- Invar
- Flatinite
- Alloys for permanent magnets (AI – Ni – Co)
- Alloys with constant modules of elasticity
- Nicked – Copper alloys
- Materials for thermo – electric elements (Thermo couples)
- Materials for bimetal

7. **MOST COMMON NON – FERROUS LIGHT METALS**
   Define

   4 Hours

   - Properties, uses and extraction of Aluminium, magnesium, beryllium etc.

8. **MOST COMMON LIGHT METAL ALLOYS**
   Define

   3 Hours

   - Aluminum alloys
   - Aluminum forging alloys
   - Aluminum – copper – magnesium
   - Aluminum – silicon – magnesium
   - Aluminum – magnesium
   - Aluminum – casting alloys
   - Aluminum – silicon
   - Aluminum – silicon – magnesium

9.   METHOD OF MANUFACTURING OF SINTERED MATERIALS
Production, pressing and sintering of metal powders.   **3 Hours**

10.   CEMENTED CARBIDES

3 Hours

- Basic materials and manufacturing
- Process of cemented carbides
- Properties and applications

11.   SINTERED OF SELF – LUBRICATING BEARING   **3 Hours**

12.   PLASTICS.   **4 Hours**

12.1   THERMOSETTING MATERIALS
- Manufacturing methods with thermosetting plastic
- Moulding
- Laminating
- Kind of thermosetting plastics
- Phenol formaldehyde
- Urea formaldehyde
- Melamine formaldehyde
- Low pressure resins

12.2.   THERMOPLASTIC MATERLALS   **4 Hours**
- Moulding methods for thermoplastic materials
- Moulding by suction
- Injection moulding
- Extruder moulding for continuous materials
- Kinds of thermoplastics
- Polyvinyl Chloride
- Polystyrene
- Polyethylene
- Acrylics
- Polyamides
- Polytetrafluor Ethylene etc.

13.   FOUNDRY PRACTICES   **10 Hours**

Introduction to Foundry practices
- Introduction to Shop safety procedure.
- Explain casting, types and basic steps in casting process
- Describe Pattern

Foundry tools and equipment
Describe
- Molding hand tools
- Jolting and Squeezing Molding machines
- Sand Muller
- Sand and Shot blasting machines
- Pit Furnaces and Tilting Furnaces

Foundry sand
Describe

- Green sand and its composition
- Dry sand and its composition
- Preparation of sand for CO_2 molding process
- Characteristics of foundry sand
- Parting sand
- Facing sand

Recommended Books & Notes:
i) Material Science　　　　　　　　**Published By PSTC, PCSIR**
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WT-227
WORKSHOP TECHNOLOGY-II

WT-227 **WORKSHOP TECHNOLOGY-II**

Total Contact Hours			**T**	**P**	**C**
Theory	64	Hours	2	15	7
Practical	480 Hours				

Aims: At the end of this course, the student will have good working knowledge of the basic machine shop and able to work independently on lathe, milling, engraving and shaping machines.

COURSE CONTENTS

1. Lathe Machine	**14 Hours**
2. Shaper and Planer	**10 Hours**
3. Milling	**18 Hours**
4. Engraving	**08 Hours**
5. Welding and Forging	**10 Hours**
6. Soldering and Brazing	**04 Hours**

DETAIL OF COURSE CONTENTS

1.   LATHE MACHINES   **14 Hours**

1.1.   **Types of Lathes**
- Centre lathe
- Bench lathe
- Engine lathe
- Turret lathe
- Capstone Lathe
- Vertical lathe
- CNC Lathe and Turning Centre

1.2.   **Drives of lathes**
- Step or cone pulley drive
- Gear drive

1.3.   Power feed motion
- Standard change gear
- Quick change gear box

1.4.   **Parts of the lathe**
- Lathe bed
- Head stock
- Tail stock
- Carriage
- Cross slide
- Compound slide
- Tool post
- Feed shaft

- Lead screw

1.5. **Accessories of lathe**
- Chucks
- Face plate
- Collets
- Centers
- Mandrel
- Steady rest
- Follower rest

1.6. **Special attachments**
- Quick change tool post
- Lever – operated carriage
- Lever – operated drilling tail stock
- Star – wheel – operated turret carriage
- Thread cutting attachment
- Milling attachment
- Grinding attachment
- Ball turning attachment

1.7. **Lathe tools**
- Left Hand Turning tool
- Right Hand Turning tool
- Threading tool
- Knurling tool
- Boring tool

1.8. **Turning operations**
- Longitudinal and transverse turning
- Speed and feed for turning
- Slotting and parting off
- Boring
- Taper turning with compound slide
- Taper turning with setting over tail stock
- Taper turning with attachment
- Eccentric turning
- Knurling
- Thread cutting
- Calculation of change gears for thread cutting
- Setting the thread cutting tool
- Lathe Setting for Threads cutting

2. <u>**SHAPER AND PLANER**</u>   **10 Hours**

2.1. **Type of machines**
- Planning machines
- Hydraulic shaping machine
- Vertical shaper or slotting machine

2.2. **The shaper drive**

2.2.1.   The friction – wheel drive

2.3.   **The parts of the shaper**

2.4.   **Accessories**
- Concentric machine vice
- Slotting attachment
- Parallels

2.5.   **Shaping Surfaces**
- Flat shaping
- Vertical shaping
- Angular shaping
- Profile Shaping

2.6.   **Operation Instruction**
- Setting speed
- Adjusting length of stroke
- Setting the ram
- Setting cross feed or table feed
- Vertical adjustment of table
- Adjusting down feed
- Setting of tool lifter in operation
- Starting and stopping of machine

3.   <u>MILLING</u>

18 Hours

3.1.   **Types of Milling machines**
- Horizontal milling machine
- Vertical milling machine
- Universal milling machine
- Bench milling machine
- Thread milling machine
- Copy – milling machine
- Multi spindle milling machine
- Gear Shaper
- Gear Hobbing

3.2.   **Drive of milling machines**
- Cone pulley drive
- Step-less variable speed gear drive

3.3.   **Parts of the milling machine**
- Base
- Column
- Over Arm

- Arbor support
- Spindle
- Table
- Saddle
- Knee
- Leveling screw
- Speed control unit

3.4. **Milling Accessories**
- Indexing Head
- Swivel Vice
- Universal Vice
- Slotting Attachment
- Vertical head
- Rotary table
- Universal head
- Arbors
- Collets
- High speed Milling attachment
- Angle Plate
- Magnetic chuck
- Vacuum chuck

3.5. **Vertical Milling cutters**
- Single End mill
- Double End mill
- Ball End mill
- Shell End mill
- Taper end mill
- T-Slot Cutter
- Dovetail Cutter
- Face Milling Cutter

3.6. **Horizontal Milling cutters**
- Fly cutter
- Slitting Saw
- Slotting Cutter
- Side and Face cutter
- Convex Cutter
- Concave Cutter
- Single Angle Cutter
- Double Angle Cutter
- Corner Rounding Cutter
- Spur Gear Cutter

3.7.   **Milling operations**
- Conventional Milling
- Climb Milling
- Slotting
- Straddle Milling
- Gange Milling
- Grooving
- Slitting (Sawinig)
- Angular Milling
- Circular Milling
- Gear cutting

3.8.   **Indexing**
- Direct Indexing
- Simple Indexing
- Angular Indexing
- Differential indexing

4.   ENGRAVING   **08 Hours**
4.1.   Engraving machine
4.2.   **Accessories**
- Electric etching apparatus
- Form engraving attachment
- Work holding devices
- Engraving templates
4.3.   **Operating the machine**
- Setting the spindle speed
- Adjusting the pantograph
- Adjusting the engraving head to the work piece
- Aligning the template table to the work table
- Aligning of the work piece to the template
- Fixing the cutter
4.4.   **The engraving cutter**
- High speed steel cutters
- Carbide engraving cutters
- Spring loaded engraving
- Engraving diamonds
- Etching pin
- Angles on the engraving cutters
- Different forms of cutter
4.5.   **Engraving operations**
- Common engraving
- Copying of cams
- Electric etching
- Cutting speed for engraving

5.   **WELDING AND FORGING**   **10 Hours**

5.1.   Definition of welding
5.2.   Welding processes
- Forge/ Pressure welding
- Fusion/ Non Pressure welding
- Resistance welding(spot, seam, projection,)

5.3.   Process and Equipments
- Oxy-acetylene welding
- Oxy-acetylene Welding equipments
- The gas cylinders
- Pressure regulator
- Blow pipe
- Cutting torch
- Radii cutting attachment
- Welding and filler rods
- Welding flux, its uses and advantages

5.4.   Electric arc welding and equipments
- Metal arc welding
- Submerged arc welding
- Tungsten inert gas(TIG) welding
- Metallic inert gas(MIG) welding
- DC generator
- AC welding transformer
- Welding Electrodes

5.5.   Forging and Forging processes
- Flat die forging(Smith forging)
- Closed die forging

5.6.   Forging Operations
- Upsetting
- Drawing down
- Setting down
- Punching
- Bending
- Cutting

6.   **SOLDERING AND BRAZING**   **4 Hours**

6.1.   Soldering methods
- Torch soldering
- Soldering iron
- Furnace soldering
- Dip soldering
- Resistance soldering

6.2.   Define Brazing
- Torch brazing
- Furnace brazing
- Electric brazing

6.3.   Fluxes, its uses and advantages

Recommended Books

i) Workshop Technology V-II   **Published by PSTC, PCSIR**
ii) Technology of Machine Tools   **by S.F. Karar**

WT-227   <u>**WORKSHOP TECHNOLOGY-II**</u>
             <u>**List of Practical**</u>   **480 Hours**

1. Square Fit Exercise
2. Gauges Exercise
3. Hammer Fabrication Exercise (Shaper Machine)
4. Drill Gauge Exercise
5. Chamfer Gauge Exercise
6. Tool Grinding Exercise
7. Step Turning Reaming and Hexagon Fit Exercise
8. Paper Weight Turning Exercise
9. Cylindrical Turning Exercise
10. Eccentric Turning Exercise
11. Scriber or Center or Pin Punch Turning Exercise
12. Boring Exercise
13. Taper Boring Exercise
14. Milling Block Exercise (Square Block)
15. Step Milling Exercise
16. T- Fit Milling Exercise
17. Sliding Fit Exercise
18. Engraving & Etching Exercise
19. Welding and Brazing Exercise
20. Practice of electric arc welding
21. Practice of flame making for gas welding
22.   (a) Harsh Flame (b) Carburizing Flame (c) Neutral Flame (d) Oxidizing flame
23. Practice of oxy-acetylene welding
24. Practice of soldering
25. Practice of brazing
26. Hexagon Milling
27. Spur Gear Cutting
28. Use of Rotary Table for octagonal Block milling
29. Cutting right hand V-threads
30. Cutting left hand V-threads
31. Cutting double start (R/H) V-threads
32. Cutting double start (L/H) V-threads

WT-227   WORKSHOP TECHNOLOGY-II

INSTRUCTIONAL OBJECTIVES:
Instructor / Teacher should ensure to:

1.   DEVELOP KNOWLEDGE OF LATHE MACHINE

- Identify and describe the use of different types lathes
- Identify lathe machine parts
- Explain the construction of lathe machine
- Understand driving and feed mechanism of lathe machine
- Describe the utility of lathe attachments, accessories and tools
- Perform various lathe operations

2.   DEVELOP KNOWLEDGE OF SHAPER AND PLANER

- Distinguish between shaper and planer
- Identify and describe the utility of mechanical mechanism and hydraulic mechanic for driving shaper
- Set length of stoke of shaper
- Set different tools on shaper
- Set work holding devices
- Perform different operations on shaper independently

3.   DEVELOPMENT KNOLEDGE OF MILLING WORK

- Identify horizontal, vertical and universal milling machines
- Identify copy milling, gear shaper and hobbing machine
- Describe brief use of different types of milling machines
- Describe the construction of parts for Horizontal, Vertical and universal milling machines
- Use different milling attachments such as swivel vice, vertical head, slotting head, universal head, index head, arbors, rotary table etc.
- Set and use Horizontal milling cutters
- Set and use vertical milling cutters
- Perform different milling operations affectively
- Use indexing methods to cut spur gears

4. DEVELOP KNOWLEDGE OF ENGRAVING

- Identify and explain the parts of engraving machine
- Identify different types of engraving cutters
- Set and use different engraving cutters
- Select suitable speeds for various engraving cutters
- Adjust pantograph to increase or decrease the size of job to be engraved
- Set alignment of template to work table
- Set alignment of work to template

- Perform different engraving operations affectively

5. DEVELOP KNOWLEDGE OF WELDING AND FORGING

- Define welding process
- Describe the process of high pressure gas welding
- Describe the process of electric arc welding
- Describe the utility of gas welding equipment
- Describe the utility of arc welding equipment
- Understand the use of radii gas cutting attachment
- Set and use gas welding equipments
- Set and use of arc welding equipments
- Set and use equipment of (TIG) for welding
- Set and use equipment of (MIG) for welding
- Use exhaust system for (TIG) and (MIG) welding process
- Set fore forge (preheating furnace) properly
- Heat up the stock up to forging temperature properly
- Perform different forging operations properly such as upsetting, drawing down, twisting, punching, bending etc.

6. DEVELOP KNOWLEDGE OF SOLDERING AND BRAZING

- Define soldering
- Define brazing
- Know the requirements of soldering and brazing
- Know about the fluxes used in soldering and brazing
- Use soldering iron properly
- Use brazing torch properly
- Perform soldering and brazing process

TD-253
TECHNICAL DRAWING & CAD-I

TD-253   **TECHNICAL DRAWING & CAD-I**

Total Contact Hours   **T**   **P**   **C**
    Theory   **32 Hours** (22 Hours for TD, 10 Hours for CAD-I)   1   6   3
    Practical   **192 Hours**

Aims: At the end of this course, the student will have very good working knowledge and understanding of advance mechanical drawing and basic Auto CAD commands.

COURSE CONTENTS

**1.   PRINCIPLES OF REPRESENTATION OF DRAWING
         VIEWS OTHER THAN ORTHOGRAPHIC VIEWS**   **3 Hours**
1.1.   Scope
1.2.   Principles of representations and conventions
    1.2.1. Choice of views
    1.2.2. Special views
    1.2.3. Partial views of symmetrical objects
    1.2.4. Interrupted views
    1.2.5. Intersectional views
    1.2.6. Representation of some plane faces
    1.2.7. Views of Adjacent parts
    1.2.8. Representation of details
    1.2.9. Developed views
    1.2.10. Taper / Inclination of views
    1.2.11. Conventional treatment of radically arranged features
    1.2.12. Alternate positional views
    1.2.13. Aligned views
    1.2.14. Simplified representation of threaded parts views
    1.2.15.1   Visible screw threads
    1.2.15.2   Hidden screw threads
    1.2.15.3   Limits of useful length
    1.2.15.4   One view representation
    1.2.15.5   Projection of various cuts on cylindrical surfaces
    1.2.15.6 Auxiliary views multi-views drawings. Partial views. By coordinates
views

2.   PRINCIPLES OF DIMENSIONING SYSTEM   **3 Hours**
2.1.   Dimension classification
    2.1.1.   Functionary
    2.1.2.   Non- functionary
    2.1.3.   Auxiliary
    2.1.4.   Aligned
    2.1.5.   Unidirectional

5.11. Revolved and of removed sections

5.12. Broken out section (long and short)

5.13. Intersection in Section

5.14. Disposition of successive sections

5.15. Auxiliary Sections

5.16. Disposition of several sections

5.17. Threads in sections

5.18. Unit threaded parts

5.19. Assembled threaded parts

6. WORKING DRAWING   3 Hours

6.1. Definition

6.2. Engineering procedure for working drawing

6.3. Detail Drawing

6.4. Tabular Drawing

6.5. Standard Drawing

6.6. The bill of material or parts list

6.7. Making a working drawing (Basic concepts)

6.8. Title Block

6.9. Form of title Block

6.10. Checking of Drawings

6.11. Order of checking

6.12. Alterations

6.13. Reproduction of drawings

6.14. Copying Methods

7. MACHINE ELEMENTS   3 Hours
7.1.   Define Standardization

    7.1.1.   Advantages of standardization

    7.1.2.   Applications of standardization

        7.1.2.1.   Nomenclature

        7.1.2.2.   Dimensions

        7.1.2.3.   Quality

        7.1.2.4.   Tools

        7.1.2.5.   Performance

        7.1.2.6.   Processes

8. LIMITS, FITS AND TOLERANCES   5 Hours

8.1. Importance

8.2. ISO system of fits

8.3. Scope

8.4. Terminology

8.5. Nominal size

8.6. Tolerance

9.2.1 General
9.2.2 Material and manufacture
9.2.3 Bearing characteristics
9.2.4 Dimension, form and running accuracy

9.3. State Deviations for dimension without indication of tolerances
9.4. Surface condition
9.5. Surface finish symbol
9.6. Additional surface treatment
9.7. Indication of surface condition of the drawing
9.8. Surface finish through different machining operations

10. **CAD   Software**   **10 Hours**

10.1 **Introduction of CAD Software**
10.1.1. User Interface
10.1.2. Template
10.1.3. Layers and Object
10.1.4. Mechanical Structure

10.2 **Drawing and Edit Tool Bars**
10.2.1 Object Snap
10.2.2. Drawing Command tool bar
10.2.3. Edit Command tool bar
10.2.4. Object Command

10.3 **Layers**
10.3.1.   Creation and modifying Layers

10.4 **Symbols**
10.4.1. Create Dimension
10.4.2. Create editing Dimension
10.4.3. Create Symbols

10.5 **Drawing Layout**
10.5.1. Creation of Layout
10.5.2. Understand creation of Drawing Frame
10.5.3. Creation of Contents and Template
10.5.4. View Commands
10.5.5. Toolbars and Profiles
10.5.6. 2-D drawings and commands
10.5.7. Use of different Draw Commands
10.5.8. Use of different Modify Commands
10.5.9. Selecting Objects
10.5.10.   Object Properties
10.5.11.   Drafting Settings and Object Snaps
10.5.12.   Text Tools
10.5.13.   Title blocks and Templates
10.5.14.   View ports and Layouts

10.5.15.   Introduction to Simple Model, wire frame Model and Solid Models

TD-253   **TECHNICAL DRAWING**

List of Practical   **96 Hours**

Exercise   01   :   Representation of turned parts (only necessary views)
Exercise   02   :   Detail drawing with operation plan (front & side views in sections)
Exercise   03   :   To produce the detail drawing (section & three views)
Exercise   04   :   Dimensioning Exercises
Exercise   05   :   Representation of gears
Exercise   06   :   Representation of bearing
Exercise   07   :   Representation of springs
Exercise   08   :   Miscellaneous machine elements
Exercise   09   :   Views in section
Exercise   10   :   Section & conventions (Home task)
Exercise   11   :   Representation of turned parts.
Exercise   12   :   Detail Drawing with operation plan
Exercise   13   :   To produce the detail drawing
Exercise   14   :   Representation of Bolts and Nuts
Exercise   15   :   Representation of springs on drawing
Exercise   16   :   Detail drawing of machine elements
Exercise   17   :   Working drawing of a pulley block
Exercise   18   :   Detail drawing of jig bushes
Exercise   19   :   Working drawing of a watch maker screw driver
Exercise   20   :   Tap wrench
Exercise   21   :   Gear & Pulley drive
Exercise   22   :   Drill Jig (Working Drawing)
Exercise   23   :   Clamping Fixture (Working Drawing)

CAD -I

Theory: 10 Hours
Practical: 96 Hours

1) CAD software fundamentals
2) Opening and saving a drawing
3) Creating new drawing
4) Drawing line, Arc, Circle etc.
5) Drawing 2D objects
6) Editing of 2D objects
7) Dimensioning of Drawings
8) Editing 3D objects
9) Different views of 3D objects
10) Publishing a drawing

Recommended Books & Notes
i)   **Engineering Drawing and Design**   **by David P. Madsen**
ii) **Engineering Drawing**   **by French Verick**
iii) **Fundaments of Engineering Drawing**   **by F.J. Luzzader**

INSTRUCTIONAL OBJECTIVES
Teacher must ensure to:

1.   **PRINCIPLES OF REPRESENTATION OF DRAWING**
           VIEWS OTHER THAN ORTHOGRAPHIC VIEWS
1.1.   Scope
1.2.   Principles of representations and conventions
        1.2.1. Choice of views
        1.2.2. Special views
        1.2.3. Partial views of symmetrical objects
        1.2.4. Interrupted views
        1.2.5. Intersectional views
        1.2.6. Representation of some plane faces
        1.2.7. Views of Adjacent parts
        1.2.8. Representation of details
        1.2.9. Developed views
        1.2.10. Taper / Inclination of views
        1.2.11. Conventional treatment of radically arranged features
        1.2.12. Alternate positional views
        1.2.13. Aligned views
        1.2.14 Simplified representation of threaded parts views
        1.2.15.1 Visible screw threads
        1.2.15.2 Hidden screw threads
        1.2.15.3 Limits of useful length
        1.2.15.4 One view representation
        1.2.15.5 Projection of various cuts on cylindrical surfaces
        1.2.15.6 Auxiliary views multi-views drawings. Partial views. By coordinates

views

2. PRINCIPLES OF DIMENSIONING SYSTEM

2.1. Dimension classification

    2.1.1. Functionary
    2.1.2. Non- functionary
    2.1.3. Auxiliary
    2.1.4. Aligned
    2.1.5. Unidirectional
    2.1.6. Tabular
    2.1.7. Arrow less
    2.1.8. Chain
    2.1.9. Chart
    2.1.10. Datum / Reference
    2.1.11. Typical
    2.1.12. Diametric
    2.1.13. Radius
    2.1.14. Location
    2.1.15. Base line
    2.1.16. Size

3. Elements of dimensioning

- Extension,
- leader,
- dimension,
- centre lines,
- arrow,
- numbers

4. General principles of Dimensioning

    4.1. Dimensions not to scale
    4.2. Dimensioning of chords, arcs and angles
    4.3. Partial views
    4.4. Big radii
    4.5. Inscription of arrow heads
    4.6. Inscription of figures
    4.7. Step dimensioning
    4.8. Dimensioning by co – ordinates
    4.9. Dimensioning of equidistant features
    4.10. Inscription of leaders
    4.11. Use of reference letters
    4.12. Special indication note with leader lines

5.   PRINCIPLES OF SECTIONS

5.1	Sectional views
5.2	Symbolic representation of the cutting plane
5.3	Sectioning principles
5.4	Selection of Section lines Different Engineering materials
5.5	Hatching line
5.6	Thin sections
5.7	Nodes on sections
5.8	Cutting planes
5.9	Parts located in front of a cutting plane
5.10	Full and Half sections
5.11	Revolved and of removed sections
5.12	Broken out section (long and short)
5.13	Intersection in Section
5.14	Disposition of successive sections
5.15	Auxiliary Sections
5.16	Disposition of several sections
5.17	Threads in sections
5.18	Unit threaded parts
5.19	Assembled threaded parts

6.   WORKING DRAWING

6.1.	Definition
6.2.	Engineering procedure for working drawing
6.3.	Detail Drawing
6.4.	Tabular Drawing
6.5.	Standard Drawing
6.6.	The bill of material or parts list
6.7.	Making a working drawing (Basic concepts)
6.8.	Title Block
6.9.	Form of title Block
6.10.	Checking of Drawings
6.11.	Order of checking
6.12.	Alterations
6.13.	Reproduction of drawings
6.14.	Copying Methods

7.   MACHINE ELEMENTS

7.1.	Define Standardization	
7.1.1.	Advantages of standardization	
7.1.2.	Applications of standardization	
	7.1.2.1.	Nomenclature
	7.1.2.2.	Dimensions
	7.1.2.3.	Quality
	7.1.2.4.	Tools

8.26   Basic hole system for
           8.26.1.   Running and sliding fits
           8.26.2.   Close sliding and press fits

9.   <u>**Gears (Conventional & symbolic representation of Gears)**</u>
           9.1.   Springs (Symbolic representation of springs)
           9.2.   Bearings
9.2.1. General
9.2.2. Material and manufacture
9.2.3. Bearing characteristics
9.2.4. Dimension, form and running accuracy
9.3.   State Deviations for dimension without indication of tolerances
9.4.   Surface condition
9.5.   Surface finish symbol
9.6.   Additional surface treatment
9.7.   Indication of surface condition of the drawing
9.8.   Surface finish through different machining operations

11.   <u>**CAD   Software**</u>

10.1   **Introduction of CAD Software**
        10.1.1. User Interface
        10.1.5. Template
        10.1.6. Layers and Object
        10.1.7. Mechanical Structure

10.6   **Drawing and Edit Tool Bars**
        10.2.1 Object Snap
        10.2.2. Drawing Command tool bar
        10.2.3. Edit Command tool bar
        10.2.5. Object Command

10.7   **Layers**
        10.3.1.   Creation and modifying Layers

10.8   **Symbols**
        10.4.4. Create Dimension
        10.4.5. Create editing Dimension
        10.4.6. Create Symbols

10.9   **Drawing Layout**
        10.5.16.   Creation of Layout
        10.5.17.   Understand creation of Drawing Frame
        10.5.18.   Creation of Contents and Template
        10.5.19.   View Commands
        10.5.20.   Toolbars and Profiles
        10.5.21.   2-D drawings and commands
        10.5.22.   Use of different Draw Commands
        10.5.23.   Use of different Modify Commands

TD-253   **<u>TECHNICAL DRAWING</u>**

<div align="center"><u>List of Practical</u>   96 Hours</div>

Exercise	01	:	Representation of turned parts (only necessary views)
Exercise	02	:	Detail drawing with operation plan (front & side views in sections)
Exercise	03	:	To produce the detail drawing (section & three views)
Exercise	04	:	Dimensioning Exercises
Exercise	05	:	Representation of gears
Exercise	06	:	Representation of bearing
Exercise	07	:	Representation of springs
Exercise	08	:	Miscellaneous machine elements
Exercise	09	:	Views in section
Exercise	10	:	Section & conventions (Home task)
Exercise	11	:	Representation of turned parts.
Exercise	12	:	Detail Drawing with operation plan
Exercise	13	:	To produce the detail drawing
Exercise	14	:	Representation of Bolts and Nuts
Exercise	15	:	Representation of springs on drawing
Exercise	16	:	Detail drawing of machine elements
Exercise	17	:	Working drawing of a pulley block
Exercise	18	:	Detail drawing of jig bushes
Exercise	19	:	Working drawing of a watch maker screw driver
Exercise	20	:	Tap wrench
Exercise	21	:	Gear & Pulley drive
Exercise	22	:	Drill Jig (Working Drawing)
Exercise	23	:	Clamping Fixture (Working Drawing)

<u>CAD -I</u>

Theory: 10 Hours
Practical: 96 Hours

11) CAD software fundamentals
12) Opening and saving a drawing
13) Creating new drawing
14) Drawing line, Arc, Circle etc.
15) Drawing 2D objects
16) Editing of 2D objects
17) Dimensioning of Drawings
18) Editing 3D objects
19) Different views of 3D objects
20) Publishing a drawing

MECHANICAL TECHNOLOGY WITH SPECIALIZATION IN PRECISION MACHINING & INSTRUMENT TECHNOLOGY (3 Years Course) 3RD YEAR

SCHEME OF STUDIES

IST YEAR			T	P	C	Page
Gen	111	Islamiat and Pak. Studies	1	0	1	
ENG	112	Functional English	2	0	2	
Math	113	Applied Mathematics-I	3	0	3	
Phy	122	Applied Physics	1	3	2	
Ch	112	Applied Chemistry	1	3	2	
Comp	142	Computer Applications	1	3	2	
WT	156	Workshop Technology-I	2	12	6	
MT	141	Health Safety and Environment	1	0	1	
TD	153	Technical Drawing	1	6	3	
		T O T A L	**13**	**27**	**22**	
2ND YEAR						
Gen	211	Islamiat and Pak Studies	1	0	1	
Phy	212	Applied Mechanics	1	3	2	
Math	212	Applied Mathematics-II	2	0	2	
MGM	211	Business Communication	1	0	1	
ET	202	Applied Electricity and Electronics	1	3	2	
Mech.	252	Metrology	1	3	2	
MS	212	Material Science-	2	0	2	
WT	227	Workshop Technology-II	2	15	7	
TD	253	Technical Drawing and CAD-I	1	6	3	
		T O T A L	**12**	**30**	**22**	
3RD YEAR						
Gen	311	Islamiat and Pak Studies	1	0	1	
Mech.	312	Hydraulics & Hydraulics Machines	1	3	2	
Mech.	323	Applied Thermodynamics	2	3	3	
Mech.	331	Industrial Planning & Production	1	0	1	
Mech.	343	Machine Design	2	3	3	
Mech.	362	Materials testing & Heat treatment	1	3	2	
Mech	382	CAD/CAM	1	3	2	
MT	312	Instrument Science	1	3	2	
WT	356	Workshop Technology-III	2	12	6	
		T O T A L	**12**	**30**	**22**	

Gen-311
ISLAMIAT AND PAKSTUDY

اسلامیات/مطالعہ پاکستان

نصاب (سال سوم)

حصہ اول   اسلامیات   Gen 311

سی	پی	نی
1	0	1

حصہ دوم   مطالعہ پاکستان

موضوعات   کل وقت 20 گھنٹے

1   قرآن مجید

سورۃ الفاتحہ۔ آیۃ الکرسی ۔ سورۃ البقرہ کی آخری آیات از امن الرسول تا آخر اور سورہ اخلاص معہ ترجمہ و تشریح

2   دس منتخب احادیث معہ ترجمہ و تشریح

بنی الاسلام علی خمس شھادۃ ان لا الہ الا اللہ و اقام الصلوۃ و ایتاء الزکوۃ و حج البیت و صوم رمضان

-        الدین النصیحہ

-        المستشار الموتمن

-        للمومن علی المومن ست خصال یعودہ اذا مرض و یشمتہ اذا مات و یجیبہ اذا دعاہ و یسلم علیہ اذا لقیہ و یشمت اذا عطس و ینصح لہ اذا غاب او شھد لا تخن من خانک

-        لا یدخل الجنۃ قاطع

-        ان اللہ حرم علیکم عقوق الامھات و اضاعۃ المال

-        یسرا و لا تعسرا بشرا و لا تنفرا

-        ذاق طعم الایمان من رضی با للہ و بالاسلام دینا و بمحمد نبیا

-        افضل الذکر لا الہ الا اللہ

3   حقوق و فرائض

حصول تعلیم بطور فرض ، والدین اور اولاد کے حقوق و فرائض، ہمسایہ کے حقوق

4   اسلام کی اخلاقی اقدار

صبر و استقلال ۔ عفو و درگزر ۔ ایفائے عہد ۔ اخوت ۔ ایثار و قربانی

منتخب احادیث

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

خصوصی مقاصد

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

حقوق و فرائض

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

خصوصی مقاصد

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

اسلامی اقدار

عمومی مقصد   طالب علم:

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

خصوصی مقاصد

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

نصاب اخلاقیات   (غیر مسلم طلباء کے لئے)   سی   پی   ٹی

سال سوم   Gen-311   1   0   1

موضوعات   کل وقت 20 گھنٹے

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

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نصاب (سال سوم)

مطالعہ پاکستان   Gen-311   نی   پی   سی

                1   0   1

حصہ دوم   کل وقت 12 گھنٹے

قیام پاکستان

<u>موضوعات</u>

-   باؤنڈری کمیشن
-   ریڈ کلف ایوارڈ
-   تقسیم بنگال و کلکتہ
-   تقسیم پنجاب
-   مسئلہ مہاجرین
-   ریاستوں کا الحاق
-   ریاست جموں و کشمیر
-   نہری پانی کا تنازعہ
-   قرارداد مقاصد
-   علماء کے بائیس نکات
-   1956 - 1962 اور 1973 کے دساتیر کی اسلامی دفعات
-   پاکستان کا محل وقوع اور اس کی جغرافیائی اہمیت
-   قدرتی وسائل (تیل، گیس، کوئلہ)

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مطالعہ پاکستان

حصہ دوم

قیام پاکستان

تدریسی مقاصد

عمومی مقصد

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

خصوصی مقاصد

- باؤنڈری کمیشن کی تشکیل اور اس کے فرائض بیان کر سکے۔
- ریڈ کلف اور اس کے ایوارڈ کے بارے میں 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۔
- قیام پاکستان کے بعد نفاذ اسلام کی کوششوں کو بیان کر سکے۔
- پاکستان کے محل وقوع اور اس کی جغرافیائی اہمیت بیان کر سکے۔
- پاکستان میں قدرتی وسائل (تیل، گیس، کوئلہ) کے بارے میں بیان کر سکے۔

Mech-312

HYDRAULICS AND HYDRAULIC MACHINES

Mech-312   HYDRAULICS AND HYDRAULIC MACHINES

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

AIMS: At the end of the course the students will be able to understand properties of incompressible fluids, pressure and flow of fluids, able to apply problems of total head of water for losses of heads etc. The student will have the knowledge of water wheels, hydraulic turbines, pumps and, hydraulics machines. Knowledge of essential parts of hydraulic circuits, types of Actuators, their applications & maintenance, Knowledge of different types of directional control valves used   in hydraulic control / circuits. The student will also be able to study hydraulic circuits of different machines & can rectify their basic faults

Course Contents:

Introduction to hydraulics	**3 Hrs**
Hydro <u>kinetics</u>	**3Hrs**
Flow Through Pipes	**4 Hrs**
<u>Impact of Jet</u>	**1 Hr**
Water Turbines	**2 Hrs**
Pumps	**4Hrs**
Hydraulic Valves and Seals	**3Hrs**
Hydraulic machines	**4Hrs**
Hydraulic Actuators	**4Hrs**
Hydraulic Circuits and Accessories	**4Hrs**

Detail of Contents:

1. Introduction to Hydraulics   **4 Hrs**

     1.1   Introduction to hydraulics
     1.2   Introduction to different properties of liquids(Water &oils)
           1.2.1   Care of Hydraulic liquids
     1.3   Density of liquids
           1.3.1   Specific weight of liquids
           1.3.2   Specific gravity of liquids
     1.4   Viscosity of liquids, Units of Viscosity, Relation of change of viscosity with the change of temperature
           1.4.1   Difference between Hydraulic & Lubricating oils

1.4.2　　Effects of viscosity on flow of liquids
1.5　Pressure head of liquids, Conversion of intensity of pressure in head of liquid
1.6　Pascal's law
1.7　Pressure and its Types, Atmospheric pressure, Gauge pressure, Absolute pressure,
1.8　Measurement of pressure with,
　　1.8.1　　Piezo-meter tube
　　1.8.2　　**Pressure** gauges(Bourdon tube pressure gauge, Diaphragm pressure gauge)
　　1.8.3　　Dead weight pressure gauge calibrator
　　1.8.4　　Calibration of pressure Gauges with Dead Weight pressure& master Gauge calibrator
1.9　Solution of simple problems on above topics

2. Hydro Kinetics　　　　　　　　　　　　　　　　　　　　　3 Hrs
2.1　Introduction
2.2　Rate of discharge
　　2.2.1　　Equation of discharge(volume, weight, mass)
2.3　Equation of continuity of flow
2.4　Total energy/head of liquid particles in motion
2.5　Bernoulli's Equation
　　2.5.1　　Limitations of Bernoulli's Equation
　　2.5.2　　Application of Bernoulli's Equation
2.6　Types of flow
2.7　Use of Pitot-tube gauge for measurement of velocity and discharge of flowing fluids
2.8　Solution of simple problems of discharge, Velocity head, pressure head, Datum head intensity of pressure in flowing liquid when all parameter are given

2.9　　**Flow meter (Venturi meter and orifice meter)**

3. Flow through pipes　　　　　　　　　　　　　　　　　　　3 Hrs
3.1　Introduction to losses of head in pipes
　　3.1.1　　Reynold's Number for
　　　　　　internal flow
3.2　Loss of head of liquid flowing in pipe
　　　　　　(major & minor losses)
　　3.2.1　　Losses of head due to friction
　　3.2.2　　Loss of head due to sudden enlargement
　　3.2.3　　Loss of head due to sudden contraction
　　3.2.4　　Loss of head at entrance in a pipe
　　3.2.5　　Loss of head in bends, elbows, valves & other pipe fittings
3.3　Solution of simple problems by direct application of formulae

4. Impact of Jet　　　　　　　　　　　　　　　　　　　　　1 Hrs
1.1　**Introduction**
1.2　**Force of Jet normally on fixed plate**
1.3　**Force of Jet normally on inclined plate**
1.4　**Force of Jet normally on moving plate**
1.5　**Force of Jet in series of vanes**
1.6　**Calculate force of jet in all above cases by application of simple formulae**

5. Water Turbines   **2 Hrs**

5.1 Introduction to Development of water Wheels & water turbines
5.2 Advantages of water turbines over water Wheels
5.3 Classification of water turbines
5.4 Impulse Turbines (Pelton wheel) & its main parts
        5.4.1 Working of pelton wheel water Turbine
        5.4.2 Sketch a pelton wheel turbine and state main parts
5.5 Reaction turbine and main parts
5.6 Differentiate between Impulse & reaction turbine
5.7 State different types of low head , high discharge water(Reaction) Turbines
        Advantages of hydraulics turbines

6. Pumps   **4 Hrs**

6.1 Introduction to pump
6.2 Types of pumps
6.3 Construction and working of Centrifugal Pumps
6.4 Construction and working of reciprocating pump
6.4.1 Discharge of a single acting reciprocating pump
6.4.2 Slip of a reciprocating pump
6.4.3 Positive Displacement (e.g. Reciprocating , Vane ,Gear etc) pumps
6.5 Comparison of centrifugal and reciprocating pump
6.6 Cavitations in pumps, their causes and remedy
    6.7   Solution of simple problems by using above formulae

7. Hydraulic valves and Seals   **3 Hrs**

7.1   Types of Directional control valves, their study, symbols and function
7.2   Pressure relief valves and their types
7.3   Flow control/ Speed control valves & their types
7.4   Study of Pilot operated directional control valves construction, uses and symbols
7.5   Study of Check valves
7.6   Study of Seals used in hydraulics circuits
7.7   Study of Safety Devices necessary in a hydraulic circuits

8. Hydraulic Simple Machines   **4Hrs**

8.1   Types of simple hydraulic machines
8.2   Hydraulic press
8.3   Mechanical advantage of hydraulic press
8.4   Accumulators Their Types and uses in Hydraulic Circuits

8.5   Hydraulic Intensifiers
8.6   Solve simple problems on mechanical advantage of hydraulic press, Accumulators, and Intensifier

9. Hydraulics Actuators   **4Hrs**

9.1   Classification of Rotary Actuators & their method of actuation
        9.1.1   Uses of Hydraulic motors
        9.1.2   Difference between hydraulic motors & pumps
9.2   Classifications of reciprocating Actuators their construction and working

10. Hydraulic Circuits and Accessories   **4 Hrs**

10.1   The parts/ components of hydraulic circuits
10.2   Uses of proximity switches

10.3   Uses of different hydraulic filters, chillers, different types of rubber hoses, pipe fittings, and couplings

Recommended Textbooks:

1.   Fluid Mechanics by John F. Douglas (Fifth Edition)
2.   Fluid Mechanics with Engineering Applications by Robert L. Daugherty, Joseph B. Franzini
3.   Hydraulics and Hydraulics Machines by E.H.LEWITT (Sir ISAAC Pitman & Sons Ltd London)
4.   **Fluid and power with applications by Anthony Esposito**
5.   **Basic applied fluid power by Oster Jon**

Mech-312 HYDRAULICS AND HYDRAULIC MACHINES

Instructional Objectives:

1. **Introduction to Hydraulics**
    1.1 Understand basic terms of Hydraulics
        1.1.1 Define hydraulics
        1.1.2 State difference between liquid and fluid
        1.1.3 Enlist properties of liquid (hydraulic oil, lubricating oil etc.)
        1.1.4 Define following terms, unit weight of liquids,, viscosity, pressure density, specific gravity
        1.1.5 Describe units of viscosity, effects of change of viscosity on change of temperature
        1.1.5.1 Difference between hydraulic & lubricating oils
        1.1.5.2 Effect of viscosity on flow , compression of hydraulic oil and its leakage from hydraulic components (valves & cylinders)
        1.1.6 Explain pressure head conversion of hydraulic pressure/ Intensity of Pressure in terms of pressure head
        1.1.7 Explain Pascal's law
        1.1.8 Describe types of pressure

    1.2 Understand Pressure Management Techniques
        1.2.1 Explain measurement of pressure by simple piezometer tube and conversion of pressure head in terms of intensity of pressure
        1.2.2 Explain diaphragm pressure gauge and bourdon tube pressure gauge
        1.2.3 Explain dead weight pressure gauge and calibration procedure of gauges
    1.3 Solve simple problems of pressure head & intensity of pressure

2. **Hydro Kinetics**
    2.1 Understand basic terms of Hydro Kinematics
    2.2 Describe rate of discharge
    2.3 Explain equation of continuity of flow
    2.4 Explain energy/head / total head of a liquid in motion
    2.5 Explain Bernoulli's Theorem and its applications
    2.6 Understand types of flow
        2.6.1 Describe the types of flow
    2.7 Describe use of piton tube in determination of velocity of flowing liquid
    2.8 Solution of simple problems of discharge, velocity head, pressure head datum head, intensity of pressure in flowing fluid when all parameters are given

3. **Flow through pipes**
    3.1 Introduction to loss of head in pipes
    3.2 Understand Renolds' Number for internal flows
    3.3 Identify various losses of head of a liquid flowing in pipes (major & minor) and their formula
    3.4 Explain methods of calculation of Losses of head due to friction
        a) Chazy's formula (b) Darcy's formula
    3.5 Explain methods of calculation of loss of head due to sudden enlargement
    3.6 Explain methods of calculation of loss of head due to sudden contraction

3.7   Explain methods of calculation of loss of head at entrance to a pipe

3.8   Explain methods of calculation of loss of head in bends elbow valves & other pipe fittings

3.9   Solve simple problems for calculation of various losses of head by direct application of formula, when all parameters are given

4. Impact of Jet
4.1 Describe Jet of water through nosels
4.2 Describe force of jet impinging normally on fixed plate
4.3 Describe force of jet impinging on inclined fixed plate
4.4 Describe force of jet impinging on moving plate
4.5 Solve simple problems based on all above cases

5. Water Turbines

5.1   Understand development of water Wheels & water turbines

5.2   State advantages and disadvantages of water turbines over water Wheels

5.3   State classification of water turbines

5.4   Impulse Turbines (Peloton wheel)

      5.4.1   Explain working of pelton wheel water turbine

      5.4.2   Sketch pelton wheel turbine and state its various parts

      5.4.3   Explain Nozzle

      5.4.4   Describe Runner and buckets

      5.4.5   Describe Casing

      5.4.6   Describe Breaking jet mechanism

5.5   Understand reaction turbine and its parts

      5.5.1   Describe spiral casing

      5.5.2   Describe guide vane mechanism

      5.5.3   Describe turbine runner

      5.5.4   Describe Draft tube

      5.5.5   Differentiate between reaction turbine and impulse turbine

5.6   State different types of low head, high discharge water Reaction Turbines (Francis Turbine, Propeller Turbine, Kaplan Turbine) and their main parts

      5.6.1   Spiral casing

      5.6.2   Guide Vane mechanism

      5.6.3   Turbine runner

      5.6.4   Draft tube

5.7   Sketch and study of reaction turbine and label its parts

6. Pumps

6.1   State functions of pumps

6.2   Describe classifications of pumps

6.3   Centrifugal pump

      6.3.1   Explain construction of Centrifugal pump

6.4   Explain construction and working of reciprocating pump

      6.4.1   State simple formula for calculation of discharge of a single acting reciprocating pump (Q=LAN / 60)

      6.4.2   Explain Slip of a pump

      6.4.3   Explain construction of Following Positive Displacement pumps, Reciprocating, Vane, Gear etc.

6.5   Compare the centrifugal and reciprocating pump

6.6   Cavitations in pumps and their remedy

6.7   Solve simple problems by using above formulas

7. Hydraulic valves and Seals

7.1   Describe types of hydraulic valves and their symbols
7.2   Describe different directional control valves, their construction, types of spools and their symbols
7.3   Describe types of pressure relief valves and their symbols
7.4   Describe speed control valves/ flow control valve, their construction, uses and symbols
7.5   Describe pilot operated directional valves construction, uses and symbols
7.6   Describe check valves their types, construction and their symbols
7.7   Describe seals used in hydraulic circuits
7.8   Describe safety devices used in hydraulic circuits

8. Hydraulic Simple Machines

8.1   Describe types of simple hydraulic machines
8.2   Explain construction of Hydraulic press
8.3   Explain Mechanical advantage of hydraulic press
8.4   Explain Hydraulic Intensifiers
8.5   Accumulators Their Types and uses in Hydraulic Circuits
8.6   Solve simple problems on mechanical advantages of hydraulic press, Hydraulic Intensifier, Hydraulic accumulator

9. Hydraulics Actuators

9.1   Describe classification of Rotary Actuators
    9.1.1   Explain Use and Construction of different Hydraulic motors
    9.1.2   Differentiate between hydraulic motors & pumps
    9.1.3   Explain different types of seals used in Hydraulic motors
9.2   Describe classifications of reciprocating Actuators
    9.2.1   Describe Use of single acting spring return hydraulic cylinder
    9.2.2   Describe Use & construction of double acting reciprocating hydraulic cylinder
    9.2.3   Describe Use and construction of different hydraulic cylinder & their seals

10. Hydraulic Circuits and Accessories

10.1   Parts/ components of hydraulic circuits (Actuator, Control valve, Reservoir, Filter, Pump, pressure control valve, Directional control valve, Hydraulic pipes and couplings, Flow control Valve)
10.2   Describe Use of proximity switches
10.3   Describe Use of hydraulic filters, chillers, different types of rubber hoses, pipe fittings, and couplings
10.4   Describe different hydraulic circuits of hydraulic control machines

Mech-312 HYDRAULICS AND HYDRAULIC MACHINES

List of Practical:

1. Observe hydraulic bench and its function

2. Practice of Calibration of Bourdon tube and diaphragm pressure gauge with dead weight and master gauge calibrator

3. Operate hydraulic press and observe power required to derive it

4. Practice on hydraulic bench for verification of conversion of velocity head, pressure head and datum head

5. Performance test on friction pipe apparatus

6. Performance test for loss of head due to sudden enlargement, contraction and entrance in a pipe using friction in a pipe apparatus

7. Performance test on Impulse turbine /Pelton turbine

8. Performance test on Reaction Turbine /Francis turbine

9. Performance of centrifugal pump at different speed

10. Performance test on reciprocating pump and observe the operation of reciprocating pump

11. Practice of Measurement of pressure at various connections in hydraulic circuits.

12. Actuation of double acting hydraulic cylinder at push of a switch , develop speed regulation through throttle and flow control valves also draw its circuit diagram

13. Actuation of double acting hydraulic cylinder at a Rapid Traverse By using one way Throttle Valve

14. Setup a pressure device on a double acting cylinder by using pressure reducing valve.

15. Practice to hold a specific load by using Double Acting Cylinder & pilot operated Check Valve

16. Construct a circuit for double acting hydraulic(differential cylinder) for mechanical interlocking with switch also draw its Hydraulic & Electric circuit diagram

17. Construct a circuit to control a double acting Hydraulic cylinder, by using 02, push button, and canceling with limit switch/Proximity switch also draw its Hydraulic & Electric circuit diagram

18. Practice to set a Hydraulic motor R.P.M. & direction by using Flow Control & directional Valve

19. To construct a Hydraulic circuit in which Accumulator stored energy can be utilized by double acting cylinder, when required

Mech-312 HYDRAULICS AND HYDRAULIC MACHINES

Practical Objectives

Student will be able to performed explain;

1. **Observe hydraulic bench and its function**

1.1   Observe pressure head
1.2   Specific gravity of liquid
1.3   Observe the conversion of intensity pressure in to head of liquid and head of liquid in to intensity
1.4   Practice to use simple manometer

2. **Practice of Calibration of Bourdon tube and diaphragm pressure gauge with dead weight   and master gauge calibrator**

2.1   Basic principle use in dead weight pressure calibrator
2.2   Observe the construction of Bourdons tube pressure gauge
2.3   Observe the construction of diaphragm pressure gauge
2.4   Calibration of Bourdon tube pressure gauge and diaphragm pressure gauge with dead weight pressure calibrator

3. **Operate hydraulic press and observe power required to derive it**

3.1   Work done against a pressure
3.2   Power required for driving a hydraulics press

4. **Practical application of Hydraulic bench for Conservation of energy of flowing fluid in pressure head an datum head as H=v²/2g**

4.1   Verify the Law of conservation of energy
4.2   Verify   total head of liquid
4.3   Bernoulli's theorem and practical application
4.4   Calculate conversion of velocity head, pressure head and datum head

5. **Performance test on friction pipe apparatus to know total head status of flowing fluid/ Bernoulli's theorem**

5.1   Observe the function of viscosity of liquid, & K.E. of flowing fluid.
5.2   Observe the friction due to roughness of ideal surface as in gauge blocks etc.
5.3   Observe friction due to roughness of pipe
5.4   Measure loss of head in pipes due to friction in pipe apparatus
5.5   Practice of calculation of loss of head due to friction by using friction in pipe apparatus

6. **Observe behavior of flowing fluid due to sudden enlargement of cross sectional area of pipe, & formation eddies current at enlarged cross section of pipe**

6.1   Observe behavior of liquid at sudden contracted cross sectional area in pipe
6.2   Observe formation of vena contracta beyond contraction (due to sudden enlargement)
6.3   Measure loss of head due to sudden enlargement, contraction and entrance in a pipe using friction in a pipe apparatus

7. **Perform the function of impulse turbine**

7.1   Observe behavior of water jet at the reduction in cross sectional area at the movement of spear in the nozzle of impulse turbine (pelton wheel)
7.2   Observe function of casing of pelton wheel
7.3   Observe pressure / atmospheric pressure around the water jet and water wheel/ impulse Turbine/ pelton wheel
7.4   Observe water hammer at the start and stop of pelton wheel turbine on pipe and hear noise of water hammer on pipe
7.5   Observe output HP at the shaft at pelton wheel turbine using purely brake mechanism
7.6   Observe the parts of a pelton wheel turbine

8. **Performance test on reaction turbine**

8.1   Operate the reaction turbine
8.2   Measure difference of pressure at different position of reaction turbine by pizometer tube or with Gauges/ dial gauges

8.3   Measure in put power at the inlet of Francis turbine
8.4   Observe the reaction turbine (Francis turbine)

9. Performance Test on centrifugal force
9.1   Observe the different parts of centrifugal pump
9.2   Observe the different parts of reciprocating pump
9.3   Compare centrifugal pump with reciprocating pump

10. Performance test on positive displacement pump
10.1   Measure discharge of reciprocating pump
10.2   Verify discharge of reciprocating pump
10.3   Measure slip of reciprocating pump
10.4   Observe the parts of reciprocating pump

11. Practice of measurement of pressure at various connections in hydraulic circuit
11.1   Perform the function of temperature gauge at oil reservoir/oil tank in a circuit
11.2   Perform the function of oil filter in hydraulic Circuit
11.3   Observe all safety devices which necessary in a hydraulic circuit
11.4   Observe the necessity of pressure relief valve in hydraulic circuit
11.5   Measure pressure at various positions in hydraulic circuit
11.6   Draw block/ circuit diagram of a Hydraulic circuit
11.7   Uses and positions of directional control valve in a Hydraulic circuit
11.8   Use, position & necessity of non-return valve in a Hydraulic circuit
11.9   Set the equipment into the test panel
11.10   Check all the connections houses are firmly coupled
11.11   Practice of determination of pressure at various connections to the driven elements and direction of flow depending different settings of directional control valve

12. Actuation of double acting hydraulic cylinder at push of a switch, develop speed regulation through throttle valve and flow control valves
12.1   Measure pressure at various positions in hydraulic circuit
12.2   Draw block/ circuit diagram of a Hydraulic circuit
12.3   Uses and positions of directional control valve in a Hydraulic circuit
12.4   Use, position & necessity of non-return valve in a Hydraulic circuit
12.5   Set the equipment into the test panel
12.6   Check all the connections houses are firmly coupled
12.7   Practice of determination of pressure at various connections to the driven elements and direction of flow depending different settings of directional control valve

13. Actuation of double acting hydraulic cylinder at a rapid Traverse by using one way Throttle Valve
13.1   Make sure the pump is switched off and oil is not in pressure at the coupling/ fitting stage
13.2   Set the equipment into the test penal
13.3   Connect the units according to the circuit diagram with connection Hoses
13.4   Check all the connection Hoses firmly coupled
13.5   Carry out the experiment as rapidly as possible to keep the overheating of oil during practical (not more than 45°C)
13.6   Observe the function of Throttle Valve and draw Circuit Diagram
13.7   Observe the function by extending a double acting hydraulic cylinder at push of a switch develop speed regulation through throttle and flow valves

14. Setup a pressure device on a double acting cylinder by using pressure reducing valve
14.1   Observe the function of Pilot operated Check Valve
14.2   Observe the sequence of Elements used in circuit

14.3   Observe the Function of Pressure Relief valve, know function of Non Return Valve in this Circuit Diagram

14.4   Mount the various units in the test panel according to the layout/circuit diagram

14.5   Connect the circuit with Pressure Houses

14.6   Connect the cylinder and measure Inlet and Outlet Pressure on Pump

14.7   Set the throttle check valve

14.8   Draw Hydraulic circuit diagram for this Practical

14.9   Check rapid Traverse of cylinder at return of stroke and complete this practical

15.   Practice to hold a specific load by using double acting cylinder and pilot operated check valve

15.1   Mount various components in the test panel

15.2   Check/set sequence of components 3/2 and 4/2 directional control valve, pressure relief valve and pilot operated chuck valve

15.3   Draw circuit diagram for the circuit l conduct the experiment according to the circuit diagram

15   Construct a circuit for double acting cylinder for mechanical interlocking with switch contacts also draw its circuit diagram

16.1   Arrange the components/valve in the test panel as per circuit diagram

16.2   Observe what is Mechanical interlocking with switch contacts

16.3   Draw circuit diagram for the circuit & conduct the experiment according to the circuit diagram Complete the experiment

16   Construct a circuit to control a double acting hydraulic cylinder , by using 02 , push button, and canceling with proximity limit switch

17.1   Observe the types of limit switches/proximity switches (conductive, capacitive & optical) used in a hydroelectric circuit

17.2   Observe what is the function of two hand safety circuit?

17.3   Draw a Hydraulic circuit diagram to connecting a double acting Hydraulic cylinder using push button, direction hold in circuit and connecting with limit switch using two hand electrical pushbutton safety circuit

17.4   Draw circuit diagram for the circuit & conduct the experiment according to the circuit diagram Complete the experiment

17   Practice to set a hydraulic motor R.P.M & direction by using Flow Control & Directional valve

18.1   Practice the use of a direction control valve changes the direction of rotation of a hydraulic motor

18.2   Observe that how we can change the velocity of hydraulic motor by using throttle valve

18.3   Draw circuit diagram for the circuit & conduct the experiment according to the circuit diagram Complete the experiment

18   To construct a hydraulic circuit in which Accumulator stored energy can be utilized by double acting cylinder , when required

19.1   Observe the types of accumulators

19.2   How much we can store energy in an accumulator

19.3   Draw circuit diagram for the circuit & conduct the experiment according to the circuit diagram Complete the experiment

Mech-312   HYDRAULICS AND HYDRAULIC MACHINES

List of Machinery:

Fluid friction in pipes with hydraulic bench	2-set
Bernoulli's Theorem Demonstration Apparatus	2
Orifice Discharge Apparatus	2
Apparatus of Energy Losses in Pipes	2
Centrifugal Pump Apparatus	1
Axial Pump Apparatus	1
Reciprocating Pump Apparatus	1
Pelton Turbine	1
Reaction Turbine	1
Hydraulic Control Equipment Set	1
Gear Pump (Transparent Model)	1
Vane Pump (Transparent Model)	1
Axial Piston Pump (Transparent Model)	1
Pressure Gauge (Transparent Model)	1
Pressure Relief Valve (Transparent Model)	1
Pressure Switch (Transparent Model)	1
Piston Accumulator (Transparent Model)	1
Dead Weight Master Gauge Calibrator	1

Mech-323
APPLIED THERMODYNAMICS

Mech-323 APPLIED THERMODYNAMICS

Total Contact Hours   **T**   **P**   **C**

    Theory   **64**   **2**   **3**   **3**

    Practical   **96**

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

Course Contents:

Fundamentals of Thermodynamics	**08 Hrs**
Laws and properties of perfect gases	**06 Hrs**
Thermodynamic processes and cycles	**10 Hrs**
Formation and properties of Steam	**4 Hrs**
Steam Boilers and their performance	**8 Hrs**
Steam and Gas turbines	**8 Hrs**
Internal Combustion Engines	**8 Hrs**
Air Compressors and their performance	**6 Hrs**
Refrigeration and Air Conditioning	**6 Hrs**

                                                      Total 64 Hrs

Details of Contents:

Fundamentals of Thermodynamics   **8 Hrs**

1.1   Introduction to thermodynamics

1.2   Units, Systems of units, Thermodynamic systems, its classification and properties

1.3   Heat, Mass and weight, Force, Work and power

1.4   Temperature, Absolute Temperature and Temperature Scales, Normal / Standard Temperature and Pressure

1.5   Pressure, Absolute pressure, Gauge pressure and Vacuum pressure

1.6   Energy, Potential energy, Kinetic energy and Internal energy of gas

1.7   Laws of thermodynamics, Laws of conservation of energy and matter, limitations of 1'st law of thermodynamics

1.8   Solution of problems by direct application of formulae for above topics

1.9   Mode of heat transfer

Laws and properties of perfect gases   **6 Hrs**

2.1   Introduction

2.2   Boyle's law, Charles law, Gay-Lussac's law, Joule's law, Avogadro's law, Regnault's law and Dalton's law

2.3   General gas equation, Characteristic Gas equation, Universal Gas equation
2.4   Specific heats of a gas, Molar specific heats of a gas and its mathematical relations
2.5   Enthalpy, and Entropy of a gas, importance of Entropy and relation between Heat & Entropy
2.6   Solution of problems by direct application of formulae for above topics

Thermodynamic processes and cycles   10 Hrs
3.1   Introduction of thermodynamic process
3.2   Classification/types of thermodynamic processes
3.3   Application of 1st law of thermodynamics for work done during a non flow-reversible process
3.4   Heating and Expansion of gases in Non flow-Reversible & Irreversible processes
3.5   Solution of problems by direct-application of formulae
3.6   Introduction and classification/types of thermodynamic cycles
3.7   Assumptions in thermodynamic cycles
3.8   Reversible and Irreversible cycles
3.9   Working of an ideal engine
3.10 CARNOT's Cycle, OTTO Cycle, DIESEL Cycle and Dual Combustion Cycle
3.11 Solution of problems for air standard efficiency of thermodynamics cycles

Formation and properties of Steam   4 Hrs
4.1   Introduction of steam, its formation, properties and classification
4.2   Important terms used for steam
4.3   Temperature-Enthalpy and Temperature- Entropy diagrams for steam formation
4.4   Use of steam tables
4.5   Calculation of total heat of Wet ,dry and super-heated steam (Solution of Problems)

Steam Boilers and Their performance   8 Hrs
5.1   Introduction of boiler
5.2   Classification of boilers
5.3   Selection of a steam boiler
5.4   Important terms used for steam boilers
5.5   Constructions and Working of:
    5.5.1 Simple vertical boiler (Single tube boiler)
    5.5.2 COCHRAN boiler (Multi tubular boiler)
    5.5.3 Locomotive Boiler
    5.5.4 Marine boiler (scotch type)
    5.5.5 Babcock and Wilcox Boiler
5.6   Boiler mountings and accessories
5.7   Comparison between Water Tube and Fire Tube boilers
5.8   Performance of steam boilers, Equivalent evaporation and boiler efficiency
5.9   Solution of problems regarding equivalent evaporation, power/H.P and efficiency of boiler

Steam and Gas Turbines   8 Hrs
6.1   Introduction and classification of turbines
6.2   Steam Turbine (Impulse type)
    6.2.1 Introduction

        6.2.2 De-**Laval** impulse turbine

        6.2.3 Advantages **of steam turbine**

6.3   Steam turbine (Reaction type)

        6.3.1 Introduction.

        6.3.2 PARSON's Reaction turbine.

        6.3.3 Comparison between Impulse & Reaction Turbines

6.4   Gas Turbines

        6.4.1 Introduction

        6.4.2 Classification

        6.4.3 Cycles of Gas turbines

        6.4.4 Uses of Gas turbines

        6.4.5 Comparison of closed cycle and open cycle turbines

        6.4.6 Comparison of Gas turbine & Steam turbine

Internal Combustion Engines   **8Hrs**

7.1   Introduction of Internal & External Combustion Engines

7.2   Classification of I.C. Engines

7.3   Cycle of operations & important terms used

7.4   Comparison of Two Strokes Cycle and Four Strokes Cycle Engines

7.5   Petrol Engine

        7.5.1 Construction and working with the help of P-V , T-S diagrams & neat sketch

        7.5.2 Valve Timing Diagrams for two strokes and four strokes cycle petrol engine

7.6   Diesel Engine

        7.6.1 Construction and working with its P-V, T-S diagrams and neat sketch

        7.6.2 Valve Timing Diagrams for two strokes cycle and four strokes cycle Diesel

              engine

7.7   Indicated power, Brake power, Friction power and efficiencies of I.C. Engines

7.8   Comparison of I.C. engine and E.C. engine

7.9   Comparison of Petrol and Diesel engines

7.10 Solution of Problems regarding I.P, B.P, Friction Power and efficiencies of I.C. engines

Air Compressors and their performance (Reciprocating & Rotary)   **6 Hrs**

8.1   Introduction

8.2   Classification of air compressors(Reciprocating & Rotary)

8.3   Technical terms used

8.4   Construction and working of single stage reciprocating Air Compressor with help of PV-diagram and neat sketch

        8.4.1 Work done per cycle by a single stage reciprocating air compressor without and with clearance volume.

8.5   Multistage compression and its advantages

8.6   Two stage reciprocating air compressor with intercooler, work done per cycle with polytrophic law of compression

8.7   Power required to drive a single stage and two stage reciprocating air compressors

8.8   Comparison of reciprocating and rotary air compressors

8.9   Work done per cycle and power required to drive a rotary compressor

8.10 Solution of Problems regarding work done power required for single stage & multistage rotary air compressors

Refrigeration and Air Conditioning **6Hrs**

9.1   Introduction

9.2   Classification of refrigeration systems / cycles

9.3   Units, terms used

9.4   Refrigerants and its properties

9.5   Introduction to vapor compression, vapour absorption in refrigeration system

9.6   Fundamentals of air conditioning system

9.7   Classification of air conditioning systems

Recommended Textbooks:

1. **Principle of Refrigeration by Royj. Dossat**
2. **Air conditioning principles and system an energy approach by Edward. G. Pita**
3. **Applied Thermodynamics T.D Eastop, A. Mcconkey**
4. **Thermodynamics by Rayner Joel**
5. **Thermodynamics Applied to Heat Engines by E.H.LEWITT (Published by; Sir ISAAC Pitman & Sons Ltd London)**
6. **Heat Engines by D.A Low (McGraw Hill Book Company , New York)**

Mech-323   APPLIED THERMODYNAMICS

Instructional Objectives:

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

1. **Know the Fundamentals of Thermodynamics**
    1.1   State the following:
        1.1.1 Fundamentals of thermodynamics
        1.1.2 Units and Systems of units
    1.2   Describe the Thermodynamic systems, its classification and properties
    1.3   State the following:
        1.3.1 Heat
        1.3.2 Mass and weight
        1.3.3 Force
        1.3.4 Work and power
    1.4   Describe the following:
        1.4.1 Temperature, Absolute Temperature and Temperature Scales
        1.4.2 Normal Temperature and Pressure
        1.4.3 Standard Temperature and Pressure
    1.5   Describe the following:
        1.5.1 Pressure and Absolute pressure.
        1.5.2 Gauge pressure and Vacuum pressure
    1.6   State the following:
        1.6.1 Energy, Potential energy and Kinetic energy
        1.6.2 Internal energy of a gas
    1.7   Describe the following:
        1.7.1 Laws of thermodynamics
        1.7.2 Laws of conservation of energy and matter
        1.7.3 Limitations of 1st law of thermodynamics
    1.8   Describe mode of heat transfer

        1.8.1 Describe Conduction
        1.8.2 Describe Convection
        1.8.3 Describe Radiation

    1.9   Solve the problems by direct application of formulae for the above topics

2. **Understand the laws and properties of perfect gases**
    2.1   State the perfect gas and its properties
    2.2   Describe the following; also derive its mathematical relations:
        2.2.1 Boyle's law
        2.2.2 Charles's law
        2.2.3 Gay-Lussac's law
        2.2.4 Joule's law
        2.2.5 Avogadro's law
        2.2.6 Regnault's law
        2.2.7 Dalton's law
    2.3   Describe the following; also derive its mathematical relations:
        2.3.1 General gas equation
        2.3.2 Characteristic Gas equation
        2.3.3 Universal Gas equation
    2.4   Describe the following:

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

2.4.2 The molar specific heats of a gas and derive its mathematical relations

2.5 State the following:

2.5.1 Enthalpy of a Gas

2.5.2 Entropy of a gas

2.5.3 Importance of Entropy

2.5.4 Relation between Heat & Entropy

2.6 Solve the problems by direct application of formulae for the above topics

3. Understand the Thermodynamics Processes and Cycles

3.1 State the thermodynamic process

3.2 State Classification /Types of thermodynamic processes

3.3 State the application of 1st law of thermodynamics for work done during a non flow-reversible process

3.4 Describe the following

3.4.1 The Non flow-Reversible & Irreversible processes with the help of P-V & T-S diagrams

3.4.2 The constant pressure process with the help of P-V & T-S diagrams: also derive its mathematical relations for work done during expansion

3.4.3 The constant volume process with the help of P-V & T-S diagrams: also derive its mathematical relations for work done during expansion

3.4.4 The constant temperature process with the help of P-V & T-S diagrams: also derive its mathematical relations for work done during expansion

3.4.5 The adiabatic process with the help of P-V & T-S diagrams: also derive its mathematical relations for work done during expansion

3.4.6 The polytrophic process with the help of P-V & T-S diagrams: also derive its mathematical relations for work done during expansion

3.5 Solve the problems by direct application of formulae for the above topics

3.6 Describe the following:

3.6.1 Thermodynamic cycle with the help of P-V diagram

3.6.2 Classification / Types of thermodynamic cycles

3.7 Describe the assumptions in thermodynamic cycles

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

3.9 Explain the construction and working of an ideal engine with the help of neat sketch

3.10 Explain the following

3.10.1 CARNOT'S CYCLE with the help of P-V & T-S diagrams; also derive its mathematical relations for Air Standard Efficiency during the cycle of operation

3.10.2 OTTO CYCLE with the help of P-V & T-S diagrams; also derive its mathematical relations for Air Standard Efficiency during the cycle of operation

3.10.3 DIESEL CYCLE with the help of P-V & T-S diagrams; also derive its mathematical relations for Air Standard Efficiency during the cycle of operation

3.10.4 DUAL COMBUSTION CYCLE with the help of P-V & T-S

diagrams; also derive its mathematical relations for Air Standard Efficiency during the cycle of operation

3.11 Solve the problems by direct application of formulae for the above topics

4. Understand the Formation and properties of Steam

4.1 Describe the steam formation, its properties and classification

4.2 State the important terms used for steam

4.3 Describe the Temperature-Enthalpy and Temperature- Entropy diagrams for steam formation

4.4 Describe the use of steam tables with help of examples

4.5 Describe the following:

   4.5.1 Derive the formulae for the calculation of total heat of wet, Dry, and super heated steam

   4.5.2 Solve the problems by direct application of formulae for the above topics

5. Understand the Steam Boilers & its performance

5.1 Describe the working and general construction of a boiler

5.2 Describe the classification of boilers

5.3 State the selection factors of a good steam boiler

5.4 Describe the important terms used for steam boilers

5.5 Explain the Following:

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

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

   5.5.3 The construction and working of MARINE Boiler (Scotch type) with the help of neat sketch

   5.5.4 The construction and working of Locomotive Boiler with the help of neat sketch

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

5.6 State the List of boiler mountings & accessories

5.7 Make a Comparison between Water tube and Fire tube boilers

5.8 Describe the following with the help of mathematical expressions

   5.8.1 Performance of boiler

   5.8.2 Equivalent evaporation of boiler

   5.8.3 Efficiency of boiler

5.9 Describe the Following :

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

   5.9.2 Solve the problems by direct application of formulae for above topics

6. Understand the Steam and Gas Turbines

6.1 State the introduction and classification of turbines

6.2 Explain the following:

   6.2.1 The construction and working of De-Level Impulse turbine with the help of neat sketch

   6.2.2   State the advantages of steam turbine over reciprocating steam engine

6.3 Explain the following:

   6.3.1   The Construction and working of PARSON'S Reaction turbine with the helping neat sketch

   6.3.2   Make a comparison between Impulse and Reaction turbine

6.4 Describe the following
      6.4.1 The introduction of Gas Turbines
      6.4.2 The classification/types of Gas turbines
      6.4.3 The cycles of Gas turbine with help of diagram
      6.4.4 State the uses of gas turbines
      6.4.5 Make a Comparison of closed cycle and open cycle turbines
      6.4.6 Make a Comparison of Gas turbine and steam turbine

7. Understand the Internal Combustion Engines

7.1 State the introduction of I.C and E.C Engines(Internal and External combustion engines)

7.2 Describe the classification of I.C Engines

7.3 Describe the cycle of operations with the help of P-V diagram and important terms used for I.C Engines

7.4 Make a comparison of two strokes cycle and four strokes cycle engines

7.5 Explain the following:
      7.5.1 The Construction and working of PETROL Engine with the help of PV-diagram & neat sketch
      7.5.2 The valve timing diagrams for two strokes and four strokes cycle PETROL Engine

7.6 Explain the following:
      7.6.1 The Construction and working of DIESEL Engine with the help of PV-diagram & neat sketch
      7.6.2 The valve timing diagrams for two strokes and four strokes cycle DIESEL Engine

7.7 Describe the following also derive its mathematical formulae:
      7.7.1 Indicated power
      7.7.2 Brake power
      7.7.3 Friction power
      7.7.4 Efficiencies of I.C. engines

7.8 Make a Comparison of I.C. and E.C. engines

7.9 Make a Comparison of PETROL and DIESEL engines

7.10 Solve problems for calculation of I.P, B.P, Friction Power and efficiencies of I.C. engines

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

8.1 State the introduction of Air Compressors

8.2 Describe the classification / types of Air Compressors(Reciprocating & Rotary)

8.3 State the terms used for Air Compressors

8.4 Explain the following:
      8.4.1 The Construction and working single cylinder- single stage double acting reciprocating air compressor with the help of P-V diagram and neat sketch
      8.4.2 The work has done single stage. Single cylinder reciprocating air compressor without and with clearance volume; also drive its Mathematical Expression.

8.5 Describe the Multistage compression with the help of P-V diagram and its advantages

8.6 Describe the two stage reciprocating air compressor with intercooler; also derive its mathematical Expression for the work done per cycle considering

polytrophic law of compression

8.7   Describe the power required to drive a single stage and two stages reciprocating Air compressors; also derive its formulae

8.8   Make a comparison of reciprocating and rotary air compressors

8.9   Describe the work done and power required to drive a rotary air compressor; also derive its formulae

8.10 Solution of the problems regarding work done and power required to drive the rotary and reciprocating air compressors

9.   Understand the Refrigeration and Air Conditioning

9.1   State the concept of Refrigeration and Air conditioning

9.2   Describe the Classification/types of Refrigeration systems

9.3   State the Units and terms used for Refrigeration and Air Conditioning

9.4   State the names and Properties of refrigerants

9.5   Describe the simple mechanism of a vapor compression **vapour absorption** in refrigeration system with the help of neat schematic diagram

9.6   State the fundamentals of Air Conditioning Systems

9.7   Describe the Classification/types Air Conditioning Systems

Mech-323 APPLIED THERMODYNAMICS

List of Practical:

1. Pressure measurement by Barometer

2. Introduction of Thermometers and Thermocouples

3. Sketch and study of Steam Boilers
   3.1 Simple vertical boiler
   3.2 Cochran (Multi tubular) boiler
   3.3 Marine boiler(Scotch type)
   3.4 Locomotive boiler

4. Sketch and study of Boiler Mountings and Accessories
   4.1 Pressure gauge (Bourdon type)
   4.2 Water level indicator
   4.3 Safety valve (Spring loaded)
   4.4 Feed water pump

5. Problem solving on steam generation

6. Practice on Petrol Engine

7. Practice on Diesel Engine

8. Practice on Ignition systems for I.C. Engines

9. Study and problem solution on Steam Turbine

10. Study of Gas Turbine

11. Performance Test of Reciprocating Air Compressor

12. Performance Test of Heating and Cooling system (Compression type A/C system)

13. Performance Test of Refrigeration system (Compression type)

Mech-323 APPLIED THERMODYNAMICS

Practical Objectives: 96 Hrs

AIMS: To transfer practical knowledge of pressure, temperature measuring instruments, boilers, I.C. engines, Turbines and air compressors etc. The students will be able

1. **Pressure measurement by Barometer**
   1.1 Construction and working of BAROMETER
   1.2 Calculation of pressure measurement

2. **Know Thermometers and Thermocouples**
   2.1 Operate to learn the construction and working of Thermometers &Thermocouples
   2.2 Application the method of calibration

3. **Sketch and study of the following boilers**
   3.1 **Study** the construction, working and safety precautions of:
       3.1.1 Simple Vertical Boiler
       3.1.2 Cochran (Multi tubular) Boiler
       3.1.3 Marine Boiler (Scotch types)
       3.1.4 Locomotive Boiler
       3.1.5 Babcock and Wilcox Boiler

4. **Sketch and study of the following Boiler Mountings and Accessories**
   4.1 Study the construction, working and safety precautions of:
       4.1.1 Pressure Gauge (Bourdon type)
       4.1.2 Water level Indicator
       4.1.3 Safety Valve (Spring loaded)
       4.1.4 Feed Water Pump

5. **Problem solving on Steam Boiler**
   5.1 **Study** the procedural steps for operations of a boiler
   5.2 **Study** the performance of a boiler & safety precautions

6. **Practice on Petrol Engine**
   6.1 Operate to learn the construction, working and safety precautions
   6.2 Operate to learn the valves timing diagrams for 2- Stroke & 4 – Stroke cycle petrol engines

7. **Practice on Diesel Engine**
   7.1 Operate to learn the construction, working and safety precautions
   7.2 Operation of the valves timing diagrams for 2- Stroke & 4 – Stroke cycle diesel engines

8. **Practice on Ignition system for I.C. Engines**
   8.1 Operate to learn the ignition system for petrol engine
   8.2 Operate to learn the ignition system for diesel engine

9. **Study and problem solution Turbine**
   9.1 **Study** the construction, working and safety precautions of steam turbines
   9.2 **Study** the performance of steam turbines

10. **Performance test of Gas Turbine**
    10.1 Operate to learn the construction, working and safety precautions of Gas turbines
    10.2 Practical performance of Gas turbines

11. Practical test of Reciprocating Air Compressor
   11.1   Operate to learn the construction, working and safety precautions of Reciprocating Air Compressor
   11.2   Practical performance of Reciprocating Air Compressor

12. Performance Test of Heating and Cooling system (Compression type A/C system)
   12.1   Operate to learn the general components of system
   12.2   Operate to learn the operational procedure of system and safety measures

13 Performance Test of Refrigeration system (Compression type)
   13.1   Operate to learn the general components of system
   13.2   Operate to learn the operational procedure of system and safety measures

Mech-323   APPLIED THERMODYNAMICS

List of Machinery:

1.	Barometer	5-Set
2.	Dead Weight Gauge Tester with Pressure gauge	1
3.	Thermometers of Celsius, Fahrenheit, Kelvin and Rankin	5
4.	Thermocouples(Different Ranges)	2
5.	Sectioned model of Simple Vertical Boiler	2
6.	Sectioned model of COCHRAN (Multi tubular boiler)	2
7.	Sectioned model of Marine Boiler (Scotch types).	2
8.	Sectioned model of Locomotive Boiler	2
9.	Working model of safety valve (spring loaded)	5
10.	"C" class working boiler water tube/fire tube package type with all mounting and accessories	1
11.	Working model of steam Turbine (Impulse and Reaction type)	1+1
12.	Working model of gas turbine(Impulse and Reaction type)	1+1
13.	Reciprocating air compressor	1
14.	Rotary air compressor	1
15.	Ignition point Testing Machine	1
16.	Air Compressor Testing Machine	1
17.	Gas Turbine Testing Machine	1
18.	AC System Trainer (Heating and Cooling)	1
19.	Refrigeration Trainer	1
20.	Working models of Petrol Engine	1
21.	Working models of Diesel Engine	1

Mech-331

INDUSTRIAL PLANNING AND PRODUCTION

Mech-331   **INDUSTRIAL PLANNING AND PRODUCTION**

Total contact Hrs:		**T**	**P**	**C**
Theory	32	**1**	**0**	**1**

AIMS: At the end of this course, the student will be able to:

i)   Understand the fundamental functions of industrial concerns.

ii)   Understand the methods(which methods, specify) generally employed in various manufacturing organizations

Course Contents:

Industrial planning	**3 Hrs**
Site selection for industry	**2 Hrs**
Plant lay out	**4 Hrs**
Production method	**3 Hrs**
Job analysis	**6 Hrs**
Production planning and control	**4 Hrs**
Quality assurance	**2 Hrs**
Maintenance activities	**4 Hrs**
Cost determination and control	**2 Hrs**
Store operation in industry	**2 Hrs**

Detail of Contents:

Industrial Planning   **3 Hrs**
- 1.1   Need of industrial planning
- 1.2   Phases of industrial planning

Site selection for Industry   **2 Hrs**
- 1.3   Economical and technical factors considered while selecting factory site

Plant layout4 Hrs
- 1.4   Definition
- 1.5   Objectives
- 1.6   Types
- 1.7   Criteria for a good lay out
- 1.8   Advantages of a good lay out

1.9   Preparing a lay out

Production Methods   3Hrs
    1.10   Introduction to production
    1.11   Important types of production

Job Analysis   6Hrs
    1.12   Motion study
    1.13   Time study

Production planning and control   4Hrs
    1.14   Production planning
    1.15   Production control

Quality assurance   2Hrs
    1.16   Inspection
    1.17   Quality control

Maintenance activities   4Hrs
    1.18   Responsibilities of maintenance department
    1.19   Types of maintenance
    1.20   Comparison of different types of maintenance
    1.21   Replacement studies

Cost determination and control   2Hrs
    1.22   Cost calculation of industrial product.
    1.23   Cost control

Store operation in industry   2Hrs
    1.24   Receipt of store items
    1.25   Records of store
    1.26   Issue of store items

Recommended Textbooks:

1. Motion and time study by RALPH M. BARNES (Publisher: Wiley, 1980)
2. Industrial Engineering and Management System by Dr. Mansor Ali (Publisher: Urban Resource Center,2001)
3. Factory and Production Management by Lockyer(Publisher: Pitman, 1974)
4. Industrial Management by Prof. M.H. Zubairi

Mech-331   <u>INDUSTRIAL PLANNING AND PRODUCTION</u>

Instructional Objectives:

1. **Industrial planning**
   1.1   Explain the need of industrial planning
      - 1.1.1   Define industrial planning
      - 1.1.2   Explain need and importance of industrial planning
   1.2   Explain different phases of industrial planning
      - 1.2.1   Explain financial planning
      - 1.2.2   Explain product planning and selection of material
      - 1.2.3   Explain selection of process and equipment

2. **Know the Economical and technical factors considered during site selection Procedure**
   2.1   Explain economical and technical factors in site selection
      - 2.1.1   Define site (location of industry)
      - 2.1.2   Describe factors for site selection
      - 2.1.3   Economical factors (cost of site, rebate in taxes, special grants)
      - 2.1.4   Technical factor(availability of labor, raw material, market of Product, services , transportation etc.)

3. **Understand plant lay out**
   3.1   Define plant lay out and its importance
   3.2   Describe the objectives of lay out
   3.3   Describe the types of lay out (product/process) with its advantages and limitations
   3.4   Explain criteria for a good lay out
   3.5   Describe advantages of a good lay out
   3.6   Explain different factors / procedures followed in preparing layout
      - 3.6.1   Explain factors considered while preparing a lay out (man. Material, machine, Movement etc.)
      - 3.6.2   Describe procedure and various steps followed in developing a lay out

4. **Production Methods**
   4.1   Define Production.
   4.2   Explain different types of production
      - 4.2.1   Explain Mass Production, Job order Production, Batch Production
      - 4.2.2   Explain flow Production
      - 4.2.3   Describe requirements of flow production

5. **Job Analysis**
   5.1   Explain motion study
      - 5.1.1   Define motion study
      - 5.1.2   Explain techniques developed by the gilbreth, like therbligs, process charts etc.
      - 5.1.3   Describe micro motion study
   5.2   Explain time study
      - 5.2.1   Define time study

      5.2.2   Describe uses of time study
      5.2.3   Describe instruments used in motion and time study
      5.2.4   Describe time study procedure
      5.2.5   Explain observation sheet (Time study tool)

6. Production Planning and Control (PPC)

6.1   Define PPC
6.2   Describe the objectives of PPC
6.3   Explain functions of production control
6.4   Explain routing, scheduling and loading
6.5   Explain Packaging and Dispatching

7. Quality Assurance

7.1   Explain inspection and its types
7.2   Explain quality control and assurance
      7.2.1   Explain quality control and assurance at various levels
      7.2.2   Describe quality standards

8. Maintenance Activities

8.1   Explain duties of maintenance department.
8.2   Explain types of maintenance
      8.2.1   Explain Preventive maintenance and Break-down maintenance
      8.2.2   Describe maintenance schedules
8.3   Explain replacement studies
      8.3.1   Explain replacement of parts in machines and equipment
      8.3.2   Explain replacement policy

9. Cost Determination and Control

9.1   Explain cost calculation of industrial products
      9.1.1   Explain procedure of cost calculation
      9.1.2   Describe elements of cost
      9.1.3   Explain factory overhead
9.2   Describe cost control

10. Store Operation

10.1   Explain procedure adopted by the store on receipt of store items
10.2   Describe forms used in store operation
10.3   Explain the procedure of issuance of store items

Mech-343
MACHINE DESIGN

Mech-343 MACHINE DESIGN

Total Contact Hours: **T**   **P**   **C**
Theory: 64 Hrs   **2**   **3**   **3**

        Practical: Machine design **96 Hrs**

AIMS: At the end of the course the students will be able to:
- i)   Calculate and analyze stresses induced in different machine parts
- ii)   Design Simple machine parts, welded joints, Screwed joints, pressure vessels, shafts and Couplings, Keys, Belt Drives, helical springs, Bearings and CAMS & Followers.

Course Contents:

Simple Stresses in Machine Parts **8Hrs**

Pressure Vessels	**6Hrs**
Welded Joints	**6Hrs**
Screwed Joints	**6Hrs**
Design of Keys	**5Hrs**
Shafts and Couplings	**8Hrs**
Belt Drives	**6 Hrs**
Springs	**6Hrs**
Bearings	**6 Hrs**
Cam and Followers	**7 Hrs**

Details of Contents:

Simple Stresses in Machine Parts **8Hrs**
- 1.1   Load and its types
- 1.2   Stress and strain
- 1.3   Tensile stress and strain
- 1.4   Compressive stress and strain
- 1.5   Shear stress and strain
- 1.6   Young's Modulus of elasticity
- 1.7   Modulus of rigidity or Shear Modulus
- 1.8   Stress strain diagram
- 1.9   Working stress
- 1.10   Factor of safety
- 1.11   Selection of Factor of Safety
- 1.12   Poisson's Ratio
- 1.13   Temperature stress

1.14   Volumetric strain and bulk modulus
1.15   Resilience and Toughness
1.16   Solution of problems of the above topics by direct application of formulae

2. Pressure Vessels   6Hrs
2.1   Introduction
2.2   Classification of pressure vessels
    2.2.1   According to dimensions.
    2.2.2   According to end – construction
2.3   Stresses in a thin cylindrical shell due to internal pressure
    2.3.1   Hoop stress
    2.3.2   Longitudinal stress
2.4   Calculation of thickness of cylinder by direct application of formula, while all parameters are provided (e.g.), Pressure. Internal Dia, hoop or longitudinal stress and efficiency of joint are given)
2.5   Calculation of hoop or longitudinal stress by direct application of formula, while P. d, t and efficiency of joint are given
2.6   Thin spherical shell subjected to internal pressure
2.7   Calculation of thickness of spherical shell when all other parameters are provided by direct application of formula
2.8   Thick cylindrical shell subjected to internal pressure
2.9   Calculation of thickness of thick vessel made of brittle material by LAME,S equation, while all other parameters are given

3. Welded Joints   6Hrs
3.1   Types of various welding joints
3.2   Strength of transverse and parallel fillet welded joint under static and fatigue loading
3.3   Calculation of length of weld under static loading, when load, plate thickness & width, tensile & shears stress are given

4. Screwed Joints   6Hrs
4.1   Introduction
4.2   Advantages and disadvantages
4.3   Thread terminology
4.4   Stress in screwed fastening due to external forces under static loading
4.5   Initial stress due to screwing up forces
4.6   Solution of simple problem by direct formula application

5. Design of Keys   5 Hrs
5.1   Introduction
5.2   Types of keys
5.3   Forces acting on a sunk key
5.4   Strength of a sunk key
5.5   Calculate length of sunk key by direct application of formula, while all parameters are directly provided

6. Shafts and Couplings   8Hrs
6.1   Introduction to shaft
6.2   Materials used for shaft and its properties
6.3   Types of shafts
6.4   Standard sizes

6.5   Stresses in shafts
6.6   Shafts subjected to twisting moment
        6.6.1   Solid shaft
        6.6.2   Hallow shaft
6.7   Calculate diameter of solid and hollow shafts by direct application of formula
6.8   Shafts subjected to bending moment
        6.8.1   Solid shaft
        6.8.2   Hollow shaft
6.9   Calculate diameter of solid and hollow shaft (bending only) by direct application of formula
6.10   Calculation of dia. of shaft subjected to bending and twisting moments
6.11   Introduction of shaft coupling
6.12   Types of couplings
6.13   Design of flange coupling
6.14   Solve problems on calculation of sizes of different components in flange coupling by direct application of formula

7. Belt Drives   **6 Hrs**
        7.1   Introduction to Belt and pulley drives
        7.2   Selection of Belt drive
        7.3   Types of Belt drive
        7.4   Type of Belts and pullies
        7.5   Type of Flat Belts drive
        7.6   Velocity ratio of Belt drive
        7.7   Slip / creep of Belt
        7.8   Length of open Belt drive
        7.9   Solve problem to find out the speed of shaft considering the diameters of flat pulleys and slip between belt and flat pulleys

8. Springs   **6Hrs**
        8.1   Introduction
        8.2   Types and uses of springs
        8.3   Materials used for helical springs
        8.4   Terms used in helical springs
        8.5   Stresses in helical springs of circular wire
        8.6   Deflection of helical springs of circular wire
        8.7   Solution of simple problem on helical springs of circular wire regarding finding out stresses, deflection and diameter of wire by direct application of formulae

9. Bearings   **6 Hrs**
        9.1   Functions of bearings
        9.2   Classification of bearing
                9.2.1   Depending upon the direction of load to be supported
                9.2.2   Depending upon the nature of contact
        9.3   Uses of bearings
        9.4   Terms used in journal bearings
        9.5   Lubrication of bearings
        9.6   Solution of simple problems on journal bearings when all parameter of journal bearing are directly provided

10. Cam and Follower Design   7Hrs

    10.1   Cam and its Types
    10.2   Followers and its Types
    10.3   Terminology of Cam and Follower
    10.4   Cam profile design

Mech-343   MACHINE DESIGN

Instructional Objectives:

1. **Simple Stresses in Machine Parts**
    1.1   Describe Load and its types
            1.1.1   Dead load
            1.1.2   Live load
            1.1.3   Suddenly applied load
            1.1.4   Impact load
    1.2   Describe Stress and strain
    1.3   Describe Tensile stress and strain
    1.4   Describe Compressive stress and strain
    1.5   Describe Shear stress and strain
    1.6   Describe Modulus of elasticity
    1.7   Describe Modulus of rigidity
    1.8   Explain Stress strain diagram
            1.8.1   Proportional limit
            1.8.2   Elastic limit
            1.8.3   Yield points
            1.8.4   Ultimate stress
            1.8.5   Breaking stress
            1.8.6   Percentage reduction in area
            1.8.7   Percentage elongation
    1.9   Describe Working stress
    1.10   Describe Factor of safety
    1.11   Describe selection of factor of safety
    1.12   Describe Poisson's ratio
    1.13   Describe temperature stress
    1.14   Describe volumetric strain and bulk modulus
    1.15   Describe Resilience and Toughness
    1.16   Solve of simple problems of the above topics by direct application of formula

2. **Pressure Vessels**
    2.1   Describe pressure vessels
    2.2   Explain Classification of pressure vessels
            2.2.1   According to dimensions
            2.2.2   According to end – construction
    2.3   Explain Stresses in a thin cylindrical shell due to internal pressure
            2.3.1   Hoop stress
            2.3.2   Longitudinal stress
    2.4   Calculate thickness of cylinder by direct application of formula, while all parameters are provided (e.g., Pressure. Internal Dia, hoop or longitudinal stress and efficiency of joint are given)
    2.5   Calculate hoop or longitudinal stress by direct application of formula, while P. d, t and efficiency of joint are given
    2.6   Explain thin spherical shell subjected to internal pressure
    2.7   Calculate thickness of spherical shell when all other parameters are provided by direct application of formula

2.8   Explain Thick cylindrical shell subjected to internal pressure

2.9   Solve simple problem to Calculate of thickness of thick vessel made of brittle material by LAMES equation, while all other parameters (e.g., Pressure. Internal Dia, tensile stress) are given

3. Welded Joints

3.1   Describe list of types of various welding joints

3.2   Explain strength of transverse and parallel fillet welded joint under static and fatigue loading

3.3   Calculation of length of weld under static loading and fatigue loading, when load, plate thickness, plate width, tensile and shears stress are given

4. Screwed Joints

4.1   Describe Screwed Joints

4.2   Describe Advantages and disadvantages of Screwed Joints

4.3   Explain Thread terminology

          4.3.1   Major diameter

          4.3.2   Minor diameter

          4.3.3   Pitch diameter

          4.3.4   Pitch

          4.3.5   Lead

          4.3.6   Helix and Helix angle

          4.3.7   Thread angle

          4.3.8   Root

          4.3.9   Crest and Apex

4.4   Explain Stresses in screwed fastening due to external forces under static loading

4.5   Describe Initial stress due to screwing up forces

4.6   Solve simple problem on screwed fastening by direct application of formula

5. Design of Keys

5.1   Describe Keys and its use

5.2   Describe Types of keys

          5.2.1   Sunk keys

                    5.2.1.1   Rectangular (Parallel & Taper) Sunk key

                    5.2.1.2   Square (Parallel & Taper) Sunk key

                    5.2.1.3   Gib-Head key

                    5.2.1.4   Feather key

                    5.2.1.5   Wood ruff key

          5.2.2   Saddle keys

                    5.2.2.1   Flat Saddle Key

                    5.2.2.2   Hollow Saddle Key

          5.2.3   Tangent keys

          5.2.4   Round keys

          5.2.5   Splines

5.3   Describe Forces acting on a sunk key

5.4   Explain strength of a sunk key

5.5   Solve simple problem to Calculate length of sunk key (Square & Rectangular) by direct application of formula, while all parameters are directly provided

6. Shafts and Couplings

6.1   Describe Shafts

6.2   Describe Materials used for shaft and its properties

6.3   Describe Types of shafts
6.4   Describe Standard sizes of shafts
6.5   Describe Stresses in shafts
6.6   Explain shafts subjected to twisting moment
         6.6.1   Solid shaft
         6.6.2   Hallow shaft
6.7   Solve simple problem to Calculate diameter of solid and hollow shafts by direct application of formula
6.8   Explain shafts subjected to bending moment
         6.8.1   Solid shaft
         6.8.2   Hollow shaft
6.9   Solve simple problem to Calculate diameter of solid and hollow shaft (under bending only) by direct application of formula
6.10   Solve simple problem to calculate dia. of shaft subjected to combined bending and twisting moments
6.11   Describe Shafts coupling
6.12   Describe Types of couplings
6.13   Explain design of flange coupling
6.14   Solve problems on calculation of sizes of different components in flange coupling by direct application of formula

7. Belt Drives

7.1   Introduction to Belt and pulley drives
7.2   Describe Selection of Belt drive
7.3   Describe Types of Belt drive
         7.3.1   Light drives
         7.3.2   Medium drives
         7.3.3   Heavy drives
7.4   Describe Types of Belts and pullies
         7.4.1   Flat belt and pullies
         7.4.2   V-belt and pullies
         7.4.3   Circular belt and pullies
7.5   Describe Types of Flat Belts drive
         7.5.1   Open belt drive
         7.5.2   Crossed or Twist belt drive
         7.5.3   Quarter Turn belt drive
         7.5.4   Belt drive with idler pulley
         7.5.5   Compound belt drive
7.6   Explain Velocity ratio of Belt drive
7.7   Explain Slip of Belt
7.8   Describe Length of open Belt drive
7.9   Solve problem to find out the speed of shaft considering the diameters of flat pulleys and slip between belt and flat pulleys

8. Springs

8.1   Describe function of springs
8.2   Explain Types and uses of springs
         8.2.1   Helical spring
         8.2.2   Conical and volute spring
         8.2.3   Torsion spring

8.2.4 Leaf spring
8.2.5 Disc spring
8.3 Describe Materials used for springs
8.4 Explain Terms used in helical springs of circular wire along with formulae for each term
8.5 Derive formula for torsional and direct shear stress induced in helical springs of circular wire. Maximum shear stress should also be found out by considering the effect of wire curvature
8.6 Derive formula for deflection of spring
8.7 Solve problems on stresses, deflection and diameters for helical springs of circular wire by direct application of formulae

9. Bearings

9.1 Describe function of bearings
9.2 Explain classification of bearing
  9.2.1 Depending upon the direction of load to be supported
  9.2.1.1 Radial bearing
  9.2.1.2 Thrust bearing
  9.2.2 Depending upon nature of contact
  9.2.2.1 Friction bearing or sliding contact bearing
  9.2.2.2 Anti friction or rolling contact bearing
9.3 Describe uses of bearings
9.4 Describe terms used in hydrodynamic journal bearing
9.5 Explain lubrications of bearings
9.6 Solve simple problems on journal bearing when load on shaft, speed of shaft, viscosity of lubricant, bearing pressure, coefficient of friction and bearing modulus are provided.

10. Cam and Follower Design

10.1 Explain Cam and its Types
   10.1.1 Cylindrical Cam
   10.1.2 Radial Cam
   10.1.3 Wedge type Cam
   10.1.4 Face Cam
10.2 Describe Followers and its Types
   10.2.1 Roller Follower
   10.2.2 Knife Edge Follower
   10.2.3 Flat face Follower
   10.2.4 Spherical face Follower
10.3 Define Terminology of Cam and Follower
   10.3.1 Base circle
   10.3.2 Trace Point
   10.3.3 Pressure angle
   10.3.4 Pitch point
   10.3.5 Pitch circle
   10.3.6 Prime circle
   10.3.7 Lift or Stroke
   10.3.8 Dwell
   10.3.9

10.4 Explain Cam profile design

  10.4.1 Draw/ Sketch displacement diagram, velocity and acceleration diagram when knife edge follower moves with uniform velocity

  10.4.2 Draw/ Sketch displacement diagram, velocity and acceleration diagram when knife edge follower moves with Simple Harmonic Motion(S.H.M)

Recommended Textbooks:

1. **Machine Design by: Paul H. Black (Published by McGraw Hill Book Company , New York)**

2. **Machine Design by Stanton. E. Wiston (Published by McGraw Hill Book Company , New York)**

3. **Machine Design by: Lafayette. Ind. (Purdue University of California)**

Mech-343   MACHINEDESIGN

List of Practical:

1.   Calculate (tensile, compressive and shear), stress and strain, modulus of elasticity, %age elongation, %age reduction in area, factor of safety for simple machine parts

2.   Calculate force required to punch a hole

3.   Calculate thickness and diameter of thin cylinders for hoop and longitudinal stresses

4.   Calculate thickness of thick cylinders by LAME 'S Equation

5.   Calculate thickness and diameter of spherical shell.

6.   Design welded joints for transverse and parallel fillet weld under static loading only

7.   Calculate stresses setup due to initial tightening and external load on screws .

8.   Check dimensions of square and rectangular keys due to failure in shearing and crushing.

9.   Design solid shaft subjected to twisting moment only.

10. Design hollow shaft subjected to twisting moment only.

11. Design Solid & Hollow shafts subjected to combined bending & twisting moment.

12. Design un-protected flange coupling for specific torque.

13. Check the speed of shaft when diameters of flat pulleys (Driver or Driven) and slip between belt and flat pulley is given.

14. Design the dimensions of closely coiled helical spring of circular wire subjected to tensile load.

15. Suggest suitable journal bearing, considering the load on shaft, speed ,viscosity of lubricant, bearing pressure, coefficient of friction and bearing modulus.

16. Design and draw the CAM profile with knife edge follower for uniform velocity:

(a) Out Stroke during 60° of Cam rotation

(b) Dwell for next 30° of Cam rotation

(c)   Return Stroke during next 60° of Cam rotation

(d) Dwell of remaining 210° of Cam rotation

(e)   Stroke of follower is 22 mm

(f) Minimum Radius of Cam is 50 mm

(g) Axis of Follower is passing through axis of Cam shaft

(h) Follower moves with uniform velocity during both out Stroke and return Stroke.

Mech-343   **MACHINE DESIGN**
                      Practical objectives:

1. Calculate (tensile, compressive and shear), strain, modulus of elasticity, %age elongation, %age reduction in area, factor of safety for simple machine parts
  1.1   Stresses induced in machine parts
  1.2   Cross-sectional area of machine element under load
  1.3   modulus of elasticity of materials
  1.4   Calculate dimensions of component under specific load
  1.5   %age elongation and %age reduction in area of a component in a tensile test

2.Calculate force required to punch a hole
  2.1   Stresses induced in punch and plate
  2.2   Area of shear by the punch
  2.3   Calculate different cases of die and punch

3.Calculate thickness and diameter of thin cylinders for hoop and longitudinal stresses
  3.1   Difference between thin and thick shells
  3.2   Hoop and longitudinal stress in cylindrical shells
  3.3   Transverse and longitudinal failure of pressure vessel

4.Calculate thickness of thick cylinders
  4.1   Lame's equations for brittle materials
  4.2   Calculate Different cases of thickness of thick shells of brittle material

5.Calculate thickness and diameter of spherical shell for circumferential stresses
  5.1   Stresses on thin spherical shells
  5.2   Stress on spherical shells considering pressure, internal diameter, thickness and joint efficiency

6.Design welded joints for transverse and parallel fillet under static loading only
  6.1   Transverse and parallel fillet weld
  6.2   Observe tensile and shear stresses in transverse and parallel fillet weld
  6.3   <u>Calculate</u> different cases of transverse and parallel fillet weld under static and <u>fatigue</u> loading

7. Analyze stresses setup due to initial tightening and external load on screws
  7.1   Stress area of a screw
  7.2   Relation between core dia. and nominal dia. of a screw thread
  7.3   Initial tightening and its specific values
  7.4   <u>Calculate</u> different cases of external load raised by different bolts

8. Check dimension of square and rectangular keys due to failure in shearing and crushing
  8.1   Understand sunk keys of all types
  8.2   Understand sizes of keys proportional to the shaft diameter
  8.3   Check length of a sunk key for same material with shaft and equal strength with shaft
  8.4   Check torque transmitted by rectangular and square keys against shearing as well as crushing
  8.5   Calculate length of a sunk key when torque transmitted dia. of shaft, stress (shear & compressive) and width of key is given

9. Design solid shaft subjected to twisting moment only
  9.1   Understand twisting and bending moment on solid shaft
  9.2   Understand torsion and bending equation for strength of shaft
  9.3   Calculate diameters of shaft under torsion when torque to be transmitted and torsional shear stress is given
  9.4   Analyze diameter of shafts subjected to combine bending and twisting moments

10. Design hollow shaft subjected to twisting moment only
  10.1   Understand twisting moment and bending moment on hollow shaft
  10.2   Know torsion and bending equation
  10.3   Calculate dia. of hollow shaft (inside & outside dia.) when bending moment, twisting moment and stresses are given

11. Design Solid & Hollow shafts subjected to combined bending &twisting moment
  11.1   Understand twisting moment and bending moment on solid & hollow shaft
  11.2   Know torsion and bending equation
  11.3   Calculate inside & outside dia. of hollow shaft when bending moment, twisting moment are given.

12. Design un-protected flange coupling for specific torque
  12.1   Un protected flange coupling
  12.2   Know empirical size of flange coupling
  12.3   Design assembly (hub, keys, flange, bolts) of unprotected type flange coupling.

13. Check the speed shafts (Driver or Driven) when diameters of flat pulleys and slip between belt and flat pulley is given
  13.1   Understand belt and belt drives
  13.2   Calculate dimensions of flat pulleys for specific speed of shaft
  13.3   Calculate the effect of slip between belt and pulley

14. Design the dimensions of closely coiled helical spring of circular wire subjected to tensile load.
  16.1   Understand helical springs of circular wire
  16.2   Understand terms used in helical springs
  16.3   Calculate deflection in helical spring
  16.4   Solve problems on calculation of dimensions of helical springs

15.   Suggest suitable journal bearing considering load on shaft, speed of shaft, viscosity of lubricant, bearing pressure, coefficient of friction and bearing modulus.
  15.1   Verify length of journal bearing
  15.2   Know the viscosity of lubricants
  15.3   Calculate the bearing modulus
   18.4   Apply the coefficient of friction in the design of journal bearings

16. Design and draw the CAM profile with knife edge follower for uniform velocity
16.1   Movement of knife edge follower
  16.2   Practice to sketch Displacement, velocity and acceleration diagram when knife edge Follower.
16.3   moves with Simple Harmonic Motion (S.H.M)
  16.4   Practice to sketch Displacement, velocity and acceleration diagram when knife edge follower moves with uniform velocity
  16.5   Practice to draw CAM profile as given data

Mech-362

MATERIALS TESTING &HEAT TREATMENT

Mech-362   MATERIALS TESTING AND HEAT TREATMENT

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

AIMS: After going through this course, student will be able to:

I)   Understand destructive and non-destructive test
II) Understand working of testing equipment
III) Know the basic theories of heat treatment processes
IV) Understand common heat treatment processes
V)   Understand common heat treatment processes of non ferrous metals

Course Contents:

(A)   MATERIALS TESTING

1.	Mechanical properties of Metallic Materials	2 Hrs
2.	Destructive Test	7Hrs
3.	Non-Destructive Tests	**7Hrs**

(B)   HEAT TREATMENT

4.	Heat Treatment of steels	3 Hrs
5.	Heat Treatment Processes	4 Hrs
6.	Heat Treatment Equipment	3 Hrs
7.	Case hardening Processes	3 Hrs
8.	Heat Treatment of Non-Ferrous Metals and Cast iron	3 Hrs

Detail of Contents:

(A)   MATERIALS TESTING

1.   Mechanical properties of Metallic Materials   **2 Hrs**
    1.1   Mechanical Properties of Materials
        1.1.1   Hardness
        1.1.2   Toughness
        1.1.3   Ductility
        1.1.4   Malleability
        1.1.5   Elasticity
        1.1.6   Brittleness

    1.1.7 Plasticity
    1.1.8 **Stiffness**
  1.2 Testing of materials
    1.2.1 Destructive tests.
    1.2.2 Non destructive tests

2. Destructive Test   **7 Hrs**
  2.1 Hardness tests
    2.1.1 Brinell hardness test
    2.1.2 Rockwell hardness test
    2.1.3 Vickers hardness test
  2.2 Izod impact test
  2.3 Tensile test
  2.4 Compression Test
  2.5 Bending test
  2.6 Shear Test
  2.7 Torsion test
  2.8 Fatigue test

3. Non-Destructive Test   **7 Hrs**
  3.1 Pressure Test
  3.2 Hammer Test (Sonic Inspection)
  3.3 Visual Inspection
  3.4 Dye Penetrant Test
  3.5 Eddy Current inspection
  3.6 Ultrasonic Inspection
  3.7 Magnetic Particle Inspection
  3.8 Radiographic Inspection

B) **HEAT TREATMENT**

  4. **Heat Treatment of steels**   **3 Hrs**
    4.1 Iron-Iron carbide diagram
    4.2 Phase diagrams
    4.3 Effect of heating on steel
    4.4 Effect of cooling on steel

  5. **Heat Treatment Processes** **4 Hrs**
    5.1 Annealing
    5.2 Hardening
    5.3 Tempering
    5.4 Normalizing

  6. **Heat Treatment Equipment** **3 Hrs**
    6.1 Heat Treatment Furnaces
    6.2 Pyrometers
    6.3 Metallurgical microscope

  7. **Case Hardening Processes**   **3 Hrs**
    7.1 Carburizing (pack, gas, liquid)

7.2   Induction hardening
7.3   Flame hardening
7.4   Cyaniding
7.5   Nitriding

8.   Heat Treatment of Non-Ferrous Metals and Cast Iron   3 Hrs
8.1   Heat treatment of cast iron
8.2   Heat treatment of Non-ferrous metals and alloys
8.3   Annealing of non-ferrous metals and precipitation hardening

Recommended Textbooks:

1.   The Testing and Inspection of Engineering Materials   By Harmer E-Davis, George Earl Troxel (McGraw Hill Book Company, New York)
2.   Materials and Processes by James. F. Young (Jhon wiley & sons Inc. New York)
3.   Physical Metallurgy by AVNER

Mech-362   MATERIALS TESTING AND HEAT TREATMENT

Instructional Objectives:

1. **Mechanical properties of materials**
   1.1   Know Mechanical Properties of Materials
       1.1.1   Enlist mechanical properties of materials (hardness, toughness, ductility malleability, brittleness, elasticity, plasticity and stiffness)
       1.1.2   Define each property
   1.2   Know Destructive Tests
       1.2.1   Enlist destructive tests
       1.2.2   Define each test
   1.3   Know Non-Destructive Tests
       1.3.1   Enlist non-destructive tests
       1.3.2   Define each test

2. **Destructive Tests**

2.1   Understand Hardness Tests and selection of test for a material
2.1.1   Explain Brinnel Hardness Test
2.1.1.1   Knows types of hardness tests
2.1.1.2   Enlist parts of brinell hardness testing machine
2.1.1.3   Explain working of brinell hardness testing machines
2.1.1.4   Explain preparation of specimen for brinell hardness testing machine
2.1.1.5   Explain the measurement of impression by microscope for brinell test
2.1.1.6   Describe relevant calculations
2.1.2.   Explain Rockwell hardness testing machine
2.1.2.1   Explain construction and working of Rockwell hardness testing machine(minor load, major load, scales B, C)
2.1.2.2   Explain preparation of specimen for Rockwell hardness testing   machine
2.1.2.3   Appreciate correct dial reading procedure
2.1.2.4   Enlist difference between brinell and Rockwell hardness testing
2.1.3   Explain Vicker hardness test
2.1.3.1   Describe Vicker hardness testing machine
2.1.3.2   Explain Vicker hardness testing method
2.2   Explain the working Principles of Impact testing Machine
2.2.1   Enlist capacity and parts of Izod impact machine
2.2.2   Explain function of each part
2.2.3   Explain working principle
2.2.4   Explain preparation of specimen(ASTM, JIS, ISO)
2.2.5   Appreciate correct dial reading technique
2.3   Explain the working Principle of Universal Testing Machine
2.3.1   Describe tensile testing machine
2.3.2   Enlist capacity and different parts of tensile testing machine and extensometer
2.3.3   Describe different function of tensile testing machine

2.3.4	Explain the preparation of standard tensile test specimen(ASTM, ISO)
2.3.5	Explain the procedure of tensile test of mild steel
2.3.6	Describe the stress strain curve obtained in a tensile test of mild steel
2.3.7	Describe the %age elongation and %age reduction in area of specimen in tensile test
2.3.8	State need of correct holding of specimen on machine
2.4	Explain Compression test
2.4.1	Describe compression test
2.4.2	Describe procedure for the conduct of compression test
2.4.3	Describe standard specimen for compression test
2.5	Understand Bending Test
2.5.1	Describe bending
2.5.2	Explain bending test and shape factor
2.5.3	Describe deflection in specimen and bending equation.
2.6	Understand Shear Test
2.6.1	Explain shear test procedure on universal testing machine
2.6.2	Explain shear stress calculation of round bar and punched plate specimen
2.7	Understand Torsion Testing Machines and Torsion Test
2.7.1	Describe torsion
2.7.2	Explain shafts subjected to twisting moment
2.7.3	Explain working of torsion testing machine
2.7.4	Explain procedure of torsion test
2.8	Understand Fatigue Testing Machine and Fatigue Test
2.8.1	Define fatigue
2.8.2	Describe the Phenomenon of Stress Hysteresis
2.8.3	Describe cyclic loading
2.8.4	Explain effect of fatigue on metals and fatigue failure
2.8.5	Explain working of fatigue testing machine
2.8.6	Explain procedure for fatigue test

3. Non Destructive Test

3.1	Describe Pressure Test (pneumatic, hydraulic)
3.2	Describe Hammer Test
3.3	Describe Visual Inspection
3.4	Explain Dye Penetrant Test
3.4.1	Describe need and uses of Dye penetrant test
3.4.2	Describe procedure of Dye penetrant test
3.5	Explain Eddy Current Inspection
3.5.1.	Describe need and uses of Eddy Current test
3.5.2	Describe procedure of Eddy Current test
3.5.3	Describe equipment of Eddy Current test
3.6	Understand Ultrasonic Test of metals
3.6.1	Describe need and uses of Ultrasonic test In the Inspection of Metals and Metallic Component
3.6.2	Explain Ultrasonic testing Equipment
3.6.3	Describe procedure of Ultrasonic test
3.7	Understand Magnetic particles inspection Methods
3.7.1	Enlist advantages disadvantages

3.7.2   Explain the equipment used
3.7.3   Explain the basic principle
3.7.4   Explain crack detection procedure
3.8   Understand Radiographic inspection
3.8.1   X-Ray Method
3.8.1.1   Enlist advantages and disadvantages of x-ray test.
3.8.1.2   Explain the basic principle of x-ray test
3.8.1.3   Explain the equipment used
3.8.1.4   Enlist the safety measures adapted in x-ray method
3.8.1.5   Explain the use of x-ray method in the inspection of castings and welded joints
3.8.2   Gamma Ray Method
3.8.2.1   Describe basic principle of Gamma Rays methods
3.8.2.1   Enlist advantages and disadvantages of Gamma Rays methods with respect to X-ray method

4.   Heat Treatment
4.1   Understand Heat Treatment of Steel
4.1.1   Describe heat treatment of steel
4.1.2   Explain constituents of steel
4.1.3   Describe allotropic phases of steel
4.1.4   Explain change of structure on heating
4.1.5   Explain role of heating rate/cooling rate
4.1.6   Distinguish between micro and macro structure
4.1.7   Sketch iron carbide diagram
4.1.8   Describe significance of various areas in iron carbide diagram
4.1.9   Explain role of iron carbide diagram in heat treatment of carbon steel
4.1.10   Describe time temperature transformation diagram
4.2   Understand Phase Diagram(Alloy steel)
4.2.1   Define phase diagram
4.2.2   Explain importance of phase diagram
4.2.3   Name different phases
4.2.4   Explain different phases
4.3   Understand effect of heating on steels
4.3.1   Describe heating curve of steels
4.3.2   Describe its importance in heat treatment of steel
4.4   Understand Effect of rate of Cooling on Steel
4.4.1   Explain the change of micro structure on cooling
4.4.2   Explain the importance of rate of cooling
4.4.3   Enlist different methods of cooling and its effect
4.4.4   Explain cooling curve of steels

5.   Heat Treatment Processes
5.1   Understand Hardening
5.1.1   Describe hardening and its objectives
5.1.2   Enlist steps taken in hardening
5.1.3   Describe effects of cooling rate on hardening
5.1.4   Define different media used for quenching

5.1.5	Describe harden ability of steels
5.2	Understand Tempering
5.2.1	Describe tempering and its objectives
5.2.2	Describe austempering and martempering
5.3	Understand Annealing
5.3.1	Define annealing and its objectives
5.3.2	Describe types of annealing
5.3.2.1	Process Annealing
5.3.2.2	Full annealing
5.3.2.3	Isothermal annealing
5.3.2.4	Spherodizing annealing
5.4	Understand Normalizing
5.4.1	Define Normalizing and its objectives
5.4.2	Describe comparison between annealing and normalizing

6.   Heat Treatment Equipment

6.1	Understand Heat Treatment Furnaces
6.1.1	Describe heat treatment furnaces
6.1.2	Classification of furnaces
6.1.2.1	Hearth Furnaces (Muffle and Semi-Muffle)
6.1.2.2	Bath furnaces
6.2	Understand Pyrometer
6.2.1	Define Pyrometer
6.2.2	Enlist types of pyrometers
6.2.3	Enlist different parts of thermocouple optical pyrometer, radiation pyrometer
6.2.4	Explain working principle of pyrometer
6.3	Understand Metallurgical Microscope
6.3.1	Describe microscope
6.3.2	Describe working and construction of metallurgical microscope
6.3.3	Explain Metallography
6.3.4	Describe preparation of specimen for metallography
6.3.5	Describe etching and etchants
6.3.6	Describe microstructure study of iron

7.   Case Hardening Processes

7.1	Understand Carburizing
7.1.1	Describe pack Carburizing
7.1.2	Describe liquid Carburizing
7.1.3	Describe gas Carburizing
7.2	Understand Induction hardening
7.2.1	Induction hardening process
7.2.2	Advantages of Induction hardening
7.3	Describe flame hardening
7.4	Describe cyaniding
7.5	Describe Nitriding

8.   Understand Heat Treatment of Non Ferrous Metals, Alloys and Cast Iron

8.1	Explain heat treatment of cast iron

8.2   Explain heat treatment of non ferrous metals and alloys

8.3   Describe precipitation hardening and annealing of non ferrous metals

Mech-362   MATERIALS TESTING AND HEAT TREATMENT
List of Practical:

(A)   MATERIALS TESTING

Practice for brinnell hardness test	3 Hrs
Practice for Rockwell hardness test for B-scale hardness	6 Hrs
Practice for Rockwell hardness test for C-scale hardness	3 Hrs
Practice for Izod test on cast iron or Aluminum standard test specimens	3Hrs
Practice for tensile test on universal testing machine on standard specimen	6Hrs
Practice for Compression test on cast iron specimen.	6Hrs
Practice for bending test on universal testing machine	3 Hrs
Practice for shear test on universal testing machine	3 Hrs
Practice for torsion test on torsion testing machine	3 Hrs
Practice for fatigue test	3 Hrs
Practice for Dye Penetrant test	3 Hrs
Practice for Ultrasonic test on ultrasonic testing equipment	3 Hrs
Practice for Magnetic particle test	3Hrs

(B)   HEAT TREATMENT

Practice for working of metallurgical microscope	3 Hrs
Practice of preparation of specimen for metallography	6 Hrs
Observe grain size of micro-structure of mild steel specimen	6 Hrs
Observe micro-structure of cast iron specimen	6 Hrs
Practice for hardening and observe micro structure of carbon steel	6Hrs
Practice for annealing and observe grain structure of carbon steel	6 Hrs
Practice for normalizing and observe grain structure	6 Hrs
Practice for pack carburizing and observe grain structure	6 Hrs
Practice for stress relieving of Aluminum	3 Hrs

Mech-362   MATERIALS TESTING AND HEAT TREATMENT
Practical Objectives:

(A)   **MATERIALS TESTING**

1. **Practice for Brinell hardness test**
   After performing Brinell hardness test, the students should be able to:
   I)   Perform grinding & polishing of specimen for Brinell test
   II)   Perform Brinell test on Brinell testing machine
   III)   Check hardness of metallic specimen

2. **Practice for Rockwell hardness test for B-scale hardness**
   After performing Rockwell hardness test for B scale, the students should be able to:
   I)   Perform grinding & polishing of specimen for Rockwell test
   II)   Fit steel ball indenter into plunger & placing weights
   III)   Perform Rockwell test for B scale with ball indenter

3. **Practice for Rockwell hardness test for C-scale hardness**
   After performing Rockwell hardness test for C scale, the students should be able to:
   I)   Perform grinding & polishing of specimen for Rockwell test
   II)   Fit Diamond Cone indenter into plunger & placing weights
   III)   Perform Rockwell test for C scale with Diamond Cone indenter

4. **Practice for Izod test on cast iron and aluminum standard test specimens**
   After performing Izod test on Izod testing machine, the students should be able to:
   I)   Make specimen of different materials according to specifications
   II)   Set different energies or pendulum heights, according to the material, on the machine
   III)   Perform Izod test on Izod testing machine
   IV)   Able to determine the toughness of the material

5. **Practice for tensile test on universal testing machine on standard specimen**
   After performing tensile test on Universal testing machine, the students should be able to:
   I)   Make specimen according to standard size
   II)   Mark gauge length points on the specimen
   III)   Clamp specimen properly in the machine gripping jaws
   IV)   Operate inlet and outlet oil valves of machine
   V)   Draw stress strain curve on tracing unit of the machine
   VI)   Remove broken specimen from machine jaws
   VII) Calculate all observations (% elongation, % reduction in area, yield stresses, ultimate tensile stresses, and breaking stresses) relevant to test

6. **Practice for Compression test on cast iron specimen.**
   After performing Compression test on Universal testing machine, the students should be able to:
   I)   Install compression attachment on machine
   II)   Perform compression test on specimen
   III)   Draw stress strain curve on tracing unit of the machine
   IV)   Calculate compressive stress and all other observations relevant to test

7. **Practice for bending test on universal testing machine**

    After performing bending test on Universal testing machine, the students should be able to:

    I)   Fit bending fixture on Universal testing machine
    II)   Perform bending test on specimen
    III) Calculate Modulus of elasticity and all other observations relevant to test

8. **Practice for shear test on universal testing machine**

    After performing Shear test on Universal testing machine, the students should be able to:

    I)   Install shear test fixture or die and punch on the machine
    II)   Perform shear test on specimen
    III) Calculate ultimate shear stress of test specimen

9. **Practice for torsion test on torsion testing machine**

    After performing Torsion test on Torsion testing machine, the students should be able to:

    I)   Fit specimen on torsion testing machine
    II)   Performing torsion test on specimen
    III) Calculate all observations relevant to test

10. **Practice for fatigue test on fatigue testing machine**

    After performing Fatigue test on Fatigue testing machine, the students should be able to:

    I)   Fit specimen on fatigue testing machine
    II)   Perform fatigue test on specimen
    III) Calculate all observations relevant to test

11. **Practice for Dye Penetrant test**

    After performing Dye penetrant test, the students should be able to:

    I)   Clean and prepare surface for the test
    II)   Apply fluorescent dye on the specimen
    III) Apply developer after cleaning the surface
    IV)   Detect surface flaws, cracks, pin holes, surface discontinuities

12. **Practice for Ultrasonic test on ultrasonic testing equipment**

    After performing Ultrasonic test ultrasonic on testing equipment, the students should be able to:

    I)   Clean and prepare surface for the test
    II)   Operate ultrasonic on testing equipment
    III) Detect flaws, blow holes and other internal defects in metals

13. **Practice for Magnetic particle test on Magnetic particle testing equipment**

    After performing Magnetic particle test on Magnetic particle testing equipment, the students should be able to:

    I)   Clean and prepare surface for the test
    II)   Operate Magnetic particle testing equipment
    III) Detect flaws, blow holes and other internal defects in metals

(B)   HEAT TREATMENT

14. **Practice for working of metallurgical microscope**

After practice of working of metallurgical microscope, the students should be able to:

I)   Know different parts of metallurgical microscope
II) Operate metallurgical microscope
III) Know function of each part
IV) Draw a neat sketch of microscope indicating its different parts

15. **Practice of preparation of specimen for metallography**

After preparation of specimen for metallography the students should be able to:

I)   Grind and polish the specimen .Etching the specimen with etching solution
II) Press specimen with plastic material

16. **Observe grain size of micro-structure of mild steel specimen**

After study of grain size of specimen the students should be able to

I)   Examine different microstructures of steel (ferrite, cementite, pearlite, etc.)

17. **Observe grain size of micro-structure of cast iron specimen**

After study of grain size of specimen the students should be able to:

I)   Examine different microstructures of cast iron (cementite, pearlite.. etc)

18. **Practice for hardening and observe of micro structure of carbon steel**

After hardening & quenching of specimen the students should be able to:

I)   Heat the carbon steel in heat treatment furnace
II) Use proper quenching media
III) Polish, grind, etch specimen for metallography
IV) Examine microstructure of hardened steel

19. **Practice for annealing and observe micro structure of steel**

After annealing of specimen the students should be able to:

I)   Heat the steel or specimen on required temperature in electric furnace
II) Give the steel soaking time
III) Remove the specimen from furnace after slow cooling
IV) Polish, grind, etch specimen for observe grain structure

20. **Practice for normalizing of steel and observe grain structure**

After Normalizing of specimen, the students should be able to:

I)   Heat the carbon steel specimen on required temperature in electric furnace
II) Give the steel soaking time
III) Remove the specimen from furnace after specified time
IV) Keep the specimen in air for cooling
V)   Polish, grind, etch specimen and observe of grain structure

21. **Practice for pack carburizing of steel and observe micro structure**

After Pack-carburizing process of low carbon steel, the students should be able to:

I)   Pack and seal specimen with Carbonaceous materials in steel box
II) Heat the specimen up to required time and temperature
III) Check hardness difference between case and core
IV) Polish, grind and etch specimen and observe grain structure

22. **Practice for stress relieving of Aluminum**

I.   Select and prepare specimen
II. Heat up specimen in muffle furnace
III. Cool the specimen at specific rate of cooling
IV. Examine the specimen for its variation in strength

TD-352
CAD-II / CAM

TD-352   CAD-II / CAM

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

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

    I. Solid Modeling
    II. CAM for Milling
    III. CAM for Turning
    IV. CAM for Wire Cut (EDM)
    V. CAM for EDM (Die Sinker)

Course Contents:

1. **Introduction to 3D CAD**   **2 Hrs**

2. **Sketch**   **3 Hrs**

3. **Dimension and Constraint**   **2 Hrs**

4. **Solid Modeling**   **8 Hrs**

5. **Assembly Modeling**   **4 Hrs**

6. **Drawing View**   **1 Hrs**

7. **Presentation Module**   **1 Hrs**

8. **Sheet Metal Components**   **3 Hrs**

9. **CAM**   **8 Hrs**

Detail of Course Contents:

1.   Introduction to 3D CAD   **2 Hrs**

      1.1   Modules
      1.2   Toolbars
      1.3   Units and Dimensions
      1.4   Important Terms and Definitions

2.   Sketch   **3 Hrs**

      2.1   Sketch Environment
      2.2   Drawing Display Tools
      2.3   Sketching Entities
      2.4   Pattern
      2.5   Tolerance
      2.6   Work Feature

3.   Dimension and Constraint   **2Hrs**

      3.1   Dimension
      3.2   Geometric Constraints

4.   Solid Modeling   **8Hrs**

      4.1   Modeling Tools
      4.2   Concept of Edit Feature
      4.3   Advanced Modeling Tools

5.   **Assembly Modeling**   **4Hrs**
      5.1   Types of Assembly
      5.2   Assembly Components
      5.3   Edit Assembly Constraint

6   Drawing Views   **1Hr**
      6.1   Types of Views
      6.2   Drawing Standards
      6.3   Drawing Sheets
      6.4   Dimension Style
      6.5   Parts Lists

7.   Presentation Module   **1Hr**

      7.1   Presentation View
      7.2   Assembly Animation

8.   Sheet Metal Components   **3Hrs**
      8.1   Sheet Metal Components Parameter
      8.2   Sheets Metal Components

9. **CAM**   **8Hrs**
   9.1   Introduction of CAM
   9.2   2-D CAM
   9.3   CAM Milling
   9.4   Rough Cutting Strategies
   9.5   Finish cutting Strategies
10. **CAM Lathe**
   - Facing
   - Boring
   - Grooving
   - Threading (Inside and Outside)
   - Cut off
11. **CAM Wire Cut**
   - Die Cutting
   - Punch Cutting
   - Taper Cutting
   - Axis Wiring Cutting
   - No Core Cutting
12. **CAM Router**
   - Contouring
   - Pocketing
   - Engraving
   - Chamfering
   - Raster to vector Translator
   - Nesting
13. **CAM Multi-Axis**

Recommended Textbooks:

1. The CNC Work Shop by Frank Nanfara (Publisher: SDC Publications, 2002)

TD-352   CAD-II / CAM

Instructional Objectives:

Instructors/Teachers must ensure to develop understanding of

1. Introduction to 3D CAD   2 Hrs
   - Modules
   - Toolbars
   - Units and Dimensions
   - Important Terms and Definitions
2. Sketch   3 Hrs
   - Sketch Environment
   - Drawing Display Tools
   - Sketching Entities
   - Pattern
   - Tolerance
   - Work Feature
3. Dimension and Constraint   2Hrs
   - Dimension
   - Geometric Constraints

4. Solid Modeling   8Hrs
   - Modeling Tools
   - Concept of Edit Feature
   - Advanced Modeling Tools

5. Assembly Modeling   4Hrs
   - Types of Assembly
   - Assembly Components
   - Edit Assembly Constraint

6 Drawing Views   1Hr
   - Types of Views
   - Drawing Standards
   - Drawing Sheets
   - Dimension Style
   - Parts Lists
7. Presentation Module   1Hr
   - Presentation View
   - Assembly Animation
8. Sheet Metal Components   3Hrs
   - Sheet Metal Components Parameter
   - Sheets Metal Components

9. CAM   8Hrs
   - Introduction of CAM
   - 2-D CAM
   - CAM Milling
   - Rough Cutting Strategies
   - Finish cutting Strategies

10. CAM Lathe
   - Facing
   - Boring
   - Grooving
   - Threading (Inside and Outside)
   - Cut off

11. CAM Wire Cut
   - Die Cutting
   - Punch Cutting
   - Taper Cutting
   - Axis Wiring Cutting
   - No Core Cutting

12. CAM Router
   - Contouring
   - Pocketing
   - Engraving
   - Chamfering
   - Raster to vector Translator
   - Nesting

13. CAM Multi-Axis

TD-352   CAD-II / CAM

List of Practical:

1. **Practice Sketch and Constrain**   **10Hrs**
2. **Practice Solid Modeling**   **20Hrs**
3. **Practice Assembly Modeling**   **10Hrs**
4. **Practice Sheet Metal**   **14Hrs**
5. **Practice Welds**   **8Hrs**
6. **Practice Drilling CAM**   **4Hrs**
7. **Practice CAM Milling**   **10Hrs**
8. **CAM Turn/Milling**   **10Hrs**
9. **CAM Wire Cut**   **10Hrs**

TD-352   CAD-II / CAM

Practical Objectives:

1. **Understand and master Sketch and Constrain Commands**

2. **Understand and master several Commands for Solid Modeling**

3. **Understand and master Assembly Modeling**

4. **Understand and master 3D Sheet Metal and open drawings**

5. **Understand and master 3D CAD for Welds**

6. **Understand and Practice Tool set-up**

7. **Understand and Practice Stock set-up**

8. **Understand Cutting Condition (Feed Rate, Spindle Speed)**

9. **Understand and Practice 2.5D CAM**

10. **Understand and Practice CAM Milling**

11. **Understand and Practice CAM Turn**

12. **Understand and Practice CAM Turn/Mill**

13. **Understand and Practice CAM Wire Cut**

14. **Understand and Practice Tool path Simulation**

15. **Understand Post set-up**

16. **Understand NC Code**

17. **Practice Cutting Strategy (Rough Cutting, Finish Cutting)**

18. **Understand Feature of CNC Machines**

TD-352 **CAD-II / CAM**

List of Machinery:

1.	**3D CAD Software (Solid Modeling)**	**50-set**
2.	**3D CAM Software (Milling, Turning, Turn/Mill, Wire Cut)**	**50**
3.	**Simulation Software for G Code**	**50**
4.	**Computer**	**50**

MT-312
INSTRUMENT SCIENCE

MT-312 **INSTRUMENT SCIENCE**

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

AIMS: At the end of this course, the student will have a fairly good working knowledge on precision measuring and pneumatic instruments.

Course contents

1.	Theory of instruments	1 hour
2.	High precision vernier calipers	5 hours
3.	High precision micrometers	6 hours
4.	High precision internal micrometers	3 hours
5.	Precision dial indicators	3 hours
6.	Precision lever type testing indicators	3 hours
7.	Bimetal thermometers	3 hours
8.	Pneumatic instruments and their controls	4 hours
9.	Symbols used in instruments	4 hours

Detail of course contents

1.   theory of instruments   1 hour
   1.1   Analogue instruments
   1.2   Digital instruments

2.   High precision vernier calipers   5 hours
   2.1   Characteristics
   2.2   Standard measuring ranges.
   2.3   Graduation patterns.
   2.4   Repairing instructions for high precision vernier   caliper
   2.5   Pocket vernier caliper
   2.6   Dismantling
   2.7   Assembling

3.   High precision micrometers   6 hours
   3.1   characteristics
   3.2   standard messuring ranges
   3.3   measuring spindle and measuring faces
   3.4   high precision checking standards
   3.5   description for adjusting the high precision
        micrometer.
   3.6   repair instructions for high precision micrometers.
   3.7   dismantling.

3.8   assembly

4. high precision internal micrometers   3 hours
    4.1   characteristics of internal micrometers.
    4.2   metric sets
    4.3   special extensions.
    4.4   repairinstructions for imicro internal.

5. Precision dial indicators   3 hours
    5.1   characteristics
    5.2   standard executions
    5.3   water proof executions
    5.4   repair instructions for precision dial indicator

6. Precision lever type testing indicators   3 hours
    6.1   Characteristics
    6.2   Assembling& dismetling

7. Bimetal thermometers   3 hours
    7.1   Principle of measurement
    7.2   Choice and use of suitable types
    7.3   Contact thermometers
    7.4   The remometers with immersion sted, mounter   centlly at
    7.5   Rear of redially at borrom.
    7.6   Boiler, refrigerator, and baking even thermometers
    7.7   Haenni rapid thermometers and cheese   thermometers
    7.8   The calibration

8. pneumatic instruments and their controls   4 hours
    8.1   Pneumatic principles and their units
    8.2   Air compressors
    8.3   Pneumatic symbols controls and working elements, sensors and signals.
    8.4   Function of pneumatic maintenance units
    8.5   Read and setup of pneumatic circuit diagrams.
    8.6   Safety precaution.

9. Symbols used in instruments   4 hours

Recommended Book & Notes
I) Instrument science published by pstc, pcsir
ii) Reference book festo pneumatic control / pstc karachi

Instrument Science

list of practical

96 hours

1. Calibration and uses of high precision vernier calipers
2. Calibration and uses of high precision micromeres
3. Calibration and uses of high precision internal micrometers
4. Calibration and uses of precision dial indicators
5. Calibration and uses of precision lever type test indicators
6. Calibration and application of bimetal thermometers
7. Calibration and application of hair hygrometers
8. Calibration and application of electrical measuring instrument
9. Calibration and application of the electro mechanic meters
10. Calibration and application of electro dynamic quotient mete
11. Calibration and application of crossed coil meter
12. Calibration and application of electrostatic meter
13. Practice of measurement pressure at various connection in pneumatic circuits
14. Actuation of double acting pneumatic cylinder at a rapid transverse by using one way throttle value control
15. Actuation of double acting pneumatic cylinder at push of a switch, develop speed regulation through throttle and flow control
16. Practice to hold a specific load by using double acting cylinder & pilot operated pneumatic check valve

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WT-356
WORKSHOP TECHNOLOGY -III

WT-356   WORKSHOP TECHNOLOGY lll

Total contact Hours   **T**   **P**   **C**

    Theory   64 **Hours**   2   12   6
    Practical   384 **Hours**

AIMS: At the end of this course, the student will have a good theoretical and
working knowledge of different types of grinding machines and will also be
familiarized with the selection of grinding wheels and the use of diamond wheels.
Student will be also able to work on different conventional machines (Milling, Jig
Boring, Jig Grinding) and CNC Machines (CNC Lathe, CNC Machining centre, Wire
Cut & EDM Sinker)

COURSE CONTENTS

1.	GRINDING	2 Hours
2.	DRIVE OF GRINDING MACHINE	1 Hours
3.	CONSTRUCTONAL DETAILS OF CYLINDRICAL GRINDING MACHINE	
		2 Hours
4.	ACCESSORIES FOR UNIVERSAL CYLINDRICAL GRINDING MACHINE	4 Hours
5.	GRINDING WHEELS	2 Hours
6.	DIAMOND WHEELS	1 Hours
7.	PEDESTAL GRAINDER	1 Hours
8.	CYLINDRICAL GRINDING	3 Hours
9.	INTERNAL CYLINDRICAL GRINDING	1 Hours
10.	TOOL & CUTTER GRINDER	2 Hours
11.	CENTRELESS GRINDING	1 Hours
12.	THREAD GRINDING	2 Hours
13.	JIG BORING	2 Hours
14.	GEAR CUTTING	3 Hours
15.	BROACHING	1 Hours
16.	HONING	1 Hours
17.	ELECTRO – EROSION MACHINING	1 Hours
18.	ELECTROLYTICALLY ASSISTED SHARPENING AND LAPPING	1 Hours
19.	THE OPTICAL DIVIDING HEAD AND OPTICAL CIRCULAR TABLE	3 Hours
20.	CNC MACHINES PROGRAMMING	10 Hours
21.	CNC LATHE AND MILLING MACHINES	2 Hours
22.	GRAPHIC DISPLAY TYPE AUTO PROGRAMMING SYSTEM	1 Hours
23.	PROGRAMMING EXAMPLE	1 Hours
24.	GENERAL INFORMATION	2 Hours

25.	MACHINE OPERATING MODES	6 Hours
26.	PROGRAMMING MODE	6 Hours

DETAIL OF COURSE CONTENTS

1.   GRINDING   2Hours
1.1   Grinding machines
1.2   Pedestal grinders
1.3   Tool post grinders
1.4   Universal cylindrical grinding
1.5   External cylindrical grinding
1.6   Size controlled external cylindrical grinder
1.7   Internal cylindrical grinder
1.8   Surface Grinder
1.9   Tool & cutter grinder
1.10   Tool and cutter grinder
1.11   Parts of grinder
1.12   Centre less grinder (External)
1.13   Centre less grinder (Internal)
1.14   Thread grinder
1.15   Profile grinders
1.16   Jig grinder

2.   DRIVE OF GRINDING MACHINE   2 Hours
2.1   Mechanical drive
2.2   Hydraulic drive

3.   CONSTRUCTONAL DETAILS OF CYLINDRICAL GRINDING MACHINE
                                                                          4 Hours
3.1   The Bed
3.2   Wheel head and slide
3.3   The spindle
3.4   The table
3.5   Work head
3.6   Work steadies

4.   ACCESSORIES FOR UNIVERSAL CYLINDRICAL GRINDING MACHINE
                                                                          4 Hours

4.1   Swiveling work-head with lever operated draw-bar
- Swiveling work-head with 3 jaw chuck
- Swiveling work-head with face piate mounted
- Swiveling work table mounted with special head stock
4.2   Fixed transverse work-head with magnetic chuck
4.3   Face plate

4.4	Three jaw steady rest
4.5	Universal steady rest
4.6	Internal grinding attachment with mounted spindle
4.7	Internal grinding attachment with mounted spindle
4.8	Wheel balancing device
4.9	Universal diamond holder
4.10	Hinged wheel dressing device
4.11	Swiveling dressing device
4.12	Radius dressing device
4.13	Table aligning device
4.14	Steep taper grinding attachment

- Steep taper grinding attachment with prismatic steady

| 4.15 | Special purpose work head |

5. GRINDING WHEELS   4 Hours

5.1 The abrasive
5.2 Bond
    5.2.1 Vitrified bond
    5.2.2 Silicate bond
    5.2.3 Shellac bond
    5.2.4 Rubber bond
    5.2.5 Synthetic resin bond
5.3 Grit and grade
5.4 Wheel structure
    5.4.1 Wheel shape
    5.4.2 Wheel selection
    5.4.3 The abrasive
    5.4.4 The bond (grade)
    5.4.5 The process
5.5 Wheel classification
5.6 Wheel mounting
5.7 Wheel balancing
5.8 Wheel truing and dressing
5.9 Wheel speeds
5.10 operating faults – loading & Glazing
    1.5.11 Grinding fluids
    1.5.12 Grinding wheel recommendations

6. DIAMOND WHEELS

                                                      2 Hours

6.1 Resinoid bonded
6.2 Metal bonded
6.3 Diamond wheel grit sizes
6.4 Diamond wheel grades
6.5 Diamond concentration

7. PEDESTAL GRAINDER

3 Hours

7.1   Hand grinding and turning tool
7.2   Chip breaking
7.3   Tool pot grinding on lathe

8. CYLINDRICAL GRINDING

3 Hours

8.1   External cylindrical grinding
8.2   Speed and feed of work
8.3   Longitudinal feed
8.4   Radial (in) feed
8.5   Plunge cut grinding
8.6   Facing
8.7   Water supply
8.8   Vibration and chatter
8.9   Operating the machine
8.10 Grinding to shoulder
8.11 Taper grinding
8.12 Facing

9. INTERNAL CYLINDRICAL GRINDING   **2 Hours**
9.1.   Construction detail
9.2   The spindle
      1.17 Speeds and driving
      1.18 Internal wheels
9.3   Work setting
9.4   Machine operation
9.5   Operation sequence

10. SURFACE GRINDING   **2Hours**

     10.1.   Disc wheel
     10.2.   Cup (ring) wheel
     10.3.   Wheels
     10.4.   Wheel truing
     10.5.   Work holding
     10.6.   The vice
     10.7.   The magnetic chuck
     10.8.   Laminated packing
     10.9.   Permanent magnetic chuck
     10.10. Demagnetization
     10.11. Surface grinding machine
     10.12. To grind a pair of parallel strips
     10.13. To grind up a pair of vie – block
     10.14. To grind the gauge

10.15. Speed and feed of work

10. TOOL & CUTTER GRINDER

3 Hours

- Cutter grinding and setting
- Clearance
- Setting for grinding
- Set – ups for fluted cutters
- Reamers and taps
- Machine relieved cutters
- **Cut – Off Grinding Or Part Of Grinding**

11. CENTRELESS GRINDING

3 Hours

- The principle of centre less grinding
- Types of work
- The grinding wheel
- The control wheel
- Longitudinal feed
- The work rest and guides
- Wheel truing
- Special attachment
- Concentric grinding attachment
- Work Ejection
- Bar grinding
- Hopper feed
- Swarf separation
- Lobing
- Scope of the process
- Controlled cycle of in feed grinding
- Centre less grinding troubles

12. THREAD GRINDING

3 Hours

- Wheel forming
- Profile grinding
- Grinding with a straight wheel
- Grinding with a formed wheel
- The Co – ordinate method
- Contour, or Profile grinding machine
- Key to illustration
- Assembling diamond carrier
- Clocking assembly
- The diamond tools
- Template making with deacon "A" preparation diagram

- Stylus points & flanks guards
- Profile grinding machine types PSM 150 & 250
- Features of profile grinding machine
- Features of template milling machines
- Template milling machines

13. JIG BORING   **3 Hours**

- Jig boring machines
- Co – ordinate dimensioning
- The SIP jig boring machine
- Locating microscope
- Locating dial indicator
- "L" type boring tool holders
- Advices with regards to "L" type tool holder
- Sharpening the cutters
- Diameter limitation for "L" type tool holder
- Spotting tool
- Precision depth measuring device
- Advice and information's
- Laying out of drawings
- Clamping work pieces
- Liming up work pieces
- Recommended cutting speeds
- Feeds
- Coolant to be used
- Some advices
- Standard temperature

14. GEAR CUTTING
                                                              3 Hours
- Generating
- Generation by rack
- Master gear
- Form cutting methods
- Automatic gear cutting machine
- Generating methods of cutting
- The sunder land method
- The gear shaper
- Gear Hobbling

15. BROACHING
                                                              3 Hours
- Machines
- Electro mechanical machines

- Operation of Broaching
- Broach design
- Internal broaches
- Front rake
- Land and relief
- Formed relieved teeth
- Rate of cut
- Surface broaches
- Key-way broaching
- Internal helical splines
- Continuous broaching
- Materials speeds coolants

16. **HONING**

2 Hours

- Honing stones
- Honing equipment
- Super finishing
- Lapping

17. **ELECTRO – EROSION MACHINING**

3 Hours

- Arc discharging machining
- Spark machining
- Electro – erosion machines & methods
- Characteristics and applications

18. **ELECTROLYTICALLY ASSISTED SHARPENING AND LAPPING**

- Electrolytically assisted abrasive machining　　**2 Hours**

19. **THE OPTICAL DIVIDING HEAD AND OPTICAL CIRCULAR TABLE**

3 Hours

- Universal measuring block
- Features of optical dividing head
- Operating principles
- Indexing operation
- Division tester

20. **MECHANICAL EXAMINATION**   **7 Hours**
- Quantitative measure of finish
- The centre line average height
- Practical application
- Indexing operation
- Division tester

21. **CNC MACHINES PROGRAMMING**
   CNC MACHINES
- History of NC   **8 Hours**
- Operation of conventional machine
- Operation of NC machine
- Operators Function
- Co – ordinate system
- Selection of reference point
- Programming language
- Introduction into programming
- Programming procedure
- Dimensioning
- Linear interpolation
- Circular interpolation
- Compensation on contour
- Paraxial tool compensation
- Rounding of corners
- Beveling of corners
- Contour pockets
- Mirror imaging
- Canned cycles
- Addresses
- Sequence of programming steps
- Programming exercise

22. **CNC LATHE AND MILLING MACHINES**

                                                                 4 Hours

- Introduction of system
- Install and start controller
- Introduction of control panel
- Switching window
- ISO Code manually program
- Example

23. <u>GRAPHIC DISPLAY TYPE AUTO PROGRAMMING SYSTEM</u>

2 Hours

- A Brief introduction
- Operation
- Basic Operation

24. <u>PROGRAMMING EXAMPLE</u>

2 Hours

- C.N.C. Lathe
- C.N.C. Milling

25. <u>GENERAL INFORMATION</u>

4 Hours

- Introduction
- MOD Functions
- Coordinates
- Linear and Angle Encoders

26. <u>MACHINE OPERATING MODES</u>

6 Hours

- Switch – on
- Manual operation
- Setup
- Electronic Hand wheel / Incremental Jog
- Positioning with Manual data input
- Program run
- Re – Approaching

27. <u>PROGRAMMING MODES</u>

6 Hours

- Conversational Programming
- File Management
- Program selection
- Tool Definition
- Tool call
- Feed rate F / rotational speed of C axis
- Miscellaneous Functions M
- Programmable stop / Dwell time
- Path Movements
- Linear movement Cartesian
- Circular movement Cartesian
- Polar coordinates
- Contour approach and departure
- Predetermined M Function
- Program jumps

- Program calls
- Standard cycles
- Coordinate transformations
- Other cycles
- Parameter programming
- Programmed probing
- Actual position capture
- Test graphics
- Counting the Machining time
- External data transfer

Recommended Book and Notes

| I) | Workshop Technology III | Published by PSTC, PCSIR |
| 2) | CNC Machines Programming | Published by PSTC, PCSIR |

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WT-356   **Workshop Technology-III**
                  List of Practical   384 Hours

1.   Helical Gear Cutting Exercise (Left hand and Right Hand)
2.   Key Ways Exercise
3.   Sliding Fit Assembly Exercise
4.   Plate Jig Exercise
5.   Surface Grinding Exercise
6.   Tool Grinding Exercise
7.   Cutter Grinding Exercise
8.   Internal Grinding Exercise
9.   External Grinding Exercise
10. Jig Boring Exercise
11. Square Thread Cutting Exercise
12. Lapping & Buffing Exercise
13. CNC Lathe & Milling Exercises
14. Linear interpolation exercise
15. Circular interpolation exercise
16. Absolute dimensional exercise
17. Incremental dimensional exercise
18. Canned cycle exercise
19. Deep hole drilling exercise
20. Boring exercise
21. Honing and Lapping exercise
22. Mirroring exercise
23. Taper cutting exercise
24. Final Project and its Report

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