

**CURRICULUM FOR  
DIPLOMA OF ASSOCIATE ENGINEER  
IN  
DIES & MOULD TECHNOLOGY  
(4 - Years Course)**

**ADVANCED DIPLOMA OF ASSOCIATE ENGINEER IN**  
**MECHANICAL TECHNOLOGY WITH SPECIALIZATION IN DIES AND MOULDS**  
**(04 Years) SCHEME OF STUDIES 1<sup>st</sup> YEAR**

<b>IST YEAR</b>			<b>T</b>	<b>P</b>	<b>C</b>	<b>Page</b>
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	
<b>T O T A L</b>			<b>13</b>	<b>27</b>	<b>22</b>	
<b>2ND YEAR</b>						
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	
<b>T O T A L</b>			<b>12</b>	<b>30</b>	<b>22</b>	
<b>3RD YEAR</b>						
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	
<b>T O T A L</b>			<b>13</b>	<b>27</b>	<b>22</b>	
<b>4TH YEAR</b>						
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	
<b>T O T A L</b>			<b>13</b>	<b>27</b>	<b>22</b>	

**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

قرآن مجید

- 3 کل وقت: 20 گھنٹے
- 1- تعارف قرآن مجید 2- نزول قرآن 3- کئی ومدنی سورتوں کی خصوصیات 4- وحی کی اقسام 3  
5- پندرہ منتخب آیات مع ترجمہ

1- لن تنالوا البر حتی تنفقوا مما تحبون

2- واعتصموا بحبل اللہ جمیعاً ولا تفرقوا

3- ولا یجرمنکم شیطان قوم علی ان لا تعدلوا

4- ان اللہ یمرکم ان تودوا الامانات الی اهلها

5- ان اللہ یمر بالعدل والاحسان

6- ان الصلوۃ تنہی عن الفحشاء والمنکر

7- لقد کان لکم فی رسول اللہ اسوۃ حسنۃ

8- ان اکرمکم عند اللہ اتقاکم

9- وما اتاکم الرسول فنخذوه وما نہاکم عنه فانتہوا

10- واولفوا بالعہد

11- وعاشروہن بالمعروف

12- یمحق اللہ الریب ویربی الصدقات

13- واصبر علی ما اصابک

14- وقولوا قولاً سدیداً

15- ان الدین عند اللہ الاسلام

(ب) سنت

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

(5)

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

(5)

- 1- توحید
  - 2- رسالت
  - 3- آخرت
  - 4- ملائکہ
  - 5- آسمانی کتب
- 2.2 عبادات
- 1- نماز
  - 2- روزہ
  - 3- حج
  - 4- زکوٰۃ
- مندرجہ بالا عبادات کی اہمیت و فضیلت، حکمتیں اور انسان کی انفرادی و معاشرتی زندگی پر اس کے اثرات

## حصہ اول

### تدریسی مقاصد

### حصہ اسلامیات

#### 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 مقاصد۔ طالب علم اس قابل ہو جائے گا 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 عبادت کے مطابق اپنی زندگی ڈھال کر ایک اچھا مسلمان بن سکے۔

سال اول (غیر مسلم طلباء کیلئے)

Gen III

نصاب اخلاقیات  
حصہ اول اخلاقیات

سی پی ٹی  
1 0 1

کل وقت: 20 گھنٹے

حصہ دوم مطالعہ پاکستان

موضوعات

اخلاقیات کی تعریف اور اہمیت

اخلاقیات کا معیار (قانون - عقل - الہامی کتب)

مندرجہ ذیل اخلاق کی وضاحت

دیانت داری

وفا داری

نظم و ضبط

راست گوئی

صبر و استقلال

حوصلہ مندی

وقت کی پابندی

صفائی

اعتماد

باہمی احترام

مصلحت



## نصاب اخلاقیات سال اول

### تدریسی مقاصد

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

خصوصی مقاصد۔ طالب علم اس قابل ہوگا کہ:

- موضوعات کا مطلب بیان کر سکے۔
- عملی زندگی سے مثالوں کی نشاندہی کر سکے۔
- اپنی شخصیت اور معاشرے پر موضوعات کے مثبت اثرات پیدا کرنے کے طریقے بیان کر سکے
- دیانت داری کی اہمیت بیان کر سکے۔
- وقاداری کی اہمیت بیان کر سکے۔
- نظم و ضبط کی افادیت بیان کر سکے۔
- صدق بیان کی ضرورت بیان کر سکے۔
- حوصلہ مندی کے فوائد بیان کر سکے
- وقت کی پابندی کے فوائد بیان کر سکے
- صفائی اور باہمی اعتماد سے حسن کارکردگی کو بیان کر سکے
- مصلحت کے فوائد بیان کر سکے

مطالعہ پاکستان

حصہ دوم

تدریسی مقاصد - حریت فکر:

عمومی مقصد - طالب علم یہ جان لے کہ اسلام میں اور مسلمان قوم میں آزادی فکر کی کیا اہمیت ہے۔

خصوصی مقاصد:

- حریت فکر کا معنی و مفہوم بیان کر سکے۔

- آزادی فکر کی اہمیت بیان کر سکے۔

- خصوصاً اسلام میں آزادی اظہار رائے کی اہمیت بیان کر سکے۔

- 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 کی روشنی میں نظریہ پاکستان بیان کر سکے۔

نظریہ پاکستان کا تاریخی پہلو

عمومی مقصد - نظریہ پاکستان کے تاریخی پس منظر سے واقفیت حاصل کر سکے۔

خصوصی مقاصد - محمد بن قاسم کے بارے میں بیان کر سکے۔

## موضوعات

- حریت فکر
- مسلمان قوم میں آزادی فکر کی تاریخ۔ مسلمانوں میں سیاسی آزادی کی اہمیت اور ضرورت۔ ذہنی و جسمانی غلامی کے نقصانات
- نظریہ پاکستان
- قیام پاکستان کی اساس (دین اسلام) قیام پاکستان کی غرض و غایت۔ نظریہ پاکستان کی وضاحت۔ نظریہ پاکستان علامہ اقبال اور قائد اعظم کے ارشادات کی روشنی میں
- نظریہ پاکستان کا تاریخی پہلو
- محمد بن قاسم کی آمد۔ مجدد الف ثانی اور شاہ ولی اللہ کی تبلیغی خدمات، سید احمد شہید کی تحریک مجاہدین
- تعلیمی تحریکیں
- علی گڑھ۔ ندوۃ العلماء۔ دیوبند۔ مدرسۃ الاسلام (سندھ)۔ اسلامیہ کالج (پشاور)۔ انجمن حمایت اسلام (لاہور)
- محمد بن قاسم کے ہندوستان پر حملہ کی وجہ بیان کر سکے
- محمد بن قاسم کے ہندوستان پر حملہ کے اثرات بیان کر سکے
- وہ بیان کر سکے کہ ہندوستان میں ہندو مسلم دو قومی نظریہ کا نکتہ آغاز کیا ہے۔
- مجدد الف ثانی کی علمی خدمات بیان کر سکے
- شاہ ولی اللہ کی علمی خدمات بیان کر سکے
- مجدد الف ثانی اور شاہ ولی اللہ نے جو تبلیغ دین اور مسلمانوں میں سیاسی شعور پیدا کیا اسے بیان کر سکے۔
- علمی تحریکیں
- عمومی مقصد۔
- برصغیر کی علمی 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 11<sup>th</sup> word or any word for that matter will be omitted. The number of missing word will range between 5-10. The chosen word may or may not be the one used in the text, but it should be an appropriate word.

#### **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

**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**

<b>Total contact hours</b>	96	<b>T</b>	<b>P</b>	<b>C</b>
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**

<b>1</b>	<b>QUADRATIC EQUATIONS</b>	<b>6 Hrs</b>
1.1	Standard Form	
1.2	Solution	
1.3	Nature of roots	
1.4	Sum & Product of roots	
1.5	Formation	
1.6	Problems	
<b>2</b>	<b>ARITHMETIC PROGRESSION AND SERIES</b>	<b>3Hrs</b>
2.1	Sequence	
2.2	Series	
2.3	nth term	
2.4	Sum of the first n terms	
2.5	Means	
2.6	Problems	
<b>3</b>	<b>GEOMETRIC PROGRESSION AND SERIES</b>	<b>3Hrs</b>
3.1	nth term	
3.2	sum of the first n terms	
3.3	Means	
3.4	Infinite Geometric progression	
3.5	Problems	
<b>4</b>	<b>BINOMIAL THEOREM</b>	<b>6 Hrs</b>
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	
<b>5</b>	<b>PARTIAL FRACTIONS</b>	<b>6 Hrs</b>
5.1	Introduction	
5.2	Linear Distinct Factors      Case I	
5.3	Linear Repeated Factors      Case II	
5.4	Quadratic Distinct Factors Case III	
5.5	Quadratic Repeated Factors Case IV	
5.6	Problems	
<b>6</b>	<b>FUNDAMENTALS OF TRIGONOMETRY</b>	<b>6 Hrs</b>
6.1	Angles	
6.2	Quadrants	
6.3	Measurements of Angles	
6.4	Relation between Sexagesimal & circular system	
6.5	Relation between Length of a Circular Arc & the Radian Measure of its central Angle	
6.6	Problems	
<b>7</b>	<b>TRIGONOMETRIC FUNCTIONS AND RATIOS</b>	<b>6 Hrs</b>
7.1	trigonometric functions of any angle	
7.2	Signs of trigonometric Functions	
7.3	Trigonometric Ratios of particular Angles	
7.4	Fundamental Identities	
7.5	Problems	
<b>8</b>	<b>GENERAL IDENTITIES</b>	<b>6 Hrs</b>
8.1	The Fundamental Law	
8.2	Deductions	
8.3	Sum & Difference Formulae	
8.4	Double Angle Identities	
8.5	Half Angle Identities	
8.6	Conversion of sum or difference to products	
8.7	Problems	
<b>9</b>	<b>SOLUTION OF TRIANGLES</b>	<b>6 Hrs</b>
9.1	The law of Sines	
9.2	The law of Cosines	
9.3	Measurement of Heights & Distances	
9.4	Problems	
<b>10</b>	<b>MENSURATION OF SOLIDS</b>	<b>30 Hrs</b>
10.1	Review of regular plane figures and Simpson's Rule	
10.2	Prisms	
10.3	Cylinders	
10.4	Pyramids	
10.5	Cones	

- 10.6 Frusta
- 10.7 Spheres

## **11 VECTORS**

**9 Hrs**

- 11.1 Scalars & Vectors
- 11.2 Addition & Subtraction
- 11.3 The unit Vectors  $i, j, k$
- 11.4 Direction Cosines
- 11.5 Scalar or Dot Product
- 11.6 Deductions
- 11.7 Dot product in terms of orthogonal components
- 11.8 Deductions
- 11.9 Analytic Expression for  $a \times b$ .
- 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.

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

**5 RESOLVE A SINGLE FRACTION INTO PARTIAL FRACTIONS USING DIFFERENT METHODS.**

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

**6 UNDERSTAND SYSTEMS OF MEASUREMENT OF ANGLES.**

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

**7 APPLY BASIC CONCEPTS AND PRINCIPLES OF TRIGONOMETRIC FUNCTIONS**

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

**8 USE TRIGONOMETRIC IDENTITIES IN SOLVING TECHNOLOGICAL PROBLEMS**

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

**9 USE CONCEPTS, PROPERTIES AND LAWS OF TRIGONOMETRIC FUNCTIONS FOR SOLVING TRIANGLES**

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

**10 USE PRINCIPLES OF MENSTRUATION IN FINDING SURFACES, VOLUME AND 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 SOLVING TECHNOLOGICAL PROBLEMS.**

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

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

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

**Phy-122**  
**APPLIED PHYSICS**

**Phy-122 APPLIED PHYSICS****Total Contact Hours**

Theory	32	<b>T</b>	<b>P</b>	<b>C</b>
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**

- |           |                                                              |                |
|-----------|--------------------------------------------------------------|----------------|
| <b>1</b>  | <b>MEASUREMENTS.</b>                                         | <b>2 Hrs</b>   |
| 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                                          |                |
| <b>2.</b> | <b>SCALARS AND VECTORS.</b>                                  | <b>4 Hrs</b>   |
| 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 |                |
| <b>3.</b> | <b>MOTION</b>                                                | <b>4 Hours</b> |
| 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                                  |                |
| <b>4.</b> | <b>TORQUE, EQUILIBRIUM AND ROTATIONAL INERTIA</b>            |                |
| 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                                           |                |
| <b>5.</b> | <b>WAVE MOTION</b>                                           | <b>5 Hrs</b>   |
| 5.1       | Review Hooke's law of elasticity,                            |                |
| 5.2       | Motion under an elastic restoring force.                     |                |
| 5.3       | Characteristics of simple harmonic motion                    |                |
| 5.4       | S.H.M. and circular motion                                   |                |

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



### **RECOMMENDED 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

**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.

**LIST OF PRACTICALS**

1. Draw graphs representing the functions:
  - a)  $y=mx$  for  $m=0, 0.5, 1, 2$
  - b)  $y=x^2$
  - c)  $y = 1/x$
2. Find the volume of a given solid cylinder using 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 of moments.
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 column in 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**

<b>T</b>	<b>P</b>	<b>C</b>
1	3	2

**Total Contact Hours**

Theory	<b>32</b>
Practical	<b>64</b>

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**

<b>1</b>	<b>INTRODUCTION AND FUNDAMENTAL CONCEPTS</b>	<b>2 Hrs</b>
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	
<b>2</b>	<b>ATOMIC STRUCTURE</b>	<b>2 Hrs</b>
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	
<b>3</b>	<b>CHEMICAL BOND</b>	<b>2 Hrs</b>
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	
<b>4</b>	<b>WATER</b>	<b>2 Hrs</b>
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	
<b>5</b>	<b>ACIDS, BASES AND SALTS</b>	<b>2 Hrs</b>

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	
<b>6</b>	<b>OXIDATION &amp; REDUCTION</b>	<b>2 Hrs</b>
6.1	The process, definition& examples	
6.2	Oxidizing and reducing agents	
6.3	Oxides and their classifications	
<b>7</b>	<b>NUCLEAR CHEMISTRY</b>	<b>2 Hrs</b>
7.1	Introduction	
7.2	Radioactivity (alpha, beta and gamma rays)	
7.3	Half life process	
7.4	Nuclear reaction & transformation of elements	
<b>8</b>	<b>CEMENT</b>	<b>2 Hrs</b>
8.1	Introduction	
8.2	Composition and manufacture	
8.3	Chemistry of setting and hardening	
8.4	Special purpose cements	
<b>9</b>	<b>GLASS</b>	<b>2 Hrs</b>
9.1	Composition and raw material	
9.2	Manufacture	
9.3	Varieties and uses	
<b>10</b>	<b>PLASTICS AND POLYMERS</b>	<b>2 Hrs</b>
10.1	Introduction and importance	
10.2	Classification	
10.3	Manufacture	
10.4	Properties and uses	
<b>11</b>	<b>PAINTS, VARNISHES AND DISTEMPER</b>	<b>2 Hrs</b>
11.1	Introduction	
11.2	Constituents	
11.3	Preparation and uses	
<b>12</b>	<b>CORROSION</b>	<b>2 Hrs</b>
12.1	Introduction with causes	
12.2	Types of corrosion	
12.3	Rusting of iron	
12.4	Protective measures against-corrosion	
<b>13</b>	<b>REFRACTORY MATERIALS AND ABRASIVE</b>	<b>2 Hrs</b>
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	
<b>14</b>	<b>ALLOYS</b>	<b>2 Hrs</b>
14.1	Introduction with need	
14.2	Preparation and Properties	
14.3	Some Important alloys and their composition	
14.4	Uses	
<b>15</b>	<b>FUELS AND COMBUSTION</b>	<b>2 Hrs</b>
15.1	Introduction of fuels	
15.2	Classification of fuels	
15.3	Combustion	
15.4	Numerical Problems of Combustion	
<b>16</b>	<b>LUBRICANTS</b>	<b>1 Hr</b>
16.1	Introduction.	
16.2	Classification.	
16.3	Properties of lubricants.	
16.4	Selection of lubricants:	
<b>17</b>	<b>POLLUTION</b>	<b>1 Hr</b>
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)

**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 no. 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 BOND**

- 3.1 Define chemical bond
- 3.2 Describe the nature of chemical bond
- 3.3 Differentiate between electrovalent and 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/liter, 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 half-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 for, particular purpose/job

## **17 UNDERSTAND THE NATURE 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**

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

**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

**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 PROCESSING)**

- 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**
- II. Introduction to Computers**

**By Shelley Cashman Series**  
**By Peter Norton**



**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

**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

		<b>T</b>	<b>P</b>	<b>C</b>
<b>Total contact Hours</b>		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.

### **COURSE CONTENTS**

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

### **DETAIL OF COURSE CONTENTS**

- 1. HOLDING DEVICES **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. FILES AND SAWS **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	
<b>8.</b>	<b><u>INSTRUMENTS FOR CHECKING SURFACES</u></b>	<b>4 Hours</b>
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	
<b>9.</b>	<b><u>MEASURING INSTRUMENTS</u></b>	<b>12 Hours</b>
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	
	<ul style="list-style-type: none"> <li>• Micrometer depth gauge</li> <li>• Micrometer head</li> <li>• Thread micrometer</li> <li>• Tube Micrometer</li> <li>• Bench micrometer</li> <li>• Inside Micrometer</li> </ul>	
9.9.	Tools for transferring measurements	
	<ul style="list-style-type: none"> <li>• Dividers</li> <li>• Calipers(Outside, Inside, Odd leg)</li> </ul>	
<b>10.</b>	<b><u>METAL CUTTING</u></b>	<b>6 Hours</b>
10.1.	Geometry of Single point cutting Tool	
10.2.	Cutting tool Materials.	
	<ul style="list-style-type: none"> <li>• High speed steel</li> <li>• Carbides</li> <li>• Ceramics</li> <li>• Cermets</li> <li>• Diamond</li> </ul>	
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

**INSTRUCTIONAL OBJECTIVE**

Instructors/Teachers must ensure to

- 1. DEVELOP KNOWLEDGE OF HOLDING DEVICES      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. DEVELOP KNOWLEDGE OF FILES AND SAWS      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. DEVELOP KNOWLEDGE OF HAND TOOLS      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. DEVELOP KNOWLEDGE OF IMPACT/STRIKING TOOLS      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**

- |                                                                                                                                              |                                                                                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>I. Workshop Technology (Part – 1)</b></p> <p><b>II. Technology of Machine Tools</b></p> <p><b>III. Workshop Technology (Vol-1)</b></p> | <p><b>By W. A. J. Chapman</b></p> <p><b>By Steve F. Krar, Albert F. Check</b></p> <p><b>By Mr. Rudolph Brunner</b></p> <p><b>Published by PSTC, PCSIR</b></p> |
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**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
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**MT-141****HEALTH SAFETY AND ENVIRONMENT**

<b>Total Contact Hours</b>		<b>T</b>	<b>P</b>	<b>C</b>
<b>Theory:</b>	<b>32Hrs</b>	<b>1</b>	<b>0</b>	<b>1</b>

**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:**

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

**Detail of Contents:**

<b>1. Introduction and Importance of Safety</b>	<b>1Hr</b>
1.1 Introduction to safety and House keeping	
1.2 Importance in Institute workshops /labs	
1.3 Importance in industry	
1.4 Accident cost	
<b>2. Accidents in Chemical Industry</b>	<b>2 Hrs</b>
2.1 Accidents in petroleum, paint and fertilizer industry	
2.2 Explosive vapors and gases	
<b>3. Accidents in Mechanical Industry</b>	<b>3 Hrs</b>
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	
<b>4.</b>	<b>Accidents in Flow Production Industry</b>	<b>2 Hrs</b>
4.1	Accidents in textile mills, paper mills & food Industries	
<b>5.</b>	<b>Accidents in other Industries</b>	<b>2Hrs</b>
5.1	Accidents in mines	
5.2	Accidents in leather industries	
5.3	Accidents in power plant	
<b>6.</b>	<b>Electric shocks &amp; Earthing (Prevention and its remedy)</b>	<b>2Hrs</b>
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	
<b>7.</b>	<b>Fire accidents and their prevention</b>	<b>3 Hrs</b>
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	
<b>8.</b>	<b>Safety in plant Lay-out</b>	<b>2 Hrs</b>
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	
<b>9.</b>	<b>Personal Protective Equipment (PPE)</b>	<b>2 Hrs</b>
9.1	Useful protective device	
9.2	Personal protective device and its importance	
9.3	Protection from chemicals and gases	
<b>10.</b>	<b>Environmental Safety</b>	<b>3 Hrs</b>
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	
<b>11.</b>	<b>Pollution</b>	<b>2 Hrs</b>
11.1	Atmosphere	
11.2	Water pollution	
11.3	Solid waste management	

- |                                                                                 |                |
|---------------------------------------------------------------------------------|----------------|
| <b>12. First Aid</b>                                                            | <b>2 Hours</b> |
| 12.1 Importance                                                                 |                |
| 12.2 Procedure and training                                                     |                |
| 12.3 Extended medical services                                                  |                |
| <b>13. Analyzing Causes of Accidents</b>                                        | <b>3 Hrs</b>   |
| 13.1 Accident prevention fundamentals                                           |                |
| 13.2 Plant inspections and accidents investigation                              |                |
| 13.3 Safety inventory, auditing, records and annual reports                     |                |
| <b>14. Promoting Safety Culture</b>                                             | <b>1 Hr</b>    |
| 14.1 Employees training culture                                                 |                |
| 14.2 Displays                                                                   |                |
| 14.3 Guidance                                                                   |                |
| <b>15. Safety Regulations &amp; adherence to International Safety Standards</b> | <b>2Hrs</b>    |
| 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                                                    |                |

**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, plant 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**

## **TECHNICAL DRAWING**

<b>Total Contact Hours</b>		<b>T</b>	<b>P</b>	<b>C</b>
Theory	<b>32 Hours</b>	1	6	3
Practical	<b>192 Hours</b>			

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

### **COURSE CONTENTS**

1. **INTRODUCTION** **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. **STANDARD LETTERING** **4 Hours**
  - 2.1. Definition and importance
  - 2.2. Types of lettering
  
3. **ELEMENTARY DRAWING PRINCIPLES** **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. **ORTHOGRAPHIC PROJECTON** **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 1<sup>st</sup> year Engineering Drawing

By A.C. Parkinsin

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**TD-153**

**Technical Drawing**

**List of Practical**

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 ENGINEER IN**  
**MECHANICAL TECHNOLOGY WITH SPECIALIZATION IN DIES AND MOULDS**  
**(04 Years) SCHEME OF STUDIES 2<sup>nd</sup> YEAR**

<b>1ST YEAR</b>			<b>T</b>	<b>P</b>	<b>C</b>	<b>Page</b>
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	
<b>T O T A L</b>			<b>13</b>	<b>27</b>	<b>22</b>	
<b>2ND YEAR</b>						
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	
<b>T O T A L</b>			<b>12</b>	<b>30</b>	<b>22</b>	
<b>3RD YEAR</b>						
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	
<b>T O T A L</b>			<b>13</b>	<b>27</b>	<b>22</b>	
<b>4TH YEAR</b>						
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	
<b>TOTAL</b>			<b>13</b>	<b>27</b>	<b>22</b>	

**Gen-211**  
**ISLAMIAT AND PAK.STUDIES**

## اسلامیات/مطالعہ پاکستان

نصاب (سال دوم)

حصہ اول اسلامیات Gen 211 ٹی پی سی  
1 0 1

حصہ دوم مطالعہ پاکستان

موضوعات

کل وقت: 20 گھنٹے

1- سورہ المؤمنوں ایک تا گیارہ آیات مع ترجمہ

2- دس منتخب احادیث مع ترجمہ و تشریح

- خیر کم من تعلم القرآن و علمه
- لا ایمان لمن لا امانة له و لا دین لمن عہدہ
- ایاکم و الظن ان الظن اکذب الحدیث
- من احدث فی امرنا هذا ما لیس منه فہورد
- من حمل علینا السلاح فلیس منا
- انا و کافل الیتیم فی الجنة هكذا
- لا یومن احد کم حتی اكون احب الیہ من والده و ولده و الناس اجمعین
- من بنی لله مسجد ابنی الله له بیتاً فی الجنة
- لا ضرر و لا ضرار فی الاسلام
- کلکم راع و کلکم مسئول عن رعیتہ

3- سیرت طیبہ

- مکی زندگی، ولادت، بعثت، ہجرت
- مدنی زندگی، مواخات، یثاق مدینہ، فتح مکہ (اسباب و نتائج)

خطبہ حجۃ الوداع

4- حضور ﷺ بحیثیت:

معلم کامل - سربراہ خاندان

5- اسلامی معاشرہ

- نظام تعلیم اور اس کے مقاصد - عدل و انصاف - امر بالمعروف و نہی عن المنکر
- جہاد، کسب حلال، مسجد (اہمیت و فضیلت)

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

تدریسی مقاصد

منتخب آیات قرآنی

قرآن مجید

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

خصوصی مقاصد

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

خصوصی مقاصد

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

سیرت طیبہ

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

خصوصی مقاصد

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



## اسلامی معاشرہ

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

### خصوصی مقاصد

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

## اسلامی ریاست

عمومی مقاصد، اسلامی ریاست کی خصوصیات بیان کر سکے۔

### خصوصی مقاصد

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

نصاب اخلاقیات (غیر مسلم طلباء کیلئے)

ٹی پی سی  
1 0 1

کل وقت 20 گھنٹے

سال دوم

موضوعات

معاشرتی اقدار (بلیاظ 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 آزادی

- 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۔

نصاب مطالعہ پاکستان

ٹی 1  
پی 0  
سی 1

کل وقت 12 گھنٹے

سہ ماہی دوم

حصہ دوم

موضوعات

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

حصہ دوم

مطالعہ پاکستان

تدریسی مقاصد

تحریک پاکستان

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

خصوصی مقاصد

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

**Phy-212**  
**APPLIED MECHANICS**

**Phy-212****APPLIED MECHANICS**

<b>Total Contact Hours</b>		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**

- |                                                            |                |
|------------------------------------------------------------|----------------|
| <b>1. MEASUREMENTS</b>                                     | <b>2 Hours</b> |
| 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                                     |                |
| <b>2. EQUILIBRIUM OF CON-CURRENT FORCES</b>                | <b>3 Hours</b> |
| 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                                      |                |
| <b>3. MOMENTS AND COUPLES:</b>                             | <b>2 Hours</b> |
| 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                                                 |                |
| <b>4. EQUILIBRIUM OF NON CONCURRENT FORCES:</b>            | <b>3 Hours</b> |
| 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                                                |                |
| <b>5. MOMENT OF INERTIA:</b>                               | <b>3 Hours</b> |
| 5.1 Review: Rotational Inertia                             |                |
| 5.2 Moment of Inertia, Theorems                            |                |
| 5.3 Moment of Inertia of symmetrical bodies                |                |

5.4	M.I. of Fly wheel with applications	
5.5	Energy stored by Fly wheel	
<b>6.</b>	<b>FRICITION:</b>	<b>2 Hours</b>
6.1	Review: Laws of friction	
6.2	Motion of body along an inclined plane (up & down)	
6.3	Rolling friction & Ball Bearings	
6.4	Fluid Friction, Stokes' Law	
<b>7.</b>	<b>WORK, ENERGY AND POWER</b>	<b>3 Hours</b>
7.1	Work-Energy relationship	
7.2	Work done by variable.	
7.3	Power	
7.4	I.H.P, B.H.P and Efficiency	
7.5	Dynamometer.	
<b>8.</b>	<b>TRANSMISSION OF POWER</b>	<b>3 Hours</b>
8.1	Belts, Ropes	
8.2	Chains	
8.3	Gears	
8.4	Clutches, functions and types with application.	
<b>9.</b>	<b>MACHINES:</b>	<b>3 Hours</b>
9.1	Efficiency of machines	
9.2	Inclined plane - Review	
9.3	Reversibility of machines	
9.4	Single purchase crab	
9.5	Double purchase crab.	
9.6	Worm and worm wheel.	
9.7	Differential Screw Jack.	
9.8	Differential Pulley, Wheel and Axle	
<b>10.</b>	<b>VIBRATORY MOTION:</b>	<b>2 Hours</b>
10.1	S.H.M. - Review	
10.2	Pendulums	
10.3	Speed Governors	
10.4	Helical spring	
10.5	Cams	
10.6	Quick return motion	
<b>11.</b>	<b>ELASTICITY:</b>	<b>3 Hours</b>
11.1	Three 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**



- 5. DIFFERENTIATION OF LOGARITHMIC & EXPONENTIAL FUNCTION. 4 Hours**
- 5.1 Differentiation of  $\ln x$
  - 5.2 Differentiation of  $\log ax$
  - 5.3 Differentiation of  $ax$
  - 5.4 Differentiation of  $e^x$
  - 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

**REFRENFCE 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.

**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  $X^n$  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  $\sin x$ ,  $\cos x$ ,  $\tan x$ .
  - 4.2 Derive formula for derivation of  $\sec x$ ,  $\operatorname{cosec} x$ ,  $\cot x$ .
  - 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 VARIABLE 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 TECHNOLOGICAL PROBLEMS**

- 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 DEFINITE 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.

**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**

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

**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:**

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

## **Detail of Contents:**

<b>1. FUNDAMENTALS OF ELECTRICITY</b>	<b>3Hrs</b>
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	
<b>2. PROTECTION DEVICES AND ELECTRICAL SAFETY</b>	<b>5 Hrs</b>
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	
<b>3. MOTORS, GENERATORS AND TRANSFORMERS</b>	<b>5 Hrs</b>
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	
<b>4. (A) MEASURING INSTRUMENTS &amp; WIRING</b>	<b>4 Hrs</b>
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>(B) DOMESTIC WIRING</b>	
4.5 Wiring and their types	
4.6 Estimate of wiring	
<b>5. FUNDAMENTALS OF ELECTRONICS</b>	<b>3 Hrs</b>
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 DEVICES AND 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**

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

**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:**

<b>1. INTRODUCTION TO MEASUREMENT AND QUALITY CONTROL</b>	<b>4Hrs</b>
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	
<b>2. LINEAR MEASUREMENTS SUPPORTING TOOLS</b>	<b>2Hrs</b>
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	
<b>3. GAUGES</b>	<b>2 Hrs</b>
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	
<b>4. ADJUSTABLE MEASURING TOOLS</b>	<b>3 Hrs</b>
4.1 Vernier Caliper	
4.2 Micrometer	
4.3 Dial indicator	
<b>5. ANGLE MEASURING TOOLS</b>	<b>3 Hrs</b>
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	
<b>6. PRECISION MEASURING INSTRUMENTS</b>	<b>3 Hrs</b>
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	
<b>7.</b>	<b>ACCURACY IN MEASUREMENTS</b>	<b>2 Hrs</b>
7.1	Elements of Metrology	
7.2	Classification of Errors	
	7.2.1 Controllable errors	
	7.2.2 Random errors	
7.3	Calibration	
7.4	Repeatability	
<b>8.</b>	<b>DIAL INSTRUMENTS</b>	<b>2 Hrs</b>
8.1	Dial Caliper	
8.2	Dial thickness gauge	
8.3	Dial bore gauge	
<b>9.</b>	<b>TAPER MEASUREMENTS</b>	<b>1 Hr</b>
4.1.	Gauge Block	
4.2.	Sine Bar	
<b>10.</b>	<b>OPTICAL MEASUREMENT</b>	<b>2 Hrs</b>
10.1	Tool Makers Micro Scope	
10.2	Profile Projector/Shadow Graph (50 X)	
10.3	Optical Flats	
<b>11.</b>	<b>COMPARATORS</b>	<b>2 Hrs</b>
11.1	Mechanical Comparator	
11.2	Electrical Comparator	
11.3	Electronic Comparator	
<b>12.</b>	<b>DIGITAL INSTRUMENTS</b>	<b>1 Hr</b>
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)	
<b>13.</b>	<b>COORDINATE MEASURING MACHINE</b>	<b>3Hrs</b>
13.1	Working principle of CMM and its coordinates	
13.2	Part and Accessories	
13.3	Use of CMM	
13.4	Digital 3D Scanner	
<b>14.</b>	<b>GEAR MEASUREMENT</b>	<b>2 Hrs</b>
14.1	Gear Testing machine	
14.2	Backlash 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
  - 5.2.2 Grinding gauges
  - 5.2.3 Tool angle gauge
  - 5.2.4 Drill gauges
  - 5.2.5 Drill point gauge
- 5.3 Discuss adjustable angle measuring tools
  - 5.3.1 Without graduations
    - 5.3.1.1 Sine bar
    - 5.3.1.2 Universal bevel
    - 5.3.1.3 Combination bevel
  - 5.3.2 With Graduations
    - 5.3.2.1 Bevel protractor
    - 5.3.2.2 Vernier bevel protractor
    - 5.3.2.3 Steel protractor
    - 5.3.2.4 Dial protractor

## **6. EXPLAIN FOLLOWING PRECISION MEASURING INSTRUMENTS**

- 6.1 Explain Vernier Height gauge
- 6.2 Explain Vernier depth gauge
- 6.3 Explain Inside Micrometer
- 6.4 Explain Micrometer depth gauge
- 6.5 Thread Micrometer
- 6.6 Explain Hot gauge Micrometer
- 6.7 Explain Vernier Micrometer

## **7. ACCURACY IN MEASUREMENT**

- 7.1 State five basis Metrology Elements
- 7.2 Explain classification of Errors
  - 7.2.1 Controllable Errors
  - 7.2.2 Random Errors
- 7.3 Explain Calibration and its need
- 7.4 Explain Repeatability

## **8. UNDERSTAND THE DIAL INSTRUMENTS**

- 8.1 Describe the use of Dial Caliper
- 8.2 Describe the use of Dial thickness gauge
- 8.3 Describe the use of Dial bore gauge

## **9. TAPER MEASUREMENTS**

- 1.1 Describe the use of Gauge Blocks
- 1.2 Describe the use of Sine Bar

## **10. OPTICAL MEASUREMENTS**

- 10.1 Discuss the use of Tool Makers Microscope
- 10.2 Discuss the use of Optical flats
- 10.3 Discuss the use of Profile projector

## **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:**

- |                                                                      |              |
|----------------------------------------------------------------------|--------------|
| <b>1. PRACTICE OF FOLLOWING GRADUATED TOOLS</b>                      | <b>3Hrs</b>  |
| 1.1 Steel Rule                                                       |              |
| 1.2 Hook Rule                                                        |              |
| 1.3 Folding Rule                                                     |              |
| 1.4 Trammels                                                         |              |
| <b>2. PRACTICE OF COMBINATION SET</b>                                | <b>3Hrs</b>  |
| <b>3. PRACTICE OF FOLLOWING SUPPORTING TOOLS</b>                     | <b>3Hrs</b>  |
| 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                                              |              |
| <b>4. PRACTICE OF FOLLOWING GAUGES</b>                               | <b>6 Hrs</b> |
| 5.1 Fixed gauges                                                     |              |
| 5.2 Adjustable gauges                                                |              |
| 5.3 Small hole gauges                                                |              |
| 5.4 Telescope gauges                                                 |              |
| <b>5. PRACTICE AND USE OF FOLLOWING PRECISION INSTRUMENTS-12 Hrs</b> |              |
| 5.1 Outside Micrometer                                               |              |
| 5.2 Inside Micrometer                                                |              |
| 5.3 Depth Micrometer                                                 |              |
| 5.4 Thread Micrometer                                                |              |
| 5.5 Vernier Micrometer                                               |              |
| <b>6. PRACTICE AND USE OF VERNIER TOOLS</b>                          | <b>9Hrs</b>  |
| 6.1 Vernier caliper                                                  |              |
| 6.2 Vernier Height gauge                                             |              |
| 6.3 Vernier depth gauge                                              |              |
| <b>7. PRACTICE AND USE OF FOLLOWING ANGLE MEASURING TOOLS</b>        | <b>6 Hrs</b> |
| 7.1 Bevel protractor                                                 |              |
| 7.2 Vernier Bevel protractor                                         |              |
| 7.3 Dial protractor                                                  |              |
| 7.4 Steel protractor                                                 |              |
| 7.5 Sine bar                                                         |              |

<b>8. CALCULATION RELATING TO TOLERANCE AND ALLOWANCE</b>	<b>3 Hrs</b>
<b>9. PRACTICE AND USE OF FOLLOWING DIAL INSTRUMENTS</b>	<b>3 Hrs</b>
9.1 Dial Caliper	
9.2 Dial Thickness gauge	
9.3 Dial Indicator	
<b>10. PRACTICE AND USE OF GAUGE BLOCKS</b>	<b>6 Hrs</b>
<b>11. PRACTICE OF TOOL MAKERS MICROSCOPE</b>	<b>6 Hrs</b>
<b>12. PRACTICE OF PROFILE PROJECTOR</b>	<b>3 Hrs</b>
<b>13. PRACTICE AND USE OF FOLLOWING COMPARATORS</b>	<b>9Hrs</b>
13.1 Mechanical comparator	
13.2 Electronic comparator	
13.3 Electrical comparator	
<b>14. PRACTICE AND USE OF DIGITAL INSTRUMENTS</b>	<b>6 Hrs</b>
14.1 Digital Micrometer	
14.2 Digital Caliper	
14.3 Digital Indicator	
14.4 Digital Depth Gauge	
14.5 Digital Height Gauge	
<b>15. PRACTICE OF MEASUREMENT ON CMM</b>	<b>9 Hrs</b>
15.1 Point to point/linear measurement	
15.2 Profile measurement (2D, 3D)	
<b>16. PRACTICE OF THREAD AND GEAR MEASUREMENT</b>	<b>9 Hrs</b>
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 whether zero error exists 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 scribe in height gauge
- 6.2.2 Set zero properly
- 6.2.3 Set the scribe 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 PRACTICE 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 taper 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**

<b>Total Contact Hours</b>		<b>T</b>	<b>P</b>	<b>C</b>
Theory	<b>64 Hours</b>	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	<b>6 Hour</b>
2.	MANUFACTURE OF STEEL	<b>6 Hours</b>
3.	MANUFACTURE OF STEEL PRODUCTS	<b>3 Hours</b>
4.	CASTING	<b>3 Hours</b>
5.	NON-FERROUS METALS AND ITS ALLOYS	<b>6 Hours</b>
6.	MOST COMMON HEAVY METAL ALLOYS	<b>6 Hours</b>
7.	MOST COMMON NON – FERROUS LIGHT METALS	<b>4 Hours</b>
8.	MOST COMMON LIGHT METAL ALLOYS	<b>3 Hours</b>
9.	METHOD OF MANUFACTURING OF SINTERED MATERIALS	<b>3 Hours</b>
10.	CEMENTED CARBIDES	<b>3 Hours</b>
11.	SINTERED OF SELF – LUBRICATING BEARING	<b>3 Hours</b>
12.	PLASTICS	<b>8 Hours</b>
13.	FOUNDRY PRACTICES	<b>10 Hours</b>

**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** 3 Hours  
Production, pressing and sintering of metal powders.

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 MATERIALS** 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<sub>2</sub> 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**

<b>Total Contact Hours</b>		<b>T</b>	<b>P</b>	<b>C</b>
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         | <b>14 Hours</b> |
| 2. Shaper and Planer     | <b>10 Hours</b> |
| 3. Milling               | <b>18 Hours</b> |
| 4. Engraving             | <b>08 Hours</b> |
| 5. Welding and Forging   | <b>10 Hours</b> |
| 6. Soldering and Brazing | <b>04 Hours</b> |

**DETAIL OF COURSE CONTENTS**

- |                                |                 |
|--------------------------------|-----------------|
| <b>1. LATHE MACHINES</b>       | <b>14 Hours</b> |
| 1.1. <b>Types of Lathes</b>    |                 |
| • Centre lathe                 |                 |
| • Bench lathe                  |                 |
| • Engine lathe                 |                 |
| • Turret lathe                 |                 |
| • Capstone Lathe               |                 |
| • Vertical lathe               |                 |
| • CNC Lathe and Turning Centre |                 |
| 1.2. <b>Drives of lathes</b>   |                 |
| • Step or cone pulley drive    |                 |
| • Gear drive                   |                 |
| 1.3. <b>Power feed motion</b>  |                 |
| • 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. SHAPER AND PLANER**

**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. MILLING**

**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 (Sawing)
- 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
  - Radium 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**  
ii) **Technology of Machine Tools**

**Published by PSTC, PCSIR  
by S.F. Karar**





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

**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 stroke of shaper
- Set different tools on shaper
- Set work holding devices
- Perform different operations on shaper independently

**3. DEVELOPMENT KNOWLEDGE 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**

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

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

- 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**

**3 Hours**

- 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**

**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

- 8.7. Upper deviation
- 8.8. Lower deviation
- 8.9. Line of reference
- 8.10. Actual size
- 8.11. Clearance
- 8.12. Interference
- 8.13. Zone of tolerance
- 8.14. The number of the tolerance
- 8.15. The letter of the tolerance
- 8.16. Fits
- 8.17. System of fits
- 8.18. Basic hole system
- 8.19. Basic shaft system
- 8.20. Comparison between basic hole and basic shaft system
- 8.21. Tolerated measurements
  - 8.21.1. In detail drawings
  - 8.21.2. In assembly drawing
- 8.22. Position tolerances
  - Straightness
  - Planarity
  - Circularity
  - Cylindericity
  - Profile of line
  - Symmetry
  - Parallelism
  - Angularity
  - Concentricity
  - Circular run out
  - Perpendicularity
- 8.23. Angular measurement
- 8.24. Recommendations for fits
- 8.25. Basic shaft system
  - 8.25.1. Running and sliding fits
  - 8.25.2. Riveting and soldering fits
  - 8.25.3. Press fits
- 8.26. Basic hole system for
  - 8.26.1. Running and sliding fits
  - 8.26.2. Close sliding and press fits
- 9. **Gears (Conventional & symbolic representation of Gears)**
- 9.1. Springs (Symbolic representation of springs)
- 9.2. Bearings

**2 Hours**



- 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

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) **Fundamentals 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

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**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
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  - 2.1.13.** Radius
  - 2.1.14.** Location
  - 2.1.15.** Base line
  - 2.1.16.** Size
  
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  - leader,
  - dimension,
  - centre lines,
  - arrow,
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- 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
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  - 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

- 8.1 Importance
- 8.2 ISO system of fits
- 8.3 Scope
- 8.4 Terminology
- 8.5 Nominal size
- 8.6 Tolerance
- 8.7 Upper deviation
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- 8.9 Line of reference
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- 8.11 Clearance
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- 8.13 Zone of tolerance
- 8.14 The number of the tolerance
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- 8.20 Comparison between basic hole and basic shaft system
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  - Parallelism
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  - Circular run out
  - Perpendicularity
- 8.23 Angular measurement
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  - 8.25.1 Running and sliding fits
  - 8.25.2 Riveting and soldering fits
  - 8.25.3 Press fits

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

**9. Gears (Conventional & symbolic representation of Gears)**

- 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. CAD Software**

**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

- 10.5.24. Selecting Objects
- 10.5.25. Object Properties
- 10.5.26. Drafting Settings and Object Snaps
- 10.5.27. Text Tools
- 10.5.28. Title blocks and Templates
- 10.5.29. View ports and Layouts
- 10.5.30. Introduction to Simple Model, wire frame Model and Solid Models



**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)
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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
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**CAD -I**

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



**ADVANCED DIPLOMA OF ASSOCIATE ENGINEER IN**  
**MECHANICAL TECHNOLOGY WITH SPECIALIZATION IN DIES AND MOULDS**  
**(04 Years) SCHEME OF STUDIES 3<sup>rd</sup> YEAR**

<b>1ST YEAR</b>			<b>T</b>	<b>P</b>	<b>C</b>	<b>Page</b>
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	
<b>T O T A L</b>			<b>13</b>	<b>27</b>	<b>22</b>	
<b>2ND YEAR</b>						
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	
<b>T O T A L</b>			<b>12</b>	<b>30</b>	<b>22</b>	
<b>3RD YEAR</b>						
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	
<b>T O T A L</b>			<b>13</b>	<b>27</b>	<b>22</b>	
<b>4TH YEAR</b>						
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	
<b>TOTAL</b>			<b>13</b>	<b>27</b>	<b>22</b>	

**Gen-311**  
**ISLAMIAT AND PAK. STUDIES**

# اسلامیات / مطالعہ پاکستان

نصاب (سال سوم)

حصہ اول اسلامیات Gen 311 ٹی پی سی

ٹی پی سی

1

0

1

حصہ دوم مطالعہ پاکستان

کل وقت 20 گھنٹے

## موضوعات

- 1 قرآن مجید  
سورۃ الفاتحہ۔ آیۃ الکرسی۔ سورۃ البقرہ کی آخری آیات از امن الرسول تا آخر سورہ اخلاص  
مع ترجمہ و تشریح
- 2 دس منتخب احادیث مع ترجمہ و تشریح  
- بنی الاسلام علی خمس شہادۃ ان لا الہ الا اللہ و اقام الصلوٰۃ و ایتاء  
الزکوٰۃ 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 دعاه و یسلم علیہ اذا لقیہ و یشمت اذا عطس و ینصح لہ  
اذا غاب او شہد لا تخن من خانک  
- لا یدخل الجنة قاطع  
- ان اللہ حرم علیکم عقوق الامہات و اضاعۃ المال  
یسرا و لا تعسرا بشراً و لا تنفرا  
- ذاق طعم الایمان من رضی باللہ و بالاسلام دینا و بمحمد نبیاً  
- 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 درگزر کی اہمیت بیان کر سکے۔

ایفائے عہد کی اہمیت بیان کر سکے۔

اخوت کے معنی و مفہوم کو بیان کر سکے۔

اخوت اسلامی کی اہمیت بیان کر سکے۔

اسلام کی اعلیٰ اقدار کو اپنا کر مثالی معاشرہ پیدا کر سکے۔

ٹی	پی	سی	(غیر مسلم طلباء کے لئے)	نصاب اخلاقیات
1	0	1	Gen-311	سال سوم
کل وقت 20 گھنٹے			<u>موضوعات</u>	

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

					نصاب (سال سوم)
	سی	پی	ٹی	Gen-311	مطالعہ پاکستان
	1	0	1		
کل وقت 12 گھنٹے					حصہ دوم
				<u>موضوعات</u>	قیام پاکستان
				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)	-



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-323**  
**APPLIED THERMODYNAMICS**

## Mech-323 **APPLIED THERMODYNAMICS**

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

**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:**

<b>Fundamentals of Thermodynamics</b>	<b>08 Hrs</b>
<b>Laws and properties of perfect gases</b>	<b>06 Hrs</b>
<b>Thermodynamic processes and cycles</b>	<b>10 Hrs</b>
<b>Formation and properties of Steam</b>	<b>04 Hrs</b>
<b>Steam Boilers and their performance</b>	<b>08 Hrs</b>
<b>Steam and Gas turbines</b>	<b>08 Hrs</b>
<b>Internal Combustion Engines</b>	<b>08 Hrs</b>
<b>Air Compressors and their performance</b>	<b>06 Hrs</b>
<b>Refrigeration and Air Conditioning</b>	<b>06 Hrs</b>

**Total 64 Hrs**

### **Details of Contents:**

<b>Fundamentals of Thermodynamics</b>	<b>8 Hrs</b>
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 <sup>st</sup> law of thermodynamics	
1.8 Solution of problems by direct application of formulae for above topics	
<b>1.9 Mode of heat transfer</b>	
<b>Laws and properties of perfect gases</b>	<b>6 Hrs</b>
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 polytropic 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 , vapor 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 1<sup>st</sup> 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 Renault'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 polytropic 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 derive 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 and vapor 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 to:

- 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-343**  
**MACHINE DESIGN**

**Mech-343****MACHINE DESIGN****Total Contact Hours:**

<b>T</b>	<b>P</b>	<b>C</b>
<b>2</b>	<b>3</b>	<b>3</b>

**Theory: 64 Hrs****Practical: 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:**

<b>Simple Stresses in Machine Parts</b>	<b>8Hrs</b>
<b>Pressure Vessels</b>	<b>6Hrs</b>
<b>Welded Joints</b>	<b>6Hrs</b>
<b>Screwed Joints</b>	<b>6Hrs</b>
<b>Design of Keys</b>	<b>5Hrs</b>
<b>Shafts and Couplings</b>	<b>8Hrs</b>
<b>Belt Drives</b>	<b>6 Hrs</b>
<b>Springs</b>	<b>6Hrs</b>
<b>Bearings</b>	<b>6 Hrs</b>
<b>Cam and Followers</b>	<b>7 Hrs</b>

**Details of Contents:**

<b>Simple Stresses in Machine Parts</b>	<b>8Hrs</b>
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 Hollow 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 pulleys
- 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

**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 LAME,s 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 Hollow 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

10.4 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:**

Machine Design by: Paul H. Black (Published by McGraw Hill Book Company , New York)

Machine Design by Stanton. E. Wiston (Published by McGraw Hill Book Company , New York)

Machine Design by: Lafayette. Ind. (Purdue University of California)



**List of Practical:**

- Calculate (tensile, compressive and shear), stress and strain, modulus of elasticity, %age elongation, %age reduction in area, factor of safety for simple machine parts
- Calculate force required to punch a hole
- Calculate thickness and diameter of thin cylinders for hoop and longitudinal stresses
- Calculate thickness of thick cylinders by LAME 'S Equation
- Calculate thickness and diameter of spherical shell.
- Design welded joints for transverse and parallel fillet weld under static loading only
- Calculate stresses setup due to initial tightening and external load on screws .
- Check dimensions of square and rectangular keys due to failure in shearing and crushing.
- Design solid shaft subjected to twisting moment only.
- Design hollow shaft subjected to twisting moment only.
- Design Solid & Hollow shafts subjected to combined bending & twisting moment.
- Design un-protected flange coupling for specific torque.
- Check the speed of shaft when diameters of flat pulleys (Driver or Driven) and slip between belt and flat pulley is given.
- Design the dimensions of closely coiled helical spring of circular wire subjected to tensile load.
- Suggest suitable journal bearing, considering the load on shaft, speed, viscosity of lubricant, bearing pressure, coefficient of friction and bearing modulus.
- Design and draw the CAM profile with knife edge follower for uniform velocity:
- (a) Out Stroke during  $60^\circ$  of Cam rotation (b) Dwell for next  $30^\circ$  of Cam rotation (c) return Stroke during next  $60^\circ$  of Cam rotation (d) Dwell of remaining  $210^\circ$  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.

**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 Lamé'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 Calculate different cases of transverse and parallel fillet weld under static and fatigue 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 Calculate 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
- 15.4 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 AND HEAT TREATMENT**

## Mech-362 MATERIALS TESTING AND HEAT TREATMENT

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

**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 Brinell 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

**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

**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**

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

**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:**

<b>1. Introduction to 3D CAD</b>	<b>2 Hrs</b>
<b>2. Sketch</b>	<b>3 Hrs</b>
<b>3. Dimension and Constraint</b>	<b>2 Hrs</b>
<b>4. Solid Modeling</b>	<b>8 Hrs</b>
<b>5. Assembly Modeling</b>	<b>4 Hrs</b>
<b>6. Drawing View</b>	<b>1 Hrs</b>
<b>7. Presentation Module</b>	<b>1 Hrs</b>
<b>8. Sheet Metal Components</b>	<b>3 Hrs</b>
<b>9. CAM</b>	<b>8 Hrs</b>

## **Detail of Course Contents:**

<b>1.</b>	<b>3D CAD</b>	<b>2 Hrs</b>
	1.1 Modules	
	1.2 Toolbars	
	1.3 Units and Dimensions	
	1.4 Important Terms and Definitions	
<b>2.</b>	<b>Sketch</b>	<b>3 Hrs</b>
	2.1 Sketch Environment	
	2.2 Drawing Display Tools	
	2.3 Sketching Entities	
	2.4 Pattern	
	2.5 Tolerance	
	2.6 Work Feature	
<b>3.</b>	<b>Dimension and Constraint</b>	<b>2Hrs</b>
	3.1 Dimension	
	3.2 Geometric Constraints	
<b>4.</b>	<b>Solid Modeling</b>	<b>8Hrs</b>
	4.1 Modeling Tools	
	4.2 Concept of Edit Feature	
	4.3 Advanced Modeling Tools	
<b>5.</b>	<b>Assembly Modeling</b>	<b>4Hrs</b>
	5.1 Types of Assembly	
	5.2 Assembly Components	
	5.3 Edit Assembly Constraint	
<b>6</b>	<b>Drawing Views</b>	<b>1Hr</b>
	6.1 Types of Views	
	6.2 Drawing Standards	
	6.3 Drawing Sheets	
	6.4 Dimension Style	
	6.5 Parts Lists	
<b>7.</b>	<b>Presentation Module</b>	<b>1Hr</b>
	7.1 Presentation View	
	7.2 Assembly Animation	
<b>8.</b>	<b>Sheet Metal Components</b>	<b>3Hrs</b>
	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)

**Instructional Objectives:**

Instructors/Teachers must ensure to develop understanding of

- |    |                                                                                                                                                                                                       |       |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1. | 3D CAD                                                                                                                                                                                                | 2 Hrs |
|    | <ul style="list-style-type: none"> <li>• Modules</li> <li>• Toolbars</li> <li>• Units and Dimensions</li> <li>• Important Terms and Definitions</li> </ul>                                            |       |
| 2. | Sketch                                                                                                                                                                                                | 3 Hrs |
|    | <ul style="list-style-type: none"> <li>• Sketch Environment</li> <li>• Drawing Display Tools</li> <li>• Sketching Entities</li> <li>• Pattern</li> <li>• Tolerance</li> <li>• Work Feature</li> </ul> |       |
| 3. | Dimension and Constraint                                                                                                                                                                              | 2Hrs  |
|    | <ul style="list-style-type: none"> <li>• Dimension</li> <li>• Geometric Constraints</li> </ul>                                                                                                        |       |
| 4. | Solid Modeling                                                                                                                                                                                        | 8Hrs  |
|    | <ul style="list-style-type: none"> <li>• Modeling Tools</li> <li>• Concept of Edit Feature</li> <li>• Advanced Modeling Tools</li> </ul>                                                              |       |
| 5. | Assembly Modeling                                                                                                                                                                                     | 4Hrs  |
|    | <ul style="list-style-type: none"> <li>• Types of Assembly</li> <li>• Assembly Components</li> <li>• Edit Assembly Constraint</li> </ul>                                                              |       |
| 6  | Drawing Views                                                                                                                                                                                         | 1Hr   |
|    | <ul style="list-style-type: none"> <li>• Types of Views</li> <li>• Drawing Standards</li> <li>• Drawing Sheets</li> <li>• Dimension Style</li> <li>• Parts Lists</li> </ul>                           |       |
| 7. | Presentation Module                                                                                                                                                                                   | 1Hr   |
|    | <ul style="list-style-type: none"> <li>• Presentation View</li> <li>• Assembly Animation</li> </ul>                                                                                                   |       |
| 8. | Sheet Metal Components                                                                                                                                                                                | 3Hrs  |
|    | <ul style="list-style-type: none"> <li>• Sheet Metal Components Parameter</li> <li>• Sheets Metal Components</li> </ul>                                                                               |       |

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



**List of Machinery:**

- |           |                                                                |               |
|-----------|----------------------------------------------------------------|---------------|
| <b>1.</b> | <b>3D CAD Software (Solid Modeling)</b>                        | <b>50-set</b> |
| <b>2.</b> | <b>3D CAM Software (Milling, Turning, Turn/Mill, Wire Cut)</b> | <b>50</b>     |
| <b>3.</b> | <b>Simulation Software for G Code</b>                          | <b>50</b>     |
| <b>4.</b> | <b>Computer</b>                                                | <b>50</b>     |

DM – 312  
TOOL TECHNOLOGY-I

T	P	C
1	3	2

**Total contact hours.**

Theory	32 Hours
Practical	96 Hours

1 Injection Moulds	20 Hours
2 Compression Moulds	12 Hours

AIMS: After going through this course, the student will be able to understand types, designing and working of injection moulds and compression moulds:

**DETAILED COURSE CONTENTS**

- |                                                                                                                                                                                                                                                                                                |                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <b>1. INTRODUCTION TO MOULDS</b>                                                                                                                                                                                                                                                               | <b>1 Hour</b>  |
| <ul style="list-style-type: none"> <li>• Importance of Tool Design</li> <li>• Introduction to Injection Mould</li> <li>• Injection Moulding (General)</li> <li>• Schematic diagram of Injection Moulding</li> <li>• Main parts of mould</li> </ul>                                             |                |
| <b>2. Cavity and Punch</b>                                                                                                                                                                                                                                                                     | <b>2 Hours</b> |
| <ul style="list-style-type: none"> <li>• Cavities, Disposition in a mould</li> <li>• Layout of a multi cavity injection Mould in respect of balance</li> <li>• Cavity Mould layout</li> <li>• Multi Cavity Arrangement</li> </ul>                                                              |                |
| <b>3. Types of Runner</b>                                                                                                                                                                                                                                                                      | <b>2 Hours</b> |
| <ul style="list-style-type: none"> <li>• Cold Runner</li> <li>• Insulated Runner</li> <li>• Hot Runner</li> </ul>                                                                                                                                                                              |                |
| <b>4. Types of Gates</b>                                                                                                                                                                                                                                                                       | <b>2 Hours</b> |
| <ul style="list-style-type: none"> <li>• Sprue gate</li> <li>• Edge gate</li> <li>• Diaphragm gate</li> <li>• Ring gate</li> <li>• Flash gate</li> <li>• Submarine (self shearing) gate</li> <li>• Submarine, Dimensions chords</li> <li>• Submarine, Dimensions height and section</li> </ul> |                |

- Pin Point gate
- 5. Parting Lines** **1 Hour**
- Introduction to Parting Lines
  - Layout of Parting Lines
  - Introduction to Sprue Hook / Sprue Pullers
  - Layout of Sprue Puller
- 6. Ejection System** **2 Hour**
- Manual Ejectors System
  - Auto Ejectors System
  - Mechanical System – Machines (schematic)
  - Hydraulic system – Machines (schematic)
  - Pneumatic ejectors System
  - Pin ejector
  - Blade ejector
  - Sleeve ejector
  - Stripper Plate
  - Disc ejector
  - Air ejector
  - Ejector from Injection side
  - Chain ejector
  - Rod ejector
  - Manual ejector and its types
- 7. Types of Push Backs** **1Hour**
- Introduction to ejector returns mechanism and its types
  - Push backs
  - Ejector return springs
  - Ejector return cams
- 8. Ejector of Internal Threaded Components** **1Hour**
- Unscrewing with rack and pinion
  - Chain drive, gear train, motor drive
  - Coarse spiral drive
- 9. Under Cuts and Sliders** **1Hour**
- Introduction to Under Cuts and Sliders
  - Basic typical arrangements of under cuts and slider arrangements
  - Operation of Two, Three, and Four Slider arrangements for under cuts
  - Inclined pillars
  - Movable Side
  - Injection Side
  - Delayed action finger cams

- Introduction to Hydraulic Cylinder their Control
- Follow split mould
- Inside undercut
- Moulding internal threaded components
- External under cuts

**10. Mould Cooling Systems 1 Hour**

- Introduction to Mould Cooling
- Recommended Temperatures of Mould for Different Types Plastic Material
- Insert sealing
- Rings used in Water Cooling System
- Simple system (mould without inserts)
- Spiral layout of water ways
- Cooling in rectangular moulds, (straight layout)
- Core and straight cooling (combined)
- Core cooling,
- Cooling in long punches / cores
- Series type
- Parallel types

**11. Three Plate Mould 1 Hour**

- Introduction to Three plate moulds
- Three plate mould (basic design)
- Three plate mould with multiple point feeding
- Working and design of locking unit
- Three plate mould design with sliders arrangement

**12 Guiding, Tool Location and Ventilation 2 Hours**

- Guide pillars and bushes
- Conventional guiding system
- Guiding system
- Introduction to Tool Location and their Types
- Tool Location
- Tool Location – taper form (deep components)
- Introduction to Mould Ventilation
- Types of air Vents, Design of air Vents

**15. Trouble shooting list of first trial 2 Hour**

**16. Steel used for Injection Moulds (Cavities, Inserts and ejector) 1 Hour**

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# COMPRESSION MOULDS

## COURSE CONTENTS

<b>2. Thermosetting Materials</b>	<b>1 Hour</b>
<ul style="list-style-type: none"><li>• Phenolic</li><li>• Urea</li><li>• Melamine</li><li>• Polyesters</li><li>• Alkyds</li><li>• Allylics</li><li>• Epoxies</li><li>• Silicones</li></ul>	
<b>1. Methods of Processing</b>	<b>1 Hour</b>
<ul style="list-style-type: none"><li>• Thermosetting</li><li>• Compression Moulding Process</li><li>• Compression Moulding Machines</li><li>• Compression mould (parts)</li></ul>	
<b>2. Parts of a Compression Mould</b>	<b>1 Hour</b>
<ul style="list-style-type: none"><li>• Compression mould (parts)</li><li>• Punch</li><li>• Cavity</li><li>• Parting line</li><li>• Spacers</li><li>• Ejectors – ejector systems</li><li>• Ejector system typical design</li><li>• Ejector returns</li><li>• Heating, heater platters</li><li>• Tool location</li><li>• Miscellaneous</li></ul>	
<b>3. Summary of Different Designs</b>	<b>1Hour</b>
<ul style="list-style-type: none"><li>• Basic designs</li><li>• Multi-cavity moulds</li><li>• Special features</li></ul>	
<b>4. Compression Moulds (General Designs)</b>	<b>2 Hour</b>
<ul style="list-style-type: none"><li>• Hand moulds</li><li>• Flash moulds</li><li>• Positive moulds</li><li>• Positive moulds (vertical flash)</li></ul>	

- Landed plunger moulds
- Landed plunger moulds (vertical flash)
- Horizontal flash, vertical flash
- Semi- positive moulds
- Semi – positive moulds (vertical flash)
- Inverted moulds
- Inverted moulds

**5. Multi Cavity Tools and Special Features**

**2 Hours**

- Multi cavity layouts
- Group moulds
- Group moulds
- Manual built – in ejector systems (top)
- Hand operated built –in ejector systems
- Sliders
- Split cavities
- Manual split mould
- Splits operated by ejector system
- External threads
- Moulding of external threads
- Internal threads
- Moulding of internal threads
- Multi cavity mould (removable core- group)
- Manual operated cores
- Encapsulations
- Encapsulation of metal inserts
- Encapsulation of metal pins and bushes
- Breaking through

**6. Transfer Moulding Process**

**½ Hour**

**7. Advantages, Disadvantages in Transfer Moulding**

**½ Hour**

**8. Transfer Moulding Presses**

**½ Hour**

**9. Parts of a Transfer Mould**

**1 Hour**

- Transfer mould (automatic)
- Runners and gates
- Gates and runners
- Location of the gate
- Ventilation
- Split type built in plunger)
- Split type with injection plate

**10. Mould for Transfer Moulding Press**

**½ Hour**

**11. Transfer Mould for Press Without Transfer Cylinder**

**1 Hour**

- Comparison pressures –temperatures

- Trouble shooting chart
- Comparison

**Recommended Books**

- Tool Knowledge Injection Moulds                      by PSTC- PCSIR
- Tool Knowledge Compression Moulds                by PSTC-PCSIR

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## DM-312 Tool Technology -1

Practical 96 hrs.

T	P	C
1	3	2

- **List of Practicals**

1. Milling of Mould Plates
2. Grinding of Mould Plates
3. Milling of Mould Spacers
4. Grinding of Mould Spacers
5. Turning of Guide Pillars
6. Turning of Guide Bushes
7. Turning of Ejector Pins
8. Grinding of Ejector Pins
9. Turning and Grinding of Push Backs
10. Turning and Grinding of Sprue Bush
11. Milling and Grinding of Ejector Plates

DM - 322  
**TOOL TECHNOLOGY-II**



	<ul style="list-style-type: none"> <li>• Design of Pillar Die sets</li> </ul>	
<b>7.</b>	<b>Types of Die Stops</b>	<b>2 Hrs</b>
	<ul style="list-style-type: none"> <li>• Plain Pin Stop</li> <li>• Headed Pin stop</li> <li>• Finger Stops</li> <li>• Trim Stops</li> <li>• Function of Trim stop</li> <li>• Solid stop</li> </ul>	
<b>8.</b>	<b>Types of Pivot Stops</b>	<b>2 Hrs</b>
	<ul style="list-style-type: none"> <li>• Explain the following types of Pivot stops</li> <li>• Manual Pivot stop</li> <li>• Semi Auto Pivot stops</li> <li>• Automatic Pivot stop</li> </ul>	
<b>9.</b>	<b>Types of Pilots</b>	<b>1 Hr</b>
	<ul style="list-style-type: none"> <li>• Explain the following types of Pilots</li> <li>• Function of a Pilot</li> <li>• Pilot Mountings</li> <li>• Pilot Support, Nose profiles</li> <li>• Punch Pilots</li> </ul>	
<b>10.</b>	<b>Strippers and Stock Guides</b>	<b>1 Hr</b>
	<ul style="list-style-type: none"> <li>• Fixed strippers</li> <li>• Pressure Pad Strippers</li> <li>• Spring / Stripper Bolt Confinement</li> <li>• Guided Strippers</li> <li>• Shedders, Inverted, Compound Stripping</li> </ul>	
<b>11.</b>	<b>Nest Guides</b>	<b>1 Hr</b>
	<ul style="list-style-type: none"> <li>• Introduction to Nest Guides</li> <li>• Pin Nest Guides</li> <li>• Head Pin, Plate Nest Guides</li> <li>• Approximating, Pusher Nest Guides</li> <li>• Loading, Unloading</li> <li>• Fool Proofing</li> </ul>	
<b>12.</b>	<b>Strip Layouts</b>	<b>1Hr</b>
	<ul style="list-style-type: none"> <li>• Describe Strip Layout</li> <li>• Terms</li> <li>• Factors Influencing Strip Layouts</li> <li>• Describe Narrow Run – wide Run</li> <li>• Explain Material Requirement</li> <li>• Gang Tool</li> </ul>	
<b>14.</b>	<b>Explain Taking Impressions Punch / Die</b>	<b>2 Hrs</b>
	<ul style="list-style-type: none"> <li>• Explain Centering Punch and Die</li> <li>• Copying Tapped, Blind and long Holes</li> <li>• Stepped Punch Length</li> <li>• Explain Slug Mounting</li> <li>• Cold welding on Cutting Punches</li> </ul>	

- Horizontal (Side Action) Cutting Tools
- Design Side Action tool
- Side Action tools, Doglegs

## **BENDING TOOL**

### **COURSE CONTENTS**

### **COURSE CONTENTS**

#### **1. BENDING**

**2 Hours**

Definition

##### **Bending operation**

- Basic bend elements and expression
- Bend radius
- Bend axis
- Bend lines
- Bend angle
- Bend area
- Neutral plane
- Bend allowance
- Spring back
- U.T.S
- Bend elements
- Bending stresses
- Plastic deformation
- Bending stresses, effects of bending
- Flat blank length
- Elements, expressions in flat blank estimation
- Estimating methods
- Estimating flat blank length
- Calculation flat blank length

##### **Bending tools**

**2 Hours**

- Expressions
- Various bending methods
- Various bending methods
- Classification of bending tools (General)
- V- Bending tools (Classification)
- V- Bending tools (details)
- Bending in air, bottoming, design aspects in V- bending
- (Wedge action, correction of spring back)
- V-Bending, Design details
- Spring back correction in V- Bending
- V- Bending tool

- V- Bending tool (with anti-slip pin)
- V- Bending tool(in die set)

**Press brakes**

**2 Hours**

- Typical press brake bends
- Press brake

1.9. **U – Bending tools**

**2 Hours**

- Design aspects (side action, die blocks, pressure pads, correction of spring back, stripping)
- U- Bending, effects of pressure pad
- Pressure pads, built in springs
- Pressure pads, external counter Force.
- Spring back correction in U-Binding
- Stripping (positive knock off pins)
- Stripping (positive knock off fork)
- Stripping (spring loaded pin)
- Stripping (hook)
- U-Bending tool (variable stock thickness)

2. **Wiping Tools**

**2 Hours**

- Wiping tools
- Wiping tools (inverted and straight)

3. **Multi bending tool**

**1 Hour**

- Multi Bending (Moving center punch)
- Multi Bending (fixed center punch)

4. **Side action**

**1 Hour**

- Side action bending tools

5. **Curling tools**

**2 Hours**

- Two step bending tool
- Curling (various methods)
- Curling (details)
- Curling (sinus form)
- Curling (without performing)
- Curling (3 steps without core)
- Horizontal, vertical working, flat
- Blank length

**Recommended Books**

- Tool Knowledge-II Press Tool By PSTC, PCSIR
- Tool Knowledge-II Bending Tool By PSTC, PCSIR

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**DM-322**

**List of Practicals**

**96 Hours**

1. Milling of die set plates
2. Grinding of die set plates
3. Milling of die set spacers
4. Grinding of die set spacers
5. Turning and grinding of guide bushes
6. Turning and grinding of guide pillars
7. Turning and grinding of dowel pins
8. Milling of bending tools set
9. Machining of bending tool parts
10. Estimation flat blank length of bending tools

**Recommended Books**

- Tool Knowledge-II Press Tool By PSTC, PCSIR
- Tool Knowledge-II Bending Tool By PSTC, PCSIR

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**DM - 335**  
**Workshop Technology DM-1**



## DM - 335

## Workshop Technology DM-1

<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>6</b>	<b>5</b>

### Total contact hours.

<b>Theory</b>	<b>96 Hours</b>
<b>Practical</b>	<b>192 Hours</b>

AIMS: After going through this course, the student will be able to understand Types, and working knowledge of tool manufacturing.

1. Clamping and Centering
2. Cemented Carbide
3. Workshop Technology III

### COURSE CONTENTS

#### **CLAMPING AND CENTERING**

**16 Hours**

- Introduction to Clamping and Centering
- Clamping on a spindle
- Clamping in chucks
- Clamping in collets
- Clamping with mandrels
- Clamping on a work table
- Clamping in vice
- Clamping directly onto a work table
- Clamping on magnetic chucks

#### **Centering**

- Various centering aids
- Centering aids for rough centering
- Dial indicator
- Lever gauge
- Centering device
- Different centering methods
- Aligning a work piece, vice or work head
- Zero setting according to a reference face
- Zero setting according to a centre
- Draw backs of a Microscope

#### **Cemented Carbides**

**2 Hours**

- Introduction to Cemented Carbide
- Manufacturing Process of Cemented Carbide
- Application of Cemented Carbide
- Cemented Carbide as a cutting material
- Correct use of Cemented Carbide

## **Grinding**

**2Hours**

- Grinding machines
- Pedestal grinders
- Tool post grinders
- Universal cylindrical grinding
- External cylindrical grinding
- Size controlled external cylindrical grinder
- Internal cylindrical grinder
- Surface Grinder
- Tool & cutter grinder
- Tool and cutter grinder
- Parts of grinder
- Centre less grinder (External)
- Centre less grinder (Internal)
- Thread grinder
- Profile grinders
- Jig grinder

## **Constructional Features of Cylindrical Grinding Machine**

**4 Hours**

- The Bed
- Wheel head and slide
- The spindle
- The table
- Work head
- Work steadies

## **Accessories for Universal Cylindrical Grinding Machine**

**4 Hours**

### **Swiveling work-head with lever operated draw-bar**

- Swiveling work-head with 3 jaw chuck
- Swiveling work-head with face plate mounted
- Swiveling work table mounted with special head stock
- Fixed transverse work-head with magnetic chuck
- Face plate
- Three jaw steady rest
- Universal steady rest
- Internal grinding attachment with mounted spindle
- Internal grinding attachment with mounted spindle
- Wheel balancing device
- Universal diamond holder
- Hinged wheel dressing device
- Swiveling dressing device
- Radius dressing device
- Table aligning device
- Steep taper grinding attachment

- Special purpose work head

### **Grinding Wheels**

**4 Hours**

- The abrasive
- Bond
- Vitrified bond
- Silicate bond
- Shellac bond
- Rubber bond
- Synthetic resin bond
- Grit and grade
- Wheel structure
- Wheel shape
- Wheel selection
- The abrasive
- The bond (grade)
- The process
- Wheel classification
- Wheel mounting
- Wheel balancing
- Wheel truing and dressing
- Wheel speeds
- Operating faults – loading & Glazing
- Grinding fluids
- Grinding wheel recommendations

### **Diamond Wheels**

**2 Hours**

- Resinoid bonded
- Metal bonded
- Diamond wheel grit sizes
- Diamond wheel grades
- Diamond concentration

### **Pedestal Grinder**

**3 Hours**

- Hand grinding and turning tool
- Chip breaking
- Tool pot grinding on lathe

### **Cylindrical Grinding**

**3 Hours**

- External cylindrical grinding
- Speed and feed of work
- Longitudinal feed
- Radial (in) feed

- Plunge cut grinding
- Facing
- Water supply
- Vibration and chatter
- Operating the machine
- Grinding to shoulder
- Taper grinding
- Facing

### **Internal Cylindrical Grinding**

**2 Hours**

- Construction detail
- The spindle
- Speeds and driving
- Internal wheels
- Work setting
- Machine operation
- Operation sequence

### **Surface Grinding**

**3 Hours**

- Disc wheel
- Cup (ring) wheel
- Wheels
- Wheel truing
- Work holding
- The vice
- The magnetic chuck
- Laminated packing
- Permanent magnetic chuck
- Demagnetization
- Surface grinding machine
- To grind a pair of parallel strips
- To grind up a pair of vee – block
- To grind the gauge
- Speed and feed of work

### **Tool & Cutter Grinder**

**3 Hours**

- Cutter grinding and setting
- Clearance
- Setting for grinding
- Set – ups for fluted cutters
- Reamers and taps

- Machine relieved cutters

### **Centre less 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
- Lobbing
- Scope of the process
- Controlled cycle of in feed grinding
- Centre less grinding troubles

### **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

## **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

## **Mechanical Examination**

**7 Hours**

- Quantitative measure of finish
- The centre line average height
- Practical application
- Indexing operation
- Division tester

## **Recommended Books:**

Clamping & Centering  
Cemented carbides  
Workshop Technology III

by PSTC, PCSIR  
by PSTC, PCSIR  
by PSTC, PCSIR

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**LIST OF PRACTICALS**

- 1 Development of Guide Pillars
- 2 Development of Guide Bushes
- 3 Drilling of mould plates on jig boring machine
- 4 Development of Mould Plates
- 5 Development of die plates
- 6 Mould fitting exercise
- 7 Die fitting exercise
- 8 Deburring of plates
- 9 Development of Mould base
- 10 Development of Ejector Pins
- 11 Use of Microscope.
- 12 Different exercises on Cylindrical Grinding Machine.

**DM -342**  
**Special Purpose Machines-I**



## DM-342 Special Purpose Machines-I

### Total Hours

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

**AIMS:** After going through this course, the student will be able to understand the types and working knowledge of Jig boring, jig grinding and spark erosion machines.

### Course Contents:

#### JIG Boring and JIG Grinding 16 Hours

- Introduction
- Application of Jig Borer and Jig Grinder
- Constructional features of machines
- Different types of reading systems
- Boring Operations
- Different types of boring heads/boring bars
- Jig Grinding operations
- Necessary movements for Jig grinding
- Grinding heads and wheels
- Jig boring on milling machine
- Make shift in Jig grinding

#### SPARK EROSION 16 Hours

- Introduction
- Principle of spark erosion
- Theory of single spark
- Servo control
- Heat effected zones
- Application of spark erosion
- Electrode and Electrode making
- Sinking by spark erosion
- Wire cutting process
- Wire cut machines
- Servo system
- Die electric system
- Attachments of spark erosion machines

### Recommended Books:

Jig boring and Jig grinding machines  
Spark Erosion machines

by PSTC, PCSIR  
by PSTC, PCSIR

**DM-342**

**List of Practicals**

**96 Hours**

1. Simple boring exercise
2. Complex boring exercise
3. Button boring exercise
4. Boring of mould exercise
5. Simple Jig grinding
6. Boring of die exercise
7. Complex jig grinding exercise
8. Bushes grinding exercise
9. Mould plates grinding exercise
10. Die plates exercise
11. Electrode making exercise
12. Setting of electrode exercise
13. Die cutting exercise
14. Punch cutting exercise

**ADVANCED DIPLOMA OF ASSOCIATE ENGINEER IN**  
**MECHANICAL TECHNOLOGY WITH SPECIALIZATION IN DIES AND MOULDS**  
**(04 Years) SCHEME OF STUDIES 4<sup>th</sup> YEAR**

<b>IST YEAR</b>			<b>T</b>	<b>P</b>	<b>C</b>	<b>Page</b>
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	
<b>T O T A L</b>			<b>13</b>	<b>27</b>	<b>22</b>	
<b>2ND YEAR</b>						
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	
<b>T O T A L</b>			<b>12</b>	<b>30</b>	<b>22</b>	
<b>3RD YEAR</b>						
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/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	
<b>T O T A L</b>			<b>13</b>	<b>27</b>	<b>22</b>	
<b>4TH YEAR</b>						
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	
<b>TOTAL</b>			<b>13</b>	<b>27</b>	<b>22</b>	

**DM - 414**  
**SPECIAL PURPOSE MACHINES-II**

**DM - 414****SPECIAL PURPOSE MACHINES-II**

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

**AIMS:** At the end of this course, the student will have a fairly good working knowledge of advance principals of Copy Milling Machine and Profile grinding machines.

<b>1. Copy Milling</b>	<b>18 Hours</b>
<b>2. Profile Grinding</b>	<b>14 Hours</b>
<b>3. CNC Machines</b>	<b>32 Hours</b>

**1. COPY MILLING** **18 Hours**

Course Content:

- Introduction
- Application of copy milling & engraving Machines
- The principle of pantograph
- The engraving machines
- The general
- The two dimensional engraving machine
- Engraving
- Form engraving attachment
- The role engraving attachment
- The three dimensional engraving machine
- The three dimensional effect
- The line by line milling attachment
- The relief milling attachment
- Copy milling machine
- The three dimensional duplicating machine (1:1)
- The universal copy milling machine
- Copy milling with templates

## **2. PROFILE GRINDING**

**14 Hours**

Course Content:

- Introduction
- The application of profile grinding
- The grinding wheels
- Profile grinding on a surface grinder
- General
- The dressing diamonds
- Profiling the wheel by conventional means
- Profiling the wheel by diaform attachment
- The profile grinding machines
- General
- The optical profile grinders
- The pantograph type profile grinders

## **3. CNC MACHINES INTRODUCTION**

**8 Hours**

- History of NC
- 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

<b>4.</b>	<b>CNC Lathe and Milling Machines</b>	<b>4 Hours</b>
	<ul style="list-style-type: none"> <li>• Introduction of system</li> <li>• Install and start controller</li> <li>• Introduction of control panel</li> <li>• Switching window</li> <li>• ISO Code manually program</li> <li>• Example</li> </ul>	
<b>5.</b>	<b>Graphic Display Type Auto Programming System</b>	<b>2 Hours</b>
	<ul style="list-style-type: none"> <li>• A Brief introduction</li> <li>• Operation</li> <li>• Basic Operation</li> </ul>	
<b>6.</b>	<b>Programming Example</b>	<b>2 Hours</b>
	<ul style="list-style-type: none"> <li>• C.N.C. Lathe</li> <li>• C.N.C. Milling</li> </ul>	
<b>7.</b>	<b>General Information</b>	<b>4 Hours</b>
	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• MOD Functions</li> <li>• Coordinates</li> <li>• Linear and Angle Encoders</li> </ul>	
<b>8.</b>	<b>Machine Operating Modes</b>	<b>6 Hours</b>
	<ul style="list-style-type: none"> <li>• Switch – on</li> <li>• Manual operation</li> <li>• Setup</li> <li>• Electronic Hand wheel / Incremental Jog</li> <li>• Positioning with Manual data input</li> <li>• Program run</li> <li>• Re – Approaching</li> </ul>	
<b>9.</b>	<b>Programming Modes</b>	<b>6 Hours</b>
	<ul style="list-style-type: none"> <li>• Conversational Programming</li> <li>• File Management</li> <li>• Program selection</li> <li>• Tool Definition</li> <li>• Tool call</li> <li>• Feed rate F / rotational speed of C axis</li> <li>• Miscellaneous Functions M</li> <li>• Programmable stop / Dwell time</li> <li>• Path Movements</li> <li>• Linear movement Cartesian</li> <li>• Circular movement Cartesian</li> </ul>	

- 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 Books**

- 1. Copy Milling**
- 2. Profile Grinding**
- 3. CNC Machines**

**Published by PSTC, PCSIR**  
**Published by PSTC, PCSIR**  
**Published by PSTC, PCSIR**

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## **Instructional Objectives:**

The teacher must ensure to:

### **1. COPY MILLING**

Course Content:

- Introduction
- Application of copy milling & engraving Machines
- The principle of pantograph
- The engraving machines
- The general
- The two dimensional engraving machine
- Engraving
- Form engraving attachment
- The role engraving attachment
- The three dimensional engraving machine
- The three dimensional effect
- The line by line milling attachment
- The relief milling attachment
- Copy milling machine
- The three dimensional duplicating machine (1:1)
- The universal copy milling machine
- Copy milling with templates

### **2. PROFILE GRINDING**

Course Content:

- Introduction
- The application of profile grinding
- The grinding wheels
- Profile grinding on a surface grinder
- General
- The dressing diamonds
- Profiling the wheel by conventional means
- Profiling the wheel by diaform attachment
- The profile grinding machines
- General
- The optical profile grinders
- The pantograph type profile grinders

### **3. CNC MACHINES INTRODUCTION**

- History of NC
- 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

#### **4. CNC Lathe and Milling Machines**

- Introduction of system
- Install and start controller
- Introduction of control panel
- Switching window
- ISO Code manually program
- Example

#### **5. Graphic Display Type Auto Programming System**

- A Brief introduction
- Operation
- Basic Operation

#### **6. Programming Example**

- C.N.C. Lathe
- C.N.C. Milling

#### **7. General Information**

- Introduction
- MOD Functions
- Coordinates
- Linear and Angle Encoders

## **8. Machine Operating Modes**

- Switch – on
- Manual operation
- Setup
- Electronic Hand wheel / Incremental Jog
- Positioning with Manual data input
- Program run
- Re – Approaching

## **9. Programming Modes**

- 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

**DM – 414**

**Lists of Practical**

**192 Hours**

1. Linear interpolation exercise
2. Circular interpolation exercise
3. Absolute dimensional exercise
4. Incremental dimensional exercise
5. Canned cycle exercise
6. Deep hole drilling exercise
7. Boring exercise
8. Mirroring exercise
9. Patterning exercise
10. Taper cutting exercise
11. Copying typical profiles exercise
12. Line by line milling exercise
13. Duplicating typical profiles in 1:1 exercise
14. Templates milling exercise
15. Wheel balancing methods
16. Surface grinding exercise
17. Mirror exercise

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**DM-425**  
**Tool Design and Making**

**DM-425****Tool Design and Making**

<b>Total contact Hours</b>		<b>T</b>	<b>P</b>	<b>C</b>
Theory	<b>64 Hours</b>	2	9	5
Practical	<b>288 Hours</b>			

**AIMS:** At the end of this course, the student will have a fairly good working knowledge of advance principals of moulds and dies designing.

**COURSE CONTENTS****10 Hours**

- Free Hand sketching (isometric 3D etc)
- Handing of drafting machine
- Use of engineering drawing instruments
- Designing concepts of moulds and dies
- Importance and purpose of designing

**Designing of press tool****24 Hours**

- Component drawing,
- Conceptual drawing before final drawing,
- Strip layout for progressive dies,
- Concept of Economy of material for designing,
- Die half and Punch half layout in 1:1 ratio,
- Assembly view according to the cutting plane,
- Checking,
- Rectification (Designing is done according to available machining facility and Press specification). Selection of material.

**Designing of Mould****30 Hours**

- Component drawing,
- Conceptual drawing,
- Selection of type of Mould
- 2 Plate Mould, Split Mould,
- 3 Plate Mould,
- Internal threaded Mould,
- Punch and cavity insert size according to shrinkage of plastic,
- Parting line decision,
- Arrangement of runner system,
- Correct selection of gate,
- Arrangement of cooling mechanism,
- Drawing of cavity half and punch half in 1:1 ratio,
- Assembly view according to the cutting plane,

- Checking Rectification (designing is done according to available machining facility and molding machine specification),
- Selection of mould material,

### **Recommended Books**

1. Injection mould by PSTC, PCSIR
2. Press Tools by PSTC, PCSIR
3. Compression Mould by PSTC, PCSIR

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**Instructional Objectives:**

The teacher must ensure to:

**COURSE CONTENTS**

- Free Hand sketching (isometric 3D etc)
- Handling of drafting machine
- Use of engineering drawing instruments
- Designing concepts of moulds and dies
- Importance and purpose of designing

**DESIGNING OF PRESS TOOL**

- Component drawing,
- Conceptual drawing before final drawing,
- Strip layout for progressive dies,
- Concept of Economy of material for designing,
- Die half and Punch half layout in 1:1 ratio,
- Assembly view according to the cutting plane,
- Checking,
- Rectification (Designing is done according to available machining facility and Press specification). Selection of material.

**DESIGNING OF MOULD**

- Component drawing,
- Conceptual drawing,
- Selection of type of Mould
- 2 Plate Mould, Split Mould,
- 3 Plate Mould,
- Internal threaded Mould,
- Punch and cavity insert size according to shrinkage of plastic,
- Parting line decision,
- Arrangement of runner system,
- Correct selection of gate,
- Arrangement of cooling mechanism,
- Drawing of cavity half and punch half in 1:1 ratio,
- Assembly view according to the cutting plane,
- Checking Rectification (designing is done according to available machining facility and molding machine specification),
- Selection of mould material,



**Designing according the Assigned Components**

Every student must design at least one Die and one Mould as per given schedule during the practical at design office of PSTC.

**Optional Designing:**

- Pressure Die Casting
- Compression mould

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**DM - 433**  
**TOOL TECHNOLOGY-III**

**DM - 433****Tool Technology-III**

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

**AIMS:** At the end of this course, the student will have a fairly good knowledge of advance principals, design and manufacturing of Jig & Fixtures and pressure die casting.

<b>1. Jigs and Fixtures</b>	<b>32 Hours</b>
<b>2. Pressure Die Casting</b>	<b>32 Hours</b>

**COURSE CONTENTS**

<b>1. JIGS AND FIXTURES</b>	<b>4 Hours</b>
1.1 Definitions of Jigs and Fixtures	
1.2 General remarks	
1.3 Major demands on Jigs and Fixtures	
1.4 Location of the work piece	
1.5 Directional and rotational freedoms	
1.6 Principles of eliminating freedoms	
1.7 Over definition of the work piece (WP)	
<b>2. Support and positioning of the WP</b>	<b>1 Hour</b>
2.1 Work piece supports (fixed)	
2.2 Adjustable rest pins (fixed jacks)	
<b>3. Introduction to Locating Nests</b>	<b>4 Hours</b>
3.1 Nesting	
3.2 Locating pins (inner shapes as reference)	
3.3 Inner shape locating pins	
3.4 Centralizes	
3.5 Locators, centralizers (schematic)	
3.6 V – Block	
3.7 Cone and tapered centralizers, locators	
3.8 Automatic controlled centralizers	
3.9 Automatic controlled centralizers	
3.10 Centralizers, Internal collets	
3.11 Centralizers, external collets	
<b>4. Introduction to Clamping</b>	<b>3 Hours</b>
4.1 Clamping methods	
4.2 clamping techniques	

4.3	Straps and screws	
4.4	Clamping various types	
4.5	Clamps, various types	
4.6	Popular lamping mistakes	
4.7	Strap clamping in view of eng. Mach.	
<b>5.</b>	<b>Introduction to Wedges</b>	<b>1 Hours</b>
5.1	Coefficients and angle of friction, basics	
5.2	Conditions of forces on wedge while clamping	
5.3	Loose wedge (application)	
5.4	Sliding wedge (applications)	
5.5	Milling fixture (application of wedge)	
<b>6.</b>	<b>Introduction to Cams</b>	<b>4 Hours</b>
6.1	Rotating wedge	
6.2	Clamping fixture	
6.3	Eccentric cams	
6.4	Spiral cams	
6.5	cams application	
<b>7.</b>	<b>Introduction to Toggle clamps</b>	<b>5 Hours</b>
7.1	Toggle clamps	
7.2	Equalizers	
7.3	Centralizer, Equalizer	
7.4	Mechanics of rocker equalizers	
7.5	Equalizers, locators, rockers	
7.6	Equalizers	
<b>8.</b>	<b>Introduction to Fixture Bodies</b>	<b>4 Hours</b>
8.1	Fixture bodies	
8.2	Miscellaneous	
8.3	Fixture location on machine table	
8.4	Centering the fixture on the machine	
8.5	Ejectors	
8.6	Fixture locks	
<b>9.</b>	<b>Introduction to Drilling Jigs</b>	<b>6 Hours</b>
9.1	Drilling bushes	
9.2	Plate jigs	
9.3	Open drilling jigs	
9.4	Closed drilling jigs	
9.5	Indexing drilling jigs	

# Pressure Die Casting

## Course Contents

<b>1. Die Casting Dies</b>	<b>08 Hours</b>
1.1 Introduction to Casting Dies	
1.2 Explain Gravity Die Casting	
1.3 Application of Gravity Die Casting	
1.4 Limitation of Gravity Die Casting	
1.5 Casting Machines types	
1.6 Book Mould Arrangement	
1.7 Manual Drive Arrangement	
1.8 Automatic Machines	
<b>2. Describe Gravity Casting Moulds</b>	
2.1 Mould design	
2.2 Risers and Gates	
2.3 Top Gating	
2.4 Side Gating	
2.5 Bottom Gating	
2.6 Gating System	
2.7 Design Details	
2.8 Undercuts	
2.9 Ejection	
2.10 Mould Material	
2.11 Mould temperature	
<b>3. Introduction To Pressure Die Casting</b>	<b>08 Hours</b>
3.1 Casting Metals types	
3.2 Application of Pressure Die Casting	
3.3 Limitation of Pressure Die Casting	
3.4 Pressure Die Casting Machines types	
3.5 Hot chamber Machines	
3.5.1 Application Of Hot Chamber Machines	
3.6 Hot chamber Machine	
3.6.1 Operating Cycle	
3.7 Cold Chamber Machine	
3.7.1 Horizontal Cold Chamber Machine	
3.7.2 Horizontal Cold Chamber Machine	
3.7.3 Operating Cycle	
3.7.4 Cold Chamber injection system	
3.7.5 Vertical cold chamber Machine	
3.9 Machine with Horizontal Parting Line	
3.10 Machine with Vertical Parting Line	
3.11 Die Design	
3.12 VCC Machine with Horizontal Parting Line	
3.12.1 VCC Machine with Vertical Parting Line	
3.12.2 Operating Cycle	

- 3.13 Machine Features
- 3.14 Hot Chamber Dies
- 3.15 Horizontal Cold Chamber Dies
- 3.16 Vertical Cold Chamber Dies
  - 3.16.1 Cavity Layout
  - 3.16.2 Parting Line
  - 3.16.3 Gating System
  - 3.16.4 Disposition of Cavities
  - 3.16.5 Selection of Parting Lines
  - 3.16.6 Runner
  - 3.16.7 Gates
  - 3.16.8 Over flows
  - 3.16.9 Runner and gates
  - 3.16.10 Runner and gates
  - 3.16.11 Runner gates over flows
  - 3.16.12 Air venting of die

**4. Introduction to Ejection Arrangement**

**08 Hours**

- 4.1 Explain the following types of Ejection system
- 4.2 Ejection machine side
- 4.3 Ejection location
- 4.4 Pin ejector, blade ejector
- 4.5 Ejector (Stripper, Pin, Blade)
- 4.6 Ejector return
- 4.7 Sliders and cores

**5. Introduction to Split cavities**

**08 Hours**

- 5.1 Drive of cores and splits
- 5.2 Shrinkage Allowance and Draft
- 5.3 Splits
- 5.4 Sliders
- 5.5 External threads
- 5.6 Internal threads
- 5.7 Introduction to Die Cooling
- 5.8 Die Cooling
- 5.9 Materials for Die Casting Dies
- 5.10 Die Lubricants
- 5.11 Hints for Trial Production
- 5.12 Surface Finishing and Quality of Castings

**Recommended Books**

- |                         |                |
|-------------------------|----------------|
| 1. Jigs & Fixtures      | by PSTC, PCSIR |
| 2. Pressure Die Casting | by PSTC, PCSIR |

## **Instructional Objectives:**

The teacher must ensure to:

### **1. JIGS AND FIXTURES**

- 1.1 Definitions of Jigs and Fixtures
- 1.2 General remarks
- 1.3 Major demands on Jigs and Fixtures
- 1.4 Location of the work piece
- 1.5 Directional and rotational freedoms
- 1.6 Principles of eliminating freedoms
- 1.7 Over definition of the work piece (WP)

### **2. Support and positioning of the WP**

- 2.1 Work piece supports (fixed)
- 2.2 Adjustable rest pins (fixed jacks)

### **3. Introduction to Locating Nests**

- 3.1 Nesting
- 3.2 Locating pins (inner shapes as reference)
- 3.3 Inner shape locating pins
- 3.4 Centralizes
- 3.5 Locators, centralizers (schematic)
- 3.6 V – Block
- 3.7 Cone and tapered centralizers, locators
- 3.8 Automatic controlled centralizers
- 3.9 Automatic controlled centralizers
- 3.10 Centralizers, Internal collets
- 3.11 Centralizers, external collets

### **4. Introduction to Clamping**

- 4.1 Clamping methods
- 4.2 clamping techniques
- 4.3 Straps and screws
- 4.4 Clamping various types
- 4.5 Clamps, various types
- 4.6 Popular clamping mistakes
- 4.7 Strap clamping in view of eng. Mach.

### **5. Introduction to Wedges**

- 5.1 Coefficients and angle of friction, basics
- 5.2 Conditions of forces on wedge while clamping
- 5.3 Loose wedge (application)
- 5.4 Sliding wedge (applications)
- 5.5 Milling fixture (application of wedge)

### **6. Introduction to Cams**

- 6.1 Rotating wedge

- 6.2 Clamping fixture
- 6.3 Eccentric cams
- 6.4 Spiral cams
- 6.5 cams application
- 7. Introduction to Toggle clamps**
- 7.1 Toggle clamps
- 7.2 Equalizers
- 7.3 Centralizer, Equalizer
- 7.4 Mechanics of rocker equalizers
- 7.5 Equalizers, locators, rockers
- 7.6 Equalizers
- 8. Introduction to Fixture Bodies**
- 8.1 Fixture bodies
- 8.2 Miscellaneous
- 8.3 Fixture location on machine table
- 8.4 Centering the fixture on the machine
- 8.5 Ejectors
- 8.6 Fixture locks
- 9. Introduction to Drilling Jigs**
- 9.1 Drilling bushes
- 9.2 Plate jigs
- 9.3 Open drilling jigs
- 9.4 Closed drilling jigs
- 9.5 Indexing drilling jigs



# Pressure Die Casting

## Course Contents

### **1. Die Casting Dies**

- 1.1 Introduction to Casting Dies
- 1.2 Explain Gravity Die Casting
- 1.3 Application of Gravity Die Casting
- 1.4 Limitation of Gravity Die Casting
- 1.5 Casting Machines types
- 1.6 Book Mould Arrangement
- 1.7 Manual Drive Arrangement
- 1.8 Automatic Machines

### **2. Describe Gravity Casting Moulds**

- 2.1 Mould design
- 2.2 Risers and Gates
- 2.3 Top Gating
- 2.4 Side Gating
- 2.5 Bottom Gating
- 2.6 Gating System
- 2.7 Design Details
- 2.8 Undercuts
- 2.9 Ejection
- 2.10 Mould Material
- 2.11 Mould temperature

### **3. Introduction to Pressure Die Casting**

- 3.1 Casting Metals types
- 3.2 Application of Pressure Die Casting
- 3.3 Limitation of Pressure Die Casting
- 3.4 Pressure Die Casting Machines types
- 3.5 Hot chamber Machines
  - 3.5.1 Application Of Hot Chamber Machines
- 3.6 Hot chamber Machine
  - 3.6.1 Operating Cycle
- 3.7 Cold Chamber Machine
  - 3.7.1 Horizontal Cold Chamber Machine
  - 3.7.2 Horizontal Cold Chamber Machine
  - 3.7.3 Operating Cycle
  - 3.7.4 Cold Chamber injection system
  - 3.7.5 Vertical cold chamber Machine
- 3.9 Machine with Horizontal Parting Line
- 3.10 Machine with Vertical Parting Line
- 3.11 Die Design

- 3.12 VCC Machine with Horizontal Parting Line
- 3.12.1 VCC Machine with Vertical Parting Line
- 3.12.2 Operating Cycle
- 3.13 Machine Features
- 3.14 Hot Chamber Dies
- 3.15 Horizontal Cold Chamber Dies
- 3.16 Vertical Cold Chamber Dies
- 3.16.1 Cavity Layout
- 3.16.2 Parting Line
- 3.16.3 Gating System
- 3.16.4 Disposition of Cavities
- 3.16.5 Selection of Parting Lines
- 3.16.6 Runner
- 3.16.7 Gates
- 3.16.8 Over flows
- 3.16.9 Runner and gates
- 3.16.10 Runner and gates
- 3.16.11 Runner gates over flows
- 3.16.12 Air venting of die

#### **4. Introduction to Ejection Arrangement**

- 4.1 Explain the following types of Ejection system
- 4.2 Ejection machine side
- 4.3 Ejection location
- 4.4 Pin ejector, blade ejector
- 4.5 Ejector (Stripper, Pin, Blade)
- 4.6 Ejector return
- 4.7 Sliders and cores

#### **5. Introduction to Split cavities**

- 5.1 Drive of cores and splits
- 5.2 Shrinkage Allowance and Draft
- 5.3 Splits
- 5.4 Sliders
- 5.5 External threads
- 5.6 Internal threads
- 5.7 Introduction to Die Cooling
- 5.8 Die Cooling
- 5.9 Materials for Die Casting Dies
- 5.10 Die Lubricants
- 5.11 Hints for Trial Production
- 5.12 Surface Finishing and Quality of Castings

**List of Practical**

1. Design of different types of Jigs
2. Design of different types of Fixtures
3. Design of book mould for Pressure Die Casting
4. Design of vertical / horizontal hot chamber operating cycles

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

**AIMS:** At the end of this course, the student will have a fairly good knowledge of advance principals, design and manufacturing of Fine blanking and Deep drawing.

**1. Fine Blanking**

**32 Hours**

**2. Deep Drawing**

**32 Hours**

## Fine Blanking

### COURSE CONTENTS

#### FINE BLANKING

**07 Hours**

**1.0 Introduction to Fine Blanking**

1.1. Comparisons conventional and fine blanking

1.1.1 Comparison

1.1.2 Comparison

**1.2. Construction of Fine Blanked Components**

**1.3. Construction of FB – Tools, Parts**

**09 Hours**

1.3.1. Introduction to FB-Tool MOVING PUNCH

1.3.1.1 Moving Punch Type

1.3.2. Introduction to FB-tool Fixed Punch

1.3.2.1. Fixed punch type

**1.4. Main Parts Explain the Following Main Parts of Dies**

**08 Hours**

1.4.1 Blanking die

1.4.1.1. Inserts

1.4.1.2. Blank ejector-die & die frame location

1.4.1.4. One piece die

1.4.1.5. Split die

**1.4.2 Explain the following types of Punches**

**08 Hours**

1.4.2.1. Moving punches, coupling systems

1.4.2.2. Moving punches, design details

1.4.2.3. Punches, dia smaller than stock thickness

1.4.2.4. Explain Punches, design details

1.4.2.5. Punch – mounting

- 1.4.3. Punch guiding Plate (press plate), V-ring**
  - 1.4.4 Ejectors**
    - 1.4.4.1. Slug ejector
    - 1.4.4.2. Blank ejector
    - 1.4.4.3. Slug ejectors
  - 1.5. FB-Presses**
  - 1.6. Design preparations**
    - 1.6.1 Cutting force
    - 1.6.2 Required press plate (V- ring ) Pressure
    - 1.6.3. Cutting clearance
    - 1.6.4. Miscellaneous
  - 1.7. Suitable stock material**
  - 1.8. Component design, a few hints**
  - 1.9. Maximum endurance of the tool**
  - 1.10.2. **Trouble shooting**
-

## Deep Drawing

### Course Contents

<b>1.</b>	<b>Deep Drawing Sheet Metal Forming</b>	<b>3 Hours</b>
1.1.	Definition of various operations	
1.1.1	Deep Drawing	
1.1.2.	Form Drawing	
1.1.3.	Calibrating	
1.1.4.	Semi – Piercing	
1.1.5.	Coining	
1.1.6.	Embossing	
1.1.7.	Collar Drawing	
1.1.8.	Hole Flanging	
1.1.9	Expression and Element	
1.1.10	Terms and Elements	
<b>2.</b>	<b>Deep Drawing Operation</b>	<b>3 Hours</b>
2.1	Deep Drawing Operation	
2.2	Factors influencing Deep Drawing	
<b>2.3</b>	<b>Deep Drawing Tools, Classification</b>	
<b>2.4</b>	<b>Operational Classification</b>	
2.5	Suitable Presses for Deep Drawing Operations	
2.6	Types of Presses	
2.7	Operational differences in Presses	
2.8	Hydraulic Presses	
2.9	Single Action, Double Action	
<b>2.10.</b>	<b>Basic Designs of DD – Tools</b>	
2.11	Push through tool	
2.13	Push through tool	
2.14	Return Tools	
2.15	Inverted drawing tools	
2.16	Redrawing Tools	
2.17	Redrawing	
2.18	Double Drawing Tools	
2.19	Double Drawing Tools	
2.20	Blanking / Drawing Tool	
2.21	Blanking / Drawing tool	
2.22	Multi Station Drawing Tools	
2.23	Progressive tools, Shearing	
2.24	Progressive tools, (Oillet Method)	
2.25	Progressive Deep Drawing tools	
2.26	Progressive Deep Drawing tools, Oillet, example	
2.27	Transfer Methods	

2.28	Transfer Method	
<b>3.</b>	<b>Ironing Tools (Vertical And Horizontal)</b>	<b>2 Hours</b>
3.1.	Ironing Tools	
3.2.	Design Details	
3.3.	Base Plate	
<b>4.</b>	<b>Drawing Dies, (Die Support, forming PAD Ejector)</b>	<b>2 Hours</b>
4.1.	Die Concepts	
4.2.	Dies, Design Details	
<b>5.</b>	<b>Drawing Die Edge Shapes</b>	<b>2 Hours</b>
5.1.	Die edges	
5.2.	Rectangular drawing dies	
5.3.	Dies, shapes and dimensions	
5.4.	Drawing Punches	
5.5.	Punches	
<b>6.</b>	<b>Blank holder</b>	<b>1 Hour</b>
6.1	Blank holders	
<b>6.2</b>	<b>Strippers</b>	<b>1 Hour</b>
6.3	Strippers	
<b>6.3</b>	<b>Nesting the Blank</b>	<b>1 Hour</b>
6.4	Nesting	
<b>7.</b>	<b>Drawing Beads</b>	<b>2 Hours</b>
7.1.	Tool with inflow bead	
7.2.	Flow Braking Beads	
7.3.	Shapes, Mountings of drawing beads	
<b>8.</b>	<b>Determining flat blank (Circular)</b>	<b>3 Hours</b>
8.1.	Circular Blanks, Calculations	
8.2.	Draw Ratio. Redrawing steps	
8.3.	Draw ratio (general, circular, semi sph, rectangular)	
8.4.	Draw rations and redraws	
8.5.	Semi – Spherical parts	
<b>9.</b>	<b>Lubrication</b>	<b>2 Hours</b>
9.1.	Drawing Force, Blank holder Force	
9.2.	Tables (Correction factor, drawing clearance)	
<b>10.</b>	<b>Drawing clearance Y</b>	<b>3 Hours</b>
10.1	Trouble shooting	
10.2.	Form Drawing	
10.3.	Definition	
10.4.	Form Drawing Operation, General	

- 10.5. Basic Construction of form Drawing Tools
- 10.6. Determining Fax obtainable height (table)
- 10.7. Typical form drawing tools
- 10.8. Calibration tool
- 10.9. Semi Piercing
- 10.10. Definition
- 10.11. Semi Piercing, General
- 10.12. Applications
- 10.13. Typical semi piercing tools
- 10.14. Embossing / Coining
- 10.15. Definitions
- 10.16. Embossing
- 10.17. Coining

**11. Embossing / Coining 2 Hours**

**12. Collar Drawing, Hole Flanging 5 Hours**

- 12.1. Definitions
- 12.2. Collar Drawing, Hole Flanging
- 12.3. Applications
- 12.4. Collar drawing tools
- 12.5. Hole flanging tools
- 12.6. Hole Flanging

**Instructional Objectives:**

The teacher must ensure:

**Course Contents**

**1. Deep Drawing Sheet Metal Forming**

- 1.1. Definition of various operations
  - 1.1.1 Deep Drawing
  - 1.1.2. Form Drawing
  - 1.1.3. Calibrating
  - 1.1.4. Semi – Piercing
  - 1.1.5. Coining
  - 1.1.6. Embossing
  - 1.1.7. Collar Drawing
  - 1.1.8. Hole Flanging
  - 1.1.9 Expression and Element
  - 1.1.10 Terms and Elements

**2. Deep Drawing Operation**

- 2.1 Deep Drawing Operation
- 2.2 Factors influencing Deep Drawing
- 2.3 Deep Drawing Tools, Classification**
- 2.4 Operational Classification**



- 2.5 Suitable Presses for Deep Drawing Operations
- 2.6 Types of Presses
- 2.7 Operational differences in Presses
- 2.8 Hydraulic Presses
- 2.9 Single Action, Double Action
  
- 2.10. Basic Designs of DD – Tools**
- 2.11 Push through tool
- 2.13 Push through tool
- 2.14 Return Tools
- 2.15 Inverted drawing tools
- 2.16 Redrawing Tools
- 2.17 Redrawing
- 2.18 Double Drawing Tools
- 2.19 Double Drawing Tools
- 2.20 Blanking / Drawing Tool
- 2.21 Blanking / Drawing tool
- 2.22 Multi Station Drawing Tools
- 2.23 Progressive tools, Shearing
- 2.24 Progressive tools, (Oeillet Method)
- 2.25 Progressive Deep Drawing tools
- 2.26 Progressive Deep Drawing tools, Oeillet, example
- 2.27 Transfer Methods
- 2.28 Transfer Method
  
- 3. Ironing Tools (Vertical And Horizontal)**
- 3.1. Ironing Tools
- 3.2. Design Details
- 3.3. Base Plate
  
- 4. Drawing Dies, (Die Support, forming PAD Ejector)**
- 4.1. Die Concepts
- 4.2. Dies, Design Details
  
- 5. Drawing Die Edge Shapes**
- 5.1. Die edges
- 5.2. Rectangular drawing dies
- 5.3. Dies, shapes and dimensions
- 5.4. Drawing Punches
- 5.5. Punches
  
- 6. Blank holder**
- 6.1 Blank holders
- 6.2 Strippers**
- 6.3 Strippers

- 6.3 Nesting the Blank**
- 6.4 Nesting
  
- 7. Drawing Beads**
- 7.1. Tool with inflow bead
- 7.2. Flow Braking Beads
- 7.3. Shapes, Mountings of drawing beads
  
- 8. Determining flat blank (Circular)**
- 8.1. Circular Blanks, Calculations
- 8.2. Draw Ratio. Redrawing steps
- 8.3. Draw ratio (general, circular, semi sph, rectangular)
- 8.4. Draw ratios and redraws
- 8.5. Semi – Spherical parts
  
- 9. Lubrication**
- 9.1. Drawing Force, Blank holder Force
- 9.2. Tables (Correction factor, drawing clearance)
  
- 10. Drawing clearance Y**
- 10.1 Trouble shooting
- 10.2. Form Drawing
- 10.3. Definition
- 10.4. Form Drawing Operation, General
- 10.5. Basic Construction of form Drawing Tools
- 10.6. Determining Fax obtainable height (table)
- 10.7. Typical form drawing tools
- 10.8. Calibration tool
- 10.9. Semi Piercing
- 10.10. Definition
- 10.11. Semi Piercing, General
- 10.12. Applications
- 10.13. Typical semi piercing tools
- 10.14. Embossing / Coining
- 10.15. Definitions
- 10.16. Embossing
- 10.17. Coining
  
- 11. Embossing / Coining**
  
- 12. Collar Drawing, Hole Flanging**
- 12.1. Definitions
- 12.2. Collar Drawing, Hole Flanging
- 12.3. Applications
- 12.4. Collar drawing tools
- 12.5. Hole flanging tools
- 12.6. Hole Flanging

**List of Practical**

1. Design of Wire Drawing Die
2. Construction of Fine Blanked Components
3. Design of fixed type punch
4. Design of moving type punch
5. Design of different types of drawing dies
6. Design of different types of drawing beads

**Recommended Books**

1. Fine Blanking Published by PSTC, PCSIR
2. Deep Drawing Published by PSTC, PCSIR

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**DM-455**  
**Workshop Technology -DM 2**

**DM-455**

## **Workshop Technology DM 2**

<b>Total contact Hours</b>		<b>T</b>	<b>P</b>	<b>C</b>
Theory	<b>96 Hours</b>	3	6	5
Practical	<b>192 Hours</b>			

**AIMS:** At the end of this course, the student will have a fairly good working knowledge of advance principals of Die making and mould making.

### **Die Making Hints**

**32 Hours**

#### **Course Contents**

#### **1. Practical Hints on Die Making**

- Introduction
- The question about how to start
- Correct reading of drawings
- Planning the manufacturing process

#### **2. Press Tool Parts**

- The die
- The punch
- The die set
- Special operations in press tool making

#### **3. Impression Setting of the Cutting Members**

- Preparing punch and die
- Taking impression
- Setting the cutting members

#### **4. Assembly The Press Tool**

#### **5. Maintenance Of Press Tools**

- Re sharpening
- Possible repairs

**Course Contents**

**1. Practice of Mould Making**

- Introduction
- The question about how to start making a mould
- Correct reading of drawings
- Planning the manufacturing process
- Machining of the mould parts
- Milling and turning
- Drilling
- Grinding
- Assembling
- Matching of bearing faces
- Horizontal and inclined bearing faces
- Vertical bearing faces
- Adjustment of sliders
- Drilling of inclined pillar holes
- Proper guidance of the sliders
- Depth adjustment of the sliders
- Adjustment of the locking bracket
- Polishing
- The different polishing materials and polishing aids
- How to prepare cavity for polishing
- Pre – polishing
- Final polishing
- Polishing errors
- Final checking before trial

**3 Hints on Special Purpose Machine**

**32 Hours**

- **Introduction**
- **Hints on Jig Boring and Jig Grinding**
  
- General
- Clamping the work piece
- Grinding of boring tools
- The correct use of Boring aids
- Correct boring procedure
- Selection of Grinding wheels
- Correct grinding procedure

- Working procedure on Milling machine with jig grinding head
- Working procedure on jig grinding machine

### **1.1 Spark Erosion Process**

- General
- The parameters settings
- Electrode making
- Clamping, Aligning and Centering
- Flushing
- Machining

### **Recommended Books**

- |                       |                |
|-----------------------|----------------|
| 1. Die Making Hints   | by PSTC, PCSIR |
| 2. Mould Making Hints | by PSTC, PCSIR |
| 3. SPM Hints          | by PSTC, PCSIR |

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## **Course Contents**

### **1. Practical Hints on Die Making**

- Introduction
- The question about how to start
- Correct reading of drawings
- Planning the manufacturing process

### **2. Press Tool Parts**

- The die
- The punch
- The die set
- Special operations in press tool making

### **3. Impression Setting Of The Cutting Members**

- Preparing punch and die
- Taking impression
- Setting the cutting members

### **4. Assembly the Press Tool**

### **5. Maintenance of Press Tools**

- Re sharpening
- Possible repairs

## **Mould Making Hints**

**32 Hours**

## **Course Contents**

### **1. Practice of Mould Making**

- Introduction
- The question about how to start making a mould
- Correct reading of drawings
- Planning the manufacturing process
- Machining of the mould parts
- Milling and turning
- Drilling



- Grinding
- Assembling
- Matching of bearing faces
- Horizontal and inclined bearing faces
- Vertical bearing faces
- Adjustment of sliders
- Drilling of inclined pillar holes
- Proper guidance of the sliders
- Depth adjustment of the sliders
- Adjustment of the locking bracket
- Polishing
- The different polishing materials and polishing aids
- How to prepare cavity for polishing
- Pre – polishing
- Final polishing
- Polishing errors
- Final checking before trial

### **3 Hints on Special Purpose Machine**

**32 Hours**

- **Introduction**
- **Hints on Jig Boring and Jig Grinding**

- General
- Clamping the work piece
- Grinding of boring tools
- The correct use of Boring aids
- Correct boring procedure
- Selection of Grinding wheels
- Correct grinding procedure
- Working procedure on Milling machine with jig grinding head
- Working procedure on jig grinding machine

### **1.2 Spark Erosion Process**

- General
- The parameters settings
- Electrode making
- Clamping, Aligning and Centering
- Flushing
- Machining

1. Blanking, Piercing, Cutting Die Manufacturing Project
2. Injection Mould Manufacturing Project
3. Centering with lever gauge on jig boring and jig grinding
4. Centering with micro scope on jig boring and jig grinding
5. Centering with electrode on EDM
6. Drilling on EDM
7. Die sinking exercise on EDM
8. Inclined pillar drilling exercises
9. Slider fitting exercises

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**DM-462**  
**PRODUCTION PLANNING -DM**

**DM-462****PRODUCTION PLANNING-DM**

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

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

- i) Understand the fundamental functions of manufacturing organizations.
- ii) Understand the methods of design, analysis and improvement of production system

**Course Contents:**

<b>1. Organization of Production Enterprises</b>	<b>8 Hrs</b>
<b>2. Process and Flow Analysis</b>	<b>8 Hrs</b>
<b>3. Estimation of Production Time</b>	<b>8 Hrs</b>
<b>4. Productivity Measurement and Improvement</b>	<b>8 Hrs</b>
<b>5. Cost Estimation and Control</b>	<b>16 Hrs</b>
<b>6. Store operations</b>	<b>4 Hrs</b>
<b>7. Management of Quality</b>	<b>12 Hrs</b>

**Detail of Contents:**

<b>1. Organization of Production Enterprises</b>	<b>8 Hrs</b>
<ul style="list-style-type: none"> <li>• Types of Organization</li> <li>• Commercial Division</li> <li>• Technical Division</li> <li>• Machine shop and Production shop</li> <li>• Tool Room</li> <li>• Quality inspection</li> </ul>	
<b>2. Process and Flow Analysis</b>	<b>8 Hrs</b>
<ul style="list-style-type: none"> <li>• Process Selection</li> <li>• Flow charting and Machine Sequencing</li> <li>• Machine Loading Chart</li> </ul>	
<b>3. Estimation of Production Time</b>	<b>8 Hrs</b>
<ul style="list-style-type: none"> <li>• Basic Preparation time and allowances</li> <li>• Setting-up time</li> <li>• Essential operation time</li> <li>• Auxiliary operation time</li> <li>• Execution time and allowances</li> </ul>	

<b>4. Productivity Measurement and Improvement</b>	<b>8 Hrs</b>
<ul style="list-style-type: none"> <li>• Significance of Productivity</li> <li>• Types of Productivity</li> <li>• Single and Multiple Factor Productivity</li> <li>• Approaches for Productivity Improvement</li> </ul>	
<b>5. Cost Estimation and Control</b>	<b>16 Hrs</b>
<ul style="list-style-type: none"> <li>• Fixed costs</li> <li>• Overhead costs</li> <li>• Recurring costs</li> <li>• Breakeven analysis</li> <li>• Marginal analysis</li> <li>• Budgeting and control</li> </ul>	
<b>6. Store operations</b>	<b>4 Hrs</b>
<ul style="list-style-type: none"> <li>• Receipt of store items</li> <li>• Records of store</li> <li>• Issuance of store items</li> </ul>	
<b>7. Management of Quality</b>	<b>12 Hrs</b>
<ul style="list-style-type: none"> <li>• Types of Quality</li> <li>• Quality Dimensions</li> <li>• Design for Quality</li> <li>• Quality Management System</li> </ul>	

### **Recommended Textbooks:**

1. Industrial Management by Prof. M.H. Zuberi
2. Industrial Engineering and Management System by Dr. Mansor Ali (Publisher: Urban Resauce Center,2001)
3. Factory and Production Management by Lockyer (Publisher: Pitman, 1974)
4. Production Planning by A. Bischof Published by PSTC, PCSIR

## **Instructional Objectives:**

### **Detail of Contents:**

#### **1. Organization of Production Enterprises**

- Types of Organization
- Commercial Division
- Technical Division
- Machine shop and Production shop
- Tool Room
- Quality inspection

#### **2. Process and Flow Analysis**

- Process Selection
- Flow charting and Machine Sequencing
- Machine Loading Chart

#### **3. Estimation of Production Time**

- Basic Preparation time and allowances
- Setting-up time
- Essential operation time
- Auxiliary operation time
- Execution time and allowances

#### **4. Productivity Measurement and Improvement**

- Significance of Productivity
- Types of Productivity
- Single and Multiple Factor Productivity
- Approaches for Productivity Improvement

#### **5. Cost Estimation and Control**

- Fixed costs
- Overhead costs
- Recurring costs
- Breakeven analysis
- Marginal analysis
- Budgeting and control

#### **6. Store operations**

- Receipt of store items
- Records of store
- Issuance of store items

#### **7. Management of Quality**

- Types of Quality
- Quality Dimensions
- Design for Quality
- Quality Management System