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 1st YEAR

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Gen-111
ISLAMIAT AND PAK STUDIES
إسلاميات/مطالعه باکستان

حصه اول اسلاميات

1.0.1

حصه دوم مطالعه باکستان

مراجع

1.0.1

کتاب و صنعت

قرآن مجید

1. تواریخ ترکان گیر
2. تاریخ ترکان 3. کی یو دنیا کی تحقیقات 4. ترک اسلام

5. پشت کتاب آتیه مزاین

1. ان تعالوا لب حمین دی تلفش ما تا خب
2. و اعتصموا ببخل الله جمعا ولا تفرقوا
3. ولا بجرمکم شتان قوم علی ان لی تعددوا
4. ان الله یامکم ان ترودوا الامانات ای اهلها
5. ان الله یامکم ان ترودوا الامانات ای اهلها
6. ان الصلوة تنعی الفساء والمنتکر
7. لقد كان لكم في رسول الله اسوة حسنة
8. ان کرمکم عند الله اتفاك
9. وما اتاكم الرسول فخذوه ومانهاکم عن فاتوه
10. واوفوا بالعهد
11. وعاویه والمعروف
12. يمحیر الله الزیب وبریبی الصدق
13. واصر على ما اصببک
14. وقولا فولا سدینا
15. ان الدين عند الله الإسلام
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حصصہ اول
 حصصہ اسلامیات
 تدريسي مقاصد

عمری مقصد:
طالب علمی تعلیم کے قانون میں اسلامی تعلیمات کا اصل ریچرچ آقبان بہت ہے۔

خصوصی مقصد:
طالب علمی تعلیم کا معاشرہ کا کیا گا?
1. قرآن میں کی دنیا کے معاشرہ کا کیا گا?
2. قرآن میں دنیا کو خوبصورت میان کرے?
3. قرآن میں دنیا کو خوبصورت میان کرے?
4. قرآن میں دنیا کو خوبصورت میان کرے?

عمری مقصد:
طالب علمی تعلیم کے قانون میں اسلامی تعلیمات کا اصل ریچرچ آقبان بہت ہے۔

خصوصی مقصد:
طالب علمی تعلیم کا معاشرہ کا کیا گا?
1. قرآن میں کی دنیا کے معاشرہ کا کیا گا?
2. قرآن میں دنیا کو خوبصورت میان کرے?
3. قرآن میں دنیا کو خوبصورت میان کرے?
4. قرآن میں دنیا کو خوبصورت میان کرے?

خصوصی مقصد:
طالب علمی تعلیم کے قانون میں اسلامی تعلیمات کا اصل ریچرچ آقبان بہت ہے۔

خصوصی مقصد:
1. قرآن میں کی دنیا کے معاشرہ کا کیا گا?
2. قرآن میں دنیا کو خوبصورت میان کرے?
3. قرآن میں دنیا کو خوبصورت میان کرے?
4. قرآن میں دنیا کو خوبصورت میان کرے?
4. دین اسلام

دین اسلام کی پیروانی انجام دو عبادات کے طور پر باہمی وحدت ہیں کہ اور بیان کرنا ضروری ہے۔

خصوصی مضامین:

افتخار اور اسلام کے لئے اعاذہ اور امتیازی قدرت بیان کرنا۔

اسلام کے پہلوی اعاذہ کی ابتکاری بیان کرنا۔

اسلام کے پیروانی قدرت کے لئے امتیازی ادارے اور امتیازی کی بیان کرنا۔

عبادات کے لئے امتیازی اور امتیازی بیان کرنا۔

عبادات کے لئے امتیازی اور امتیازی بیان کرنا۔

اسلام کے عبادات کے لئے امتیازی اور امتیازی بیان کرنا۔

ء
مال اول (نیزہ طالبہ کی نظیر)

نصب انخلاقوت

خصائص انخلاقوت

Gen III

خصوص مطالعہ کیا گیا

موضوعات

انخلاقوت کی تعریف اور ربط

انخلاقوت کا معیار (قانون عمل الباہمی کتاب)

نہر خلی جو انخلاقوت کی دوسرہ

دیکھتی ہوئی

واگرز

مخصوص

مخصوص

روشن

مخصوص

منابع

وپچ یہ

ائف

توہر

مخصوص
نصاب اخلاقیات سال اول

تدریکی متماہی

عبوری قصیده

کے اخلاقیات کی جگہ سے نکل تری زمری میں کئی تزاری دیکھا گیا ہے

خصوصی متناسب ٹال کے فنکار

موہومات کا مطلب ہاں کر ہے

کل زندگی وہ شاہنواں کی شکاپر کر ہے

اپنے فلسفی اور سماجی شیو کے موہومات کے کھیت اثرات پہلی آنے کے طرف تری ہاڑ ہے

دیانتی داری کی ایک ہور ہاڑ ہے

وقا داری کی ایک ہور ہاڑ ہے

تلا تلا شیو کی ایک ہور ہاڑ ہے

صداقہ ہاڑ کی پورضوہت ہاڑ ہے

حولہ کی ایک ہور ہاڑ ہے

وقا کی ایک ہور ہاڑ کے متعلق ہاڑ ہے

صنافی اور پاکی احترام سے ہم کا کارگیری کو بیان کر رہے ہے

حولہ کی ایک ہور ہاڑ ہے
خطا نظریہ پاکستان

 تصویر

 نظریہ پاکستان

 عمومی مقصد: نظریہ پاکستان (دین اسلام) سے لوگوں کے معیار اور قانون میں

 خصوصی مقصد: نظریہ پاکستان کے معاشرتی اور اقتصادی مسائل کے

 عمومی مقصد: نظریہ پاکستان کا متعدد بانوں میں موجود

 خصوصی مقصد: نظریہ پاکستان کے معاشرتی اور اقتصادی مسائل کے

 عمومی مقصد: نظریہ پاکستان کے معاشرتی اور اقتصادی مسائل کے

 خصوصی مقصد: نظریہ پاکستان کے معاشرتی اور اقتصادی مسائل کے
حصار مصالح پاکستان

 robe

تاریخ قریشی

مسلمانوں میں ابتدائی فنکار فلک مسلمانوں کی طبیعت کی تاتعلیم کی اہتمام اور میراد، تازہ دیہی مانگ نئی امتحانات کے نتیجے

تاریخ پاکستان کی ایجاد (دینی اسلام) قیام پاکستان کی تاریخ میں مکرر ہے۔ تاریخ پاکستان کی معاشرتی تاریخ پاکستان

تعلیم کا اہم کردار کا اہم کردار کا اہم کردار

تاریخ پاکستان کا تاریخی پہلو

جہاں تک قیام پاکستان کی خصوصیات اور شہریتی اقدامات کی معاشرتی تاریخ پاکستان

تاریخ کے کردار

علمیات ان کے بہترین پڑھائی اور شہریتی اقدامات کی تاریخ

تاریخ پاکستان کا تاریخی پہلو

جہاں تک قیام پاکستان کی خصوصیات اور شہریتی اقدامات کی معاشرتی تاریخ پاکستان

تاریخ کے کردار

علمیات ان کے بہترین پڑھائی اور شہریتی اقدامات کی تاریخ
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 11th word or any word for that matter will be omitted. The number of missing word will range between 5-10. The chosen word may or may not be the one used in the text, but it should be an appropriate word.

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/or 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.
3. A Hand Book of English Students by Gatherer
PAPER-A

1. DEMONSTRATE BETTER READING, COMPREHENSION AND VOCABULARY
   1.1 Manipulate, skimming and scanning of the text.
   1.2 Identify new ideas.
   1.3 Reproduce facts, characters in own words
   1.4 Write summary of stories

2. UNDERSTAND FACTS OF THE TEXT
   2.1 Rewrite words to fill in the blanks recalling the text.
   2.2 Use own words to fill in the blanks.

PAPER-B

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

4. APPLY THE CONCEPTS OF COMPOSITION WRITING TO PRACTICAL SITUATIONS
   4.1 Use concept to construct applications for employment, for character certificate, for grant of scholarship.
   4.2 Define and write telegrams, cablegrams and radiograms, telexes, facsimiles
   4.3 Describe steps of a good composition writing.
   4.4 Describe features of a good composition.
   4.5 Describe methods of composition writing.
   4.6 Use these concepts to organize facts and describe them systematically in practical situation;

5. APPLIES RULES OF TRANSLATION
   5.1 Describe confusion.
   5.2 Describe rules of translation.
   5.3 Use rules of translation from Urdu to English in simple paragraph and sentences.
Math-113
APPLIED MATHEMATICS-I
Math-113  APPLIED MATHEMATICS-I

Total contact hours  96  
Theory  T  P  C  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
2. Develop skill, mathematical attitudes and logical perception in the use of mathematical instruments as required in the technological fields.
3. Acquire mathematical clarity and insight in the solution of technical problems.

COURSE CONTENTS
1  QUADRATIC EQUATIONS  6 Hrs
1.1 Standard Form
1.2 Solution
1.3 Nature of roots
1.4 Sum & Product of roots
1.5 Formation
1.6 Problems

2  ARITHMETIC PROGRESSION AND SERIES  3Hrs
2.1 Sequence
2.2 Series
2.3 nth term
2.4 Sum of the first n terms
2.5 Means
2.6 Problems

3  GEOMETRIC PROGRESSION AND SERIES  3Hrs
3.1 nth term
3.2 sum of the first n terms
3.3 Means
3.4 Infinite Geometric progression
3.5 Problems

4  BINOMIAL THEOREM  6 Hrs
4.1 Factorials
4.2 Binomial Expression
4.3 Binomial Co-efficient
4.4 Statement
4.5 The General Term
4.6 The Binomial Series.
4.7 Problems

5 PARTIAL FRACTIONS  6 Hrs
5.1 Introduction
5.2 Linear Distinct Factors  Case I
5.3 Linear Repeated Factors  Case II
5.4 Quadratic Distinct Factors Case III
5.5 Quadratic Repeated Factors Case IV
5.6 Problems

6 FUNDAMENTALS OF TRIGONOMETRY  6 Hrs
6.1 Angles
6.2 Quadrants
6.3 Measurements of Angles
6.4 Relation between Sexagesimal & circular system
6.5 Relation between Length of a Circular Arc & the Radian Measure of its central Angle
6.6 Problems

7 TRIGONOMETRIC FUNCTIONS AND RATIOS  6 Hrs
7.1 trigonometric functions of any angle
7.2 Signs of trigonometric Functions
7.3 Trigonometric Ratios of particular Angles
7.4 Fundamental Identities
7.5 Problems

8 GENERAL IDENTITIES  6 Hrs
8.1 The Fundamental Law
8.2 Deductions
8.3 Sum & Difference Formulae
8.4 Double Angle Identities
8.5 Half Angle Identities
8.6 Conversion of sum or difference to products
8.7 Problems

9 SOLUTION OF TRIANGLES  6 Hrs
9.1 The law of Sines
9.2 The law of Cosines
9.3 Measurement of Heights & Distances
9.4 Problems

10 MENSURATION OF SOLIDS  30 Hrs
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 Sealers & Vectors
11.2 Addition & Subtraction
11.3 The unit Vectors i, j, k
11.4 Direction Cosines
11.5 Sealer or Dot Product
11.6 Deductions
11.7 Dot product in terms of orthogonal components
11.8 Deductions
11.9 Analytic Expression for a x b.
11.10 Problems.

12 MATRICES AND DETERMINANTS 9 Hrs
12.1 Definition of Matrix
12.2 Rows & Columns
12.3 Order of a Matrix
12.4 Algebra of Matrices
12.5 Determinants
12.6 Properties of Determinants
12.7 Solution of Linear Equations
12.8 Problems

REFERENCE BOOKS
2. Prof. Riazali Khan - Polytechnic Mathematic Series Vol I & II, Majeed Sons, Faisalabad
INSTRUCTIONAL OBJECTIVES

1 USE DIFFERENT METHODS FOR THE SOLUTION OF QUADRATIC EQUATIONS
1.1 Define a standard quadratic equation.
1.2 Use methods of factorization and method of completing the square for solving the equations.
1.3 Derive quadratic formula.
1.4 Write expression for the discriminant.
1.5 Explain nature of the roots of a quadratic equation.
1.6 Calculate sum and product of the roots.
1.7 Form a quadratic equation from the given roots.
1.8 Solve problems involving quadratic equations.

2 UNDERSTAND APPLY CONCEPT OF ARITHMETIC PROGRESSION AND SERIES
2.1 Define an Arithmetic sequence and a series.
2.2 Derive formula for the nth term of an A.P.
2.3 Explain Arithmetic Mean between two given numbers.
2.4 Insert n Arithmetic means between two numbers.
2.5 Derive formulas for summation of an Arithmetic series.
2.6 Solve problems on Arithmetic Progression and Series.

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

4 EXPAND AND EXTRACT ROOTS OF A BINOMIAL
4.1 State binomial theorem for positive integral index.
4.2 Explain binomial coefficients: (n, 0), (n,1)…………(n, r),………..(n, n)
4.3 Derive expression for the general term.
4.4 Calculate the specified terms.
4.5 Expand a binomial of a given index. -
4.6 Extract the specified roots.
4.7 Compute the approximate value to a given decimal place.
4.8 Solve problems involving binomials.
5 RESOLVE A SINGLE 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 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
Total Contact Hours

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

COURSE CONTENTS

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

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

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

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

5. **WAVE MOTION**
   - 5.1 Review Hooke's law of elasticity,
   - 5.2 Motion under an elastic restoring force.
   - 5.3 Characteristics of simple harmonic motion
   - 5.4 S.H.M. and circular motion
5.5 Simple pendulum
5.6 Wave form of S.H.M.
5.7 Resonance
5.8 Transverse vibration of a stretched string

6. **SOUND**  
6.1 Longitudinal waves
6.2 Intensity, loudness, pitch and quality of sound
6.3 Units of Intensity of level and frequency response of ear
6.4 Interference of sound waves silence zones, beats
6.5 Acoustics
6.6 Doppler effect

7. **LIGHT**  
7.1 Review laws of reflection and refraction
7.2 Image formation by mirrors and lenses
7.3 Optical instruments
7.4 Wave theory of light
7.5 Interference, diffraction, polarization of light waves
7.6 Applications of polarization in sunglasses, optical activity and stress analysis

8. **OPTICAL FIBER**  
8.1 Optical communication and problems
8.2 Review total internal reflection and critical angle
8.3 Structure of optical fiber
8.4 Fiber material and manufacture
8.5 Optical fiber - uses.

9. **LASERS**  
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) \( y = l/x \)

2. Find the volume of a given solid cylinder using vernier calipers.

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

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

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

6. Verify law of triangle of forces and Lami's theorem

7. Determine the weight of a given body using
   a) Law of parallelogram of forces
   b) Law of triangle of forces
   c) Lami's theorem


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.


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

Total Contact Hours
Theory 32
Practical 64

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

AIMS After studying this course a student will be able to;
1. Understand the significance and role of chemistry in the development of modern technology.
2. Become acquainted with the basic principles of chemistry as applied in the study of relevant Technology.
4. Gains skill for the efficient conduct of practical’s in a Chemistry lab.

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

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

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

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

5 ACIDS, BASES AND SALTS 2 Hrs
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<tr>
<td>5.1</td>
<td>Definitions with examples</td>
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<td>5.2</td>
<td>Properties, their strength, basicity &amp; Acidity</td>
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<td>5.3</td>
<td>Salts and their classification with examples</td>
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<td>pH-value and scale</td>
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<td>OXIDATION &amp; REDUCTION</td>
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<td>The process, definition &amp; examples</td>
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<td>Oxidizing and reducing agents</td>
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<td>Oxides and their classifications</td>
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<td>7</td>
<td>NUCLEAR CHEMISTRY</td>
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<td>Introduction</td>
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<td>7.2</td>
<td>Radioactivity (alpha, beta and gamma rays)</td>
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<td>Half life process</td>
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<td>Nuclear reaction &amp; transformation of elements</td>
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<td>Composition and manufacture</td>
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<td>Chemistry of setting and hardening</td>
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<td>Special purpose cements</td>
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<td>Composition and raw material</td>
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<td>PLASTICS AND POLYMERS</td>
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<td>PAINTS, VARNISHES AND DISTEMPER</td>
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<td>CORROSION</td>
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<td>Types of corrosion</td>
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<td>Rusting of iron</td>
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<td>Protective measures against-corrosion</td>
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<td>13</td>
<td>REFRACTORY MATERIALS AND ABRASIVE</td>
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<td>Introduction to Refractories</td>
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13.3 Properties and Uses
13.4 Introduction to Abrasives
13.5 Artificial and Natural Abrasives and their uses

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

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

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

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

BOOKS RECOMMENDED
1. Text Book of Intermediate Chemistry (I & II)
2. Ilmi Applied Science by Sh. Atta Muhammad
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 ho. and mass no.; isotopes and isobars
2.5 Explain the arrangements of electrons in different shells and sub energy levels
2.6 Explain the grouping and placing of ^elements’ in the periodic table

3 UNDERSTAND THE NATURE OF CHEMICAL LBOUND
3.1 Define chemical bond
3.2 Describe the nature of chemical bond
3.3 Differentiate between electrovalent 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 a 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

Total Contact Hours

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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 3 hrs

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  By Shelley Cashman Series
   II. Introduction to Computers  By Peter Norton
List of Practical:

Identify keyboard, mouse, CPU, disks, disk drives, monitor and printer 3 Hrs

MS WINDOWS XP 12 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 number 04
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-MAIL 12 Hrs
1.24 Identifying internet explorer
1.25 Practice of searching data from any search engine
1.26 Practice of create an E-Mail account and how to send and receive mails, download attachments
COMP-142

COMPUTER APPLICATIONS

Practical Objectives:

1. Identify key board, mouse, CPU, disks, disk drives, monitor, and printer
   1.1. Understand use and features of keyboard, CPU, disk drives, disks, monitor, and printer

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

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

4.1 Identifying the MS EXCEL Screen and its menu
   4.1.1 Student will be able to identify the MS EXCEL screen and its menus

4.2 Practice of create a new sheet, saving and re-opening it from the location and spell check
   4.2.1 Student will be able to create new documents, save documents and reopen the saved documents and spell check and grammar

4.3 Practice of insert and delete of row and columns (format of cell)
   4.3.1 Student will be able to insert and delete row and columns

4.4 Practice of entering data and formulas in worksheet(Add, Subtract, Multiplying, and Divide & Average)
   4.4.1 Student will be able to use different formulas in worksheet(Add, Subtract, Multiplying, and Divide & Average)

4.5 Repeating practical serial number 04

4.6 Practice of insert chart and its types
   4.6.1 Student will be able to insert different types of chart into worksheet

4.7 Practice of page setup, set the page margins, and printing
   4.7.1 Student will be able to adjust page setup, margin and print worksheets

5. **MS OFFICE (MS-POWER POINT)**

1.1 Identifying the MS POWER POINT Screen and its menu
   1.1.1 Student will be able to identify the MS POWER POINT screen and its menus

1.2 Practice of create a new presentation and save
   1.2.1 Student will be able to create a presentation and save it

1.3 Practice of open saves presentations
   1.3.1 Student will be able to open the saves presentations

1.4 Practice of insert picture and videos
   1.4.1 Students will be able to insert picture and video clips

2. **INTERNET & E-MAIL**

2.1 Identifying internet explorer
   2.1.1 Students will be able to identify the Internet explorer screen

2.2 Practice of searching data from any search engine
   1.2.1 Students will be able to search information catalog, e-books etc from different search engine

2.3 Practice of create an E-Mail account and how to send and receive mails, download attachments
   2.3.1 Students will be able to create E-mail account, send and receive mails and download attachments
WT-156 WORKSHOP TECHNOLOGY-I

Total contact Hours

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<tr>
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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  10 Hours

   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

4.2. Ball peen, cross peen, straight peen, sledge hammer
4.3. Soft hammers types and uses.

5. **Marking Tools** 3 Hours

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

6. **Assembly Tools** 4 Hours

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

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

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

8. **INSTRUMENTS FOR CHECKING SURFACES** 4 Hours

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

9. **MEASURING INSTRUMENTS** 12 Hours

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

10. **METAL CUTTING** 6 Hours

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

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

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

*****************************************************************************
Bench Fitting Exercises

1. Filing exercise on U-Channel Exercise
2. Step Filling Exercise
3. Sawing Exercise
4. Marking exercise
5. Marking with Height gauge
6. Stamping Exercise
7. Chipping Exercise
8. Counter Filling Exercise
9. Drilling Exercise
10. Debarring Exercise
11. Tapping Exercise
12. Internal Filling Exercise
13. Reaming Exercise
14. Counter Sinking Exercise
15. Counter boring Exercise
16. Wire Bending Exercise
17. Sheet Metal Bending Exercise
18. Internal/External Round Filling
19. Riveting Exercise
20. External Threading with Die
21. Push Fit Exercise
22. Sheet Metal Fits Exercise
23. Doweling Exercise
24. Introduction to Lathe and Simple Step Turning
MT-141  HEALTH SAFETY AND ENVIRONMENT

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

Pre-requisites: None

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

Course Contents:

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

Detail of Contents:

1. Introduction and Importance of Safety  1Hr
   1.1 Introduction to safety and House keeping
   1.2 Importance in Institute workshops /labs
   1.3 Importance in industry
   1.4 Accident cost

2. Accidents in Chemical Industry  2 Hrs
   2.1 Accidents in petroleum, paint and fertilizer industry
   2.2 Explosive vapors and gases

3. Accidents in Mechanical Industry  3 Hrs
   3.1 Due to material handling and transportation
   3.2 Accidents due to hand tools
   3.3 Accidents in machines shop
   3.4 Accidents in Metal workshop
   3.5 Accidents in wood working shop
3.6 Accidents in foundry, welding and forging shop
3.7 Safety in CNC machines operation

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

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

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

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

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

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

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

11. Pollution 2 Hrs
11.1 Atmosphere
11.2 Water pollution
11.3 Solid waste management
12. First Aid  
   12.1 Importance  
   12.2 Procedure and training  
   12.3 Extended medical services  
13. Analyzing Causes of Accidents  
   13.1 Accident prevention fundamentals  
   13.2 Plant inspections and accidents investigation  
   13.3 Safety inventory, auditing, records and annual reports  
14. Promoting Safety Culture  
   14.1 Employees training culture  
   14.2 Displays  
   14.3 Guidance  
15. Safety Regulations & adherence to International Safety Standards  
   15.1 Safety Regulations & adherence to International Safety Standards  
   15.2 Pakistan Factory Act (laws concerning to safety)  
   15.3 Workman compensation act  
   15.4 Industrial insurance and social security  
   15.5 Legal aspects of safety
MT-141 HEALTH SAFETY AND ENVIRONMENT

Instructional Objectives:

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

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

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

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

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

6. **Electric shocks & Earthling (Prevention and its remedy)**
   6.1 Describe Electricity as danger
   6.2 Describe Electric shock phenomena
   6.3 Describe Reasons of electric shock
   6.4 Describe Prevention of electric shock
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
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. **OTHOGRAPHIC 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 1st year Engineering Drawing By A.C. Parkinsin

TD-153 Technical Drawing
List of Practical 192 Hours

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## ADVANCED DIPLOMA OF ASSOCIATE ENGINEER IN MECHANICAL TECHNOLOGY WITH SPECIALIZATION IN DIES AND MOULDS (04 Years) SCHEME OF STUDIES 2nd YEAR

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Gen-211
ISLAMIAT AND PAK.STUDIES
اسلامیات/مطالعہ پاکستان

حصہ اول اسلامیات 211

حصہ دوم مطالعہ پاکستان

م وقت: 20 گھنٹے

1. سوواں، جنوبی آیاں نے ایسا ہے کہ میں:

- خیر کم میں تعلیم القرآن و علیمہ
- لا ایمان لکن لا اماتة له ولادین لمن عبیدہ
- ایاکم و الظن ان الظن اکذب الحدیث
- من اخد ث فئی امرنا هذا ما ليس منه فهورد
- من حمل علینا السلاح فلئیز منا
- ان کا قل البتیم فی الجنة هیذا

- لا بومن اخذ کم حتى اکون احب الیه من والده و ولده الناس اجمعین
- من بین لله مسجد ابنی الله له بیتا فی الجنة
- لضرور ولا ضرار فی الإسلام
- کلکم راع و کلکم مسنود عن رعیتیه

2. کتب طریقہ

- کی زنگی، ولادت، بیت، بیجت
- کی نفی، نگاهات، بیجت، بیت، کی(اسباب و نتائج)

3. حضرت عائشہ رضی اللہ عن

4. معلم کاہل سردار عثمان

5. اسلامی وسائل

- نظامت الاضافات علیہ تاریخ
- اسلامی وسائل

6. اسلامی وسائل
اسلامیات

سر وکال مقدمہ

قرآن کی ترتیب کا ذیل

عوام خاص طالب علمیان سے کہا گیا تھا کہ آیات آیاتی کی رشی میں مون کے وصاف کی کہانیاں?

خصوصی مقتضیات

- قرآن آیات کا ترتیب بیان کر کے۔
- قرآن آیات کی ترتیب کر کے۔
- قرآن آیات کی روشن شرا آی کے وصاف بیان کر کے۔
- قرآن آیات کے بیان کر کے اور جو مون کے وصاف انکے امر مدبوب کر کے۔

اعادہ بیت توہیں

عوام خصوصی احادیث کی ذیلی سے اسلامی اخلاقی الادارے (افرادی واعظوں) سے آگاہ ہو کے تقریر

خصوصی مقتضیات

- احادیث کا ترتیب بیان کر کے۔
- احادیث کا ترتیب بیان کر کے۔
- احادیث کی روشنی سے اسلامی اخلاقی الادارے واعظوں۔
- احادیث کی روشنی سے اسلامی اخلاقی الادارے۔
- احیاء بیت میںے دہی کی ترغیب کے مطابق اپنی زندگی کے روک کرے۔

کرست ظہور

عوام خصوصی ظہور علیہ کی ذیلی سے بارے سے مون جانے کے

خصوصی مقتضیات

- ظہور علیہ کی اندری زندگی انصار کے میں بیان کر کے۔
- ظہور علیہ کی اندریزندگی انصار کے۔
- ظہور علیہ کی اندری زندگی انصار کے۔
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- ظہور علیہ کی اندری زندگی انصار کے۔
اسلامی معاشرہ

عموی مقام کے اسلامی معاشرہ کی خصوصیات سے آگاہِ حاصل کر کے

خصوصی مقام

- اسلامی معاشرہ کا مصنف وشیخ محمد بیان کے
- اسلامی معاشرہ کے اشرافی خصوصیات بیان کے
- اسلامی معاشرہ سے اعلی واعلا کی اہمِ بیان کے
- تبلیغ کے مختلف منصوبے بیان کے
- تبلیغ کے مختلف اصطلاحات بیان کے
- جہادی اہتمام بیان کے
- جہادی اہتمام بیان گر کے
- جہادی وقائع شریعت بیان کے
- جہادی مختلف اقسام بیان کے
- لفظی بکری تعریف کر کے
- جہادی فلسفہ معاشرت کو جوہال کرنے کے بارے میں افادات کو بیان کے

اسلامی یوگ

عموی مقام کے اسلامی یوگ کی خصوصیات بیان کے

خصوصی مقام

- یوگ کے تعریف بیان کے
- اسلامی یوگ کے تعریف بیان کے
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- اسلامی یوگ کے تعریف بیان کے
تربیت اخلاقیات ( خیر و سلامة کی بنیاد)

101

نسل دیم

موضع جات

متعلقیت اخلاقیات سے، ا&P گروپ میں دوسری خیر و سلامة کی بنیاد کا کونسل اور دوسری چار کانفرنس میں مصروف ہو ہوئے قرار پائے ہوئے قرار دیا گیا قرار دیا گیا قرار دیا گیا قرار دیا گیا قرار دیا گیا قرار دیا گیا قرار دیا گیا قرار دیا گیا قرار دیا گیا قرار دیا گیا قرار دیا گیا

اخلاقیاتی انجمن قیرآباد

بندگان

موجودہ

تعارف کا نیچہ

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نصب اخلاقیات

نسل دیم

قدرتی مبنا غیب

عموی مشاعر

طالب علم

اخلاقیاتی انجمن قیرآباد

سالم غیب

موجودہ

موجودہ

علمی زندگی کی جائزہ کرنا

اخلاقیات

تربیت اخلاقیات

تربیت اخلاقیات

تربیت اخلاقیات
ظلمی دو ہندوستان کے خصوصی معاملوں میں تجاویز

ضروری متقی معاصر

تحکیم پاکستان

قومی پاکستان کے اساسات دو شکیاریوں کو برقرار کر کے

خصوصی مقامات

- قومیت کے مفہوم کو بیان کر کے
- وقفی انتظامیات کو تحریف و ترکیب کر کے
- وقفی انتظامیات کو شکیاریوں کو بیان کر کے
- بمباری سلامات کی خودودوزی کو بیان کر کے
- قومی تحقیق کو خالی کر کے لے سلامات کی سازی بیان کر کے
- آزادی اور فتح پاکستان کے لئے عفونتی کالا اور خان کا عفونتی کالا بیان کر کے
- قومی پاکستان کے سکھرہ سبق مملکت کے قیام کے لئے اسلام کو خوشور کو بیان کر کے
- مسلمانی قیام پاکستان کے لئے جدید بیان کر کے
Phy-212
APPLIED MECHANICS
Phy-212 APPLIED MECHANICS

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

AIMS
1. Apply the concepts of Applied Physics to understand Mechanics
2. Apply laws and principles of Mechanics in solving technological problems
4. Demonstrate efficient skill of practical work in Mechanics Lab.

COURSE CONTENTS

1. MEASUREMENTS 2 Hours
   1.1 Review: Dimensional formula of Equations of Motion
   1.2 Review: Systems of measurement, S.I. Units, conversion
   1.3 Significant Figures
   1.4 Degree of accuracy

2. EQUILIBRIUM OF CON-CURRENT FORCES 3 Hours
   2.1 Concurrent forces
   2.2 Addition and Resolution of Vectors
   2.3 Toggle Joint, Hanging Chains
   2.4 Roof Trusses, Cranes.
   2.5 Framed structures

3. MOMENTS AND COUPLES: 2 Hours
   3.1 Principle of Moments - Review
   3.2 Levers
   3.3 Safety valve
   3.4 Steel yard
   3.5 Parallel forces, couple
   3.6 Torque

4. EQUILIBRIUM OF NON CONCURRENT FORCES: 3 Hours
   4.1 Non-concurrent forces
   4.2 Free body diagram
   4.3 Varignon's theorem
   4.4 Conditions of total Equilibrium (Review)
   4.5 Ladders

5. MOMENT OF INERTIA: 3 Hours
   5.1 Review: Rotational Inertia
   5.2 Moment of Inertia, Theorems
   5.3 Moment of Inertia of symmetrical bodies
5.4 M.I. of Fly wheel with applications
5.5 Energy stored by Fly wheel

6. **FRICTION:**
   6.1 Review: Laws of friction
   6.2 Motion of body along an inclined plane (up & down)
   6.3 Rolling friction & Ball Bearings
   6.4 Fluid Friction, Stokes’ Law

7. **WORK, ENERGY AND POWER**
   7.1 Work-Energy relationship
   7.2 Work done by variable.
   7.3 Power
   7.4 I.H.P, B.H.P and Efficiency
   7.5 Dynamometer.

8. **TRANSMISSION OF POWER**
   8.1 Belts, Ropes
   8.2 Chains
   8.3 Gears
   8.4 Clutches, functions and types with application.

9. **MACHINES:**
   9.1 Efficiency of machines
   9.2 Inclined plane - Review
   9.3 Reversibility of machines
   9.4 Single purchase crab
   9.5 Double purchase crab.
   9.6 Worm and worm wheel.
   9.7 Differential Screw Jack.
   9.8 Differential Pulley, Wheel and Axle

10. **VIBRATORY MOTION:**
    10.1 S.H.M. - Review
    10.2 Pendulums
    10.3 Speed Governors
    10.4 Helical spring
    10.5 Cams
    10.6 Quick return motion

11. **ELASTICITY:**
    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**  
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**  
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.
7.4 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.
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.
8. Calibrate a steelyard.
10. Use reaction of beams apparatus to study resultant of parallel forces.
11. Find the Moment of Inertia of a Flywheel.
12. Find the angle of reaction for a wooden block placed on an inclined plane.
15. Study the transmission of power through friction gears.
16. Study the transmission of power through belts.
17. Study the transmission of power through toothed wheels.
18. Study the function of clutches.
20. Find the efficiency of a screw.
24. Study conversion of rotary motion to vibratory motion of piston in a cylinder.
25. Study the reciprocating motion.
26. Study the working of cams.
27. Study the quick return motion.
28. Compare the Elastic constants of the given wires.
29. Verify Hooke’s Law using Helical Spring.
30. Find the coefficient of Rigidity of a wire using Maxwell’s needle.
31. Find the coefficient of rigidity of a round bar using torsion 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 load).
36. Study working and function of link mechanism of different types.
BOOKS RECOMMENDED:

3. Applied Mechanics by Inchley and Morley
5. Applied Mechanics by Junarker.
6. Engineering Science Vol-I by Brown and Bryant
7. Practical Physics by Mehboob Ilahi Malik &Ikram-ul-Haq
8. Experimental Physics Note Book by M. Aslam Khan & M. Akram Sandhu
9. Experimental Mechanics (Urdu Process) by M. Akram Sandhu
Math-212
Applied Mathematics-II
MATH-212  
Applied Mathematics-II

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Theory: 64 Hours.

Aims & Objectives:

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

COURSE CONTENTS:

1. **FUNCTIONS & LIMITS.**  
   1.1 Constants and variables  
   1.2 Functions & their types  
   1.3 The concept of limit  
   1.4 Limit of a function  
   1.5 Fundamental theorems on limit  
   1.6 Some important limits  
   1.7 Problems

2. **DIFFERENTIATION.**  
   2.1 Increments  
   2.2 Different Coefficient or Derivative  
   2.3 Differentiation ab-initio or by first principle  
   2.4 Geometrical Interpretation of Differential Coefficient  
   2.5 Differential Coefficient of Xa, (ax + b)a  
   2.6 Three important rules  
   2.7 Problems.

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

4. **DIFFERENTIATION OF TRIGNOMETRIC FUNCTION.**  
   4.1 Differential coefficient of sin x, cos x, tang x from first principle.  
   4.2 Differential coefficient of Cosec x, Sec x, Cot x.  
   4.3 Differentiation of inverse trigonometric function.  
   4.4 Problems.
5. DIFFERENTIATION OF LOGARITHMIC & EXPONENTIAL FUNCTION. 4 Hours
   5.1 Differentiation of In x
   5.2 Differentiation of log ax
   5.3 Differentiation of ax
   5.4 Differentiation of ex
   5.5 Problems.

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

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

8. METHOD FOR INTEGRATION. 6 Hours
   8.1 Integration by substitution
   8.2 Integration by parts
   8.3 Problems.

9. DEFINITE INTEGRALS. 6 Hours
   9.1 Properties
   9.2 Application to Area
   9.3 Problems

10. PLANE ANALYTIC GEOMETRY & STRAIGHT LINE. 6 Hours
    10.1 Coordinate System
    10.2 Distance Formula
    10.3 The Ratio Formulas
    10.4 Inclination and slope of a line
    10.5 The Slope Formula
    10.6 Problems.

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

12.1 Standard form of equation  
12.2 Central form of equation  
12.3 General form of equation  
12.4 Radius & coordinate of the Centre  
12.5 Problems

**REFRENFCE BOOKS**

1. Thomas finny –Calculus and analytic geometry  
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 Xn and (ax+b)n
   3.2 Derive product, quotient and chain rules.
   3.3 Find derivative of implicit function & explicit function.
   3.4 Differentiate parametric forms; function w.r.t another function and by Rationalization.
   3.5 Solve problems using these formulas.

4. USE RULES OF DIFFERENTIATION TO SOLVE PROBLEMS OF ALGEBRIC FUNCTIONS.
   4.1 Differentiate from first principle sin x , cosx, tang x.
   4.2 Derive formula for derivation of sec x,cosec x, cot x.
   4.3 Find differential coefficient of inverse trigonometric functions.

5. USE RULES OF DIFFERENTIATION TO LOGARITHMIC AND EXPONENTIAL FUNCTIONS.
   5.1 Derive formulas for differential coefficient of logarithmic and exponential functions.
   5.2 Solve problems using these formulas.

6. UNDERSTAND RATE OF CHANGE OF ONE VARRIABLE WITH RESPECT TO ANOTHER.
   6.1 Write expression for velocity, acceleration, and slope of a line.
   6.2 Define an increasing and decreasing function, maxima and minima values, of inflection.
   6.3 Explain criteria for maxima and minima values of a function.
6.4 Solve problems involving rate of change of variables.

7. APPLY CONCEPT OF INTEGRATION IN SOLVING 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

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.**
   6.1 Goals of report writing
   6.2 Report format.
   6.3 Types of reports.
   6.4 Report writing strategy.

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

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

**RECOMMENDED BOOKS**
INSTRUCTIONAL OBJECTIVES

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

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

3. DETERMINE THE USES OF QUESTIONING SKILLS TO GATHER AND CLARIFY INFORMATION IN THE ORAL COMMUNICATION PROCESS.
   3.1 Identify different types of questions.
   3.2 Determine the purpose of each type of question and its application.
   3.3 Identify the hazards to be avoided when asking questions.
   3.4 Demonstrate questioning skills.

4. DEMONSTRATE THE USE OF ACTIVE LISTENING SKILL IN THE ORAL COMMUNICATION PROCESS.
   4.1 State the principles of active listening.
   4.2 Identify skills of active listening.
   4.3 Identify barriers to active listening.
   4.4 State the benefits of active listening.
   4.5 Demonstrate listening skills.
   4.6 Explain the importance of giving and receiving feedback.

5. DETERMINE THE APPROPRIATE INTERVIEW TYPE FOR THE SPECIFIC WORK-RELATED SITUATION AND CONDUCT A WORK-RELATED INTERVIEW.
   5.1 State the significance of interviews.
   5.2 State the characteristics of interviews.
   5.3 Explain the activities in an interviewing situation.
   5.4 Describe the types of interviews.
   5.5 Explain the interviewing strategy.
   5.6 Prepare instrument for a structured interview.
6. **PREPARE A REPORT OUT-LINE, BASED ON SUBJECT MATTER AND AUDIENCE.**
   6.1 Identify the different types of reports.
   6.2 Determine when to use an informal or formal report presentation.
   6.3 Identify the stages of planning a report.
   6.4 Identify the parts of a report and choose the parts appropriate for each type of report.
   6.5 Draft a report outline.

7. **DEMONSTRATE READING COMPREHENSION.**
   7.1 Identify major reading problems.
   7.2 Identify basic reading skills.
   7.3 State methods of previewing written material.
   7.4 Identify methods of concentration when reading.
   7.5 Demonstrate reading comprehension.

8. **UNDERSTAND THE PRINCIPLES OF GROUP COMMUNICATIONS.**
   8.1 State the purpose and characteristics of major types of meeting.
   8.2 Explain responsibilities of a meeting/committee.
   8.3 Identify problems likely to be faced at meeting and means to overcome these problems.
   8.4 Distinguish between content and process at meetings.
   8.5 Explain the key characteristics of a good group facilitator.
ET-202
APPLIED ELECTRICITY AND ELECTRONICS
Elect-202  APPLIED ELECTRICITY AND ELECTRONICS

Total Contact Hours

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<td>Practical:</td>
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Pre-requisites: Applied Physics (1st year)

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

Course Contents:

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

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

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

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

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

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

5. FUNDAMENTALS OF ELECTRONICS 3 Hrs
   5.1 Semiconductor 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 Inverters 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 CONTROLLER (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
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 x 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 their 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 CONTROLLER (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 CONTROLLER (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 megger
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 optocplur
   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 CONTROLLER (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
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Total Contact Hours

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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 4 Hrs
2. LINEAR MEASUREMENTS SUPPORTING TOOLS 2 Hrs
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 3 Hrs
14. GEAR MEASUREMENTS 2 Hrs
Detail of Contents:

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

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

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

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

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

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

7. ACCURACY IN MEASUREMENTS  
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

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

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

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

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

12. 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 Read Out (DRO)

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

14. GEAR MEASUREMENT  
14.1 Gear Testing machine  
14.2 Backlash Measurement

Recommended Textbooks:
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 Explain 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:

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

2. PRACTICE OF COMBINATION SET  3Hrs

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

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

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

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

7. PRACTICE AND USE OF FOLLOWING ANGLE MEASURING TOOLS  6 Hrs
   7.1 Bevel protractor
   7.2 Vernier Bevel protractor
   7.3 Dial protractor
   7.4 Steel protractor
   7.5 Sine bar
8. CALCULATION RELATING TO TOLERANCE AND ALLOWANCE 3 Hrs

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

10. PRACTICE AND USE OF GAUGE BLOCKS 6 Hrs

11. PRACTICE OF TOOL MAKERS MICROSCOPE 6 Hrs

12. PRACTICE OF PROFILE PROJECTOR 3 Hrs

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

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

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

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

Note:- Quarterly Industrial visit must be arranged for observing physically, the use of above inspection tools/instruments in quality control lab.
Mech-252  METROLOGY

PRACTICAL OBJECTIVES:

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

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

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

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

3.5 PRACTICE OF ENGINEERS PARALLELS
   3.5.1 Select the engineers parallels properly
   3.5.2 Use the engineers parallels to support job

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

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

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

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

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

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

   7.2 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
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
2. MANUFACTURE OF STEEL
3. MANUFACTURE OF STEEL PRODUCTS
4. CASTING
5. NON-FERROUS METALS AND ITS ALLOYS
6. MOST COMMON HEAVY METAL ALLOYS
7. MOST COMMON NON – FERROUS LIGHT METALS
8. MOST COMMON LIGHT METAL ALLOYS
9. METHOD OF MANUFACTURING OF SINTERED MATERIALS
10. CEMENTED CARBIDES
11. SINTERED OF SELF – LUBRICATING BEARING
12. PLASTICS
13. FOUNDRY PRACTICES

1. **IRON AND STEEL MANUFACTURE OF PIG IRON**

Define

Basic Raw Materials

- Iron Ores
- Coke
- Limestone
- Blast furnace and products
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 (Al – Ni – Co)
   • Alloys with constant modules of elasticity
   • Nicked – Copper alloys
   • Materials for thermo – electric elements (Thermo couples)
   • Materials for bimetal

7. **MOST COMMON NON-FERROUS LIGHT METALS**

   **Define**

   4 Hours

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

8. **MOST COMMON LIGHT METAL ALLOYS**

   **Define**

   3 Hours

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

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

10. **CEMENTED CARBIDES**
   3 Hours
   • Basic materials and manufacturing
   • Process of cemented carbides
   • Properties and applications

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

12. **PLASTICS.**
   4 Hours

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

   12.2. **THERMOPLASTIC 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 CO₂ molding process
- Characteristics of foundry sand
- Parting sand
- Facing sand

**Recommended Books & Notes:**

i) **Material Science**

Published By PSTC, PCSIR

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WT-227
WORKSHOP TECHNOLOGY-II
WT-227 WORKSHOP TECHNOLOGY-II

Total Contact Hours

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

COURSE CONTENTS

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

DETAIL OF COURSE CONTENTS

1. LATHE MACHINES 14 Hours
   1.1. Types of Lathes
       - Centre lathe
       - Bench lathe
       - Engine lathe
       - Turret lathe
       - Capstone Lathe
       - Vertical lathe
       - CNC Lathe and Turning Centre
   1.2. Drives of lathes
       - Step or cone pulley drive
       - Gear drive
   1.3. Power feed motion
       - Standard change gear
- Quick change gear box

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

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

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

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

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

2. **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
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
• Gage Milling
• Grooving
• Slitting (Sawing)
• Angular Milling
• Circular Milling
• Gear cutting

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

4. **ENGRAVING**

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**

5.1. Definition of welding

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

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

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

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

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

6. **SOLDERING AND BRAZING**

6.1. Soldering methods
- Torch soldering
- Soldering iron
- Furnace soldering
- Dip soldering
- Resistance soldering
6.2. Define Brazing
- Torch brazing
- Furnace brazing
- Electric brazing

6.3. Fluxes, its uses and advantages

Recommended Books

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

Total Contact Hours

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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

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**

   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

7. **MACHINE ELEMENTS**

   7.1. Define Standardization
   7.1.1. Advantages of standardization
   7.1.2. Applications of standardization
   7.1.2.1. Nomenclature
   7.1.2.2. Dimensions
   7.1.2.3. Quality
   7.1.2.4. Tools
   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
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
   - Cylindricity
   - 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)  
   2 Hours
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

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**  

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<td>Representation of turned parts (only necessary views)</td>
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<td>Exercise 02</td>
<td>Detail drawing with operation plan (front &amp; side views in sections)</td>
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<td>To produce the detail drawing (section &amp; three views)</td>
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<td>Representation of springs</td>
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<td>Tap wrench</td>
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<td>Clamping Fixture (Working Drawing)</td>
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96 Hours
CAD -I

Theory: 10 Hours
Practical: 96 Hours

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

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

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6.14 Copying Methods

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   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
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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
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Exercise 10 : Section & conventions (Home task)
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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
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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

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 3rd YEAR

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Gen-311
ISLAMIAT AND PAK. STUDIES
ءاست/مطالعہ پاکستان

Gen 311

حیض رہی۔ 311

حیض دوم: مطالعہ پاکستان

موہوحت

1. قرآن میں

2. فتح علیہ میں

بنی اسلام علیّ خمس شهادت ان لاالله الا اللہ و اقام الصلوۃ و ايام

المکروہ و رحمۃ و صوم رمضان

الذین النصیحہ

المستشار الموتی

لمسلمین علیّ المومن ست خصال یعودہ ادا مرض و یشتمہ اذمات

ویحیٰہ اذہ عاء و یسلم علیّ اذلکی و یشمت اذہ عطس و ینسح له

اذغاب او شہد لا تخت من خانک

لا یدخل الجنۃ قاطع

ان اللہ حرم علیکم عقوبۃ الامہات و اضاعة المال

یسرا و لا تمسا باشرا و لا تنقوا

ذاق طعم الامہم من رضی با اللہ و بالاسلام دینا و بمحمدینبا

افضل الذکر لالله الا اللہ

حقوق و رفاه

3. حصول تعیین الورث، والدین اور والدین کے حقوق و رفاه، بساؤ کے حقوق

4. قانونی اخلاقی اقدامیں

صبر و انتقال غوروں رہے ایہم اہم، بہادر و راہینی
خطہ‌ی احادیث

عویش مقتدر ہے احادیث کی روشنی سے اسلامی فقہ کی تفسیر کی گئی جس کا نتیجہ ہے کہ

خصوصی متنہاد

حادیث کا نظر حاضر کیے

حادیث کا نظر حاضر کیے

مختلفی اور انفرادی زندگی سے احادیث کے انتظامی طور پر کیے

حقوق و فائض

عویش مقتدر ہے اسلامی فقہ کا کہا جا چاہے فردین چاہے

خصوصی متنہاد

والدین کے حقوق فائض بیان کر کے

بماخیلین کے حقوق بیان کر کے

اسلام میں حقوق فائض کی ابتکار بیان کر کے

حقوق فائض کی گاہ کی بیان کی سوپر سے سوپر اور غیر اسی طرح کا جذب اپنے کر کے

اسلامی اقدام

عویش مقتدر ہے طالب علم

بیان کا کہا جا کہ مقتدر انس اخلاقی سے ضعف بہت ہے

خصوصی متنہاد

اخلاقیہ کے موضوعات بیان کر کے

اسلام میں اخلاقیہ کی ابتکار بیان کر کے

قرار دیتے کی روشنی سے مصروف اخلاقیہ کی ابتکار بیان کر کے

اسلام میں ضعفر وگردی ابتکار بیان کر کے

افکار کے طبیعی موضوعات بیان کر کے

افکار کے طبیعی موضوعات بیان کر کے

اسلام کی افکار اور اوراپیا کر مثالی اخلاقیہ بہتر بکر کے

150
موضویات

- اساس، ویژگی دردوار
- شیئت
- عدل و نصاب
- تویی قدس کا نام
- قرآن نظری یا سبک
- احراز آدیبیت
- تاریخی
- غوی وؤوری
- بردار
- خوآنیار
- اشراق
- چامق

ایپات کی معرقت (بدر پایم نصرتی، اساتید آم، شماریت، اواره)
نصاب (سال سوم)
غزاء پاکستان

خصم

قومی پاکستان

موجودیت

- پاکستانی مشت
- ریلی کافی
- تمل پاکستان
- تمل پاکستانی
- سمندری بحرین
- ریاست کالائی
- ریاست گورنر کیلپر
- شریک پاکستان کا تعاون
- قرارداد معاہد
- خلاء کے باعث

1956 - 1962 اور 1974 کے معاہد کے اعلی دفاتر

پاکستان کا نجوم تحقیق کے اجلاس کی تفریحات

قرنیہ وسیطہ (ملی کیسی کوکر)
قانون پاکستان کے برائے آزادی کے بارے میں مطالعہ

مقدمہ

پاکستان کے برائے آزادی کے بارے میں مطالعہ

فیصلہ

تاریخی مقدمہ

پاکستان کے برائے آزادی کے بارے میں مطالعہ

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تاریخ

جائزہ

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جائزہ

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تاریخ

جائزہ
Mech-323

APPLIED THERMODYNAMICS
Mech-323  APPLIED THERMODYNAMICS

Total Contact Hours

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

Course Contents:

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

Total 64 Hrs

Details of Contents:

Fundamentals of Thermodynamics: 8 Hrs
1.1 Introduction to thermodynamics
1.2 Units, Systems of units, Thermodynamic systems, its classification and properties
1.3 Heat, Mass and weight, Force, Work and power
1.4 Temperature, Absolute Temperature and Temperature Scales, Normal / Standard Temperature and Pressure
1.5 Pressure, Absolute pressure, Gauge pressure and Vacuum pressure
1.6 Energy, Potential energy, Kinetic energy and Internal energy of gas
1.7 Laws of thermodynamics, Laws of conservation of energy and matter, limitations of 1’st law of thermodynamics
1.8 Solution of problems by direct application of formulae for above topics
1.9 Mode of heat transfer

Laws and properties of perfect gases: 6 Hrs
2.1 Introduction
2.2 Boyle’s law, Charles law, Gay-Lussac’s law, Joule’s law, Avogadro’s law, Regnault’s law and Dalton’s law
2.3 General gas equation, Characteristic Gas equation, Universal Gas equation
2.4 Specific heats of a gas, Molar specific heats of a gas and its mathematical relations
2.5 Enthalpy, and Entropy of a gas, importance of Entropy and relation between Heat & Entropy
2.6 Solution of problems by direct application of formulae for above topics

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

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

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

**Steam and Gas Turbines**  
**8 Hrs**
6.1 Introduction and classification of turbines
6.2 Steam Turbine (Impulse type)
   6.2.1 Introduction
6.2.2 De-Laval impulse turbine
6.2.3 Advantages of steam turbine

6.3 Steam turbine (Reaction type)
6.3.1 Introduction.
6.3.2 PARSON’s Reaction turbine.
6.3.3 Comparison between Impulse & Reaction Turbines

6.4 Gas Turbines
6.4.1 Introduction
6.4.2 Classification
6.4.3 Cycles of Gas turbines
6.4.4 Uses of Gas turbines
6.4.5 Comparison of closed cycle and open cycle turbines
6.4.6 Comparison of Gas turbine & Steam turbine

Internal Combustion Engines 8 Hrs
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 P-V-diagram and neat sketch
8.4.1 Work done per cycle by a single stage reciprocating air compressor without and with clearance volume.
8.5 Multistage compression and its advantages
8.6 Two stage reciprocating air compressor with intercooler, work done per cycle with polytrophic law of compression
8.7 Power required to drive a single stage and two stage reciprocating air compressors
8.8 Comparison of reciprocating and rotary air compressors
8.9 Work done per cycle and power required to drive a rotary compressor
8.10 Solution of Problems regarding work done power required for single stage & multistage rotary air compressors
Refrigeration and Air Conditioning  
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)  
Mech-323  APPLIED THERMODYNAMICS

Instructional Objectives:

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

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

2. **Understand the laws and properties of perfect gases**
   2.1 State the perfect gas and its properties
   2.2 Describe the following; also derive its mathematical relations:
      2.2.1 Boyle’s law
      2.2.2 Charles’s law
      2.2.3 Gay-Lussac’s law
      2.2.4 Joule’s law
      2.2.5 Avogadro’s law
      2.2.6 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

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

2.5 State the following:
2.5.1 Enthalpy of a Gas
2.5.2 Entropy of a gas
2.5.3 Importance of Entropy
2.5.4 Relation between Heat & Entropy

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

3. Understand the Thermodynamics Processes and Cycles
3.1 State the thermodynamic process
3.2 State Classification / Types of thermodynamic processes
3.3 State the application of 1st law of thermodynamics for work done during a non flow-reversible process
3.4 Describe the following
   3.4.1 The Non flow-Reversible & Irreversible processes with the help of P-V & T-S diagrams
   3.4.2 The constant pressure process with the help of P-V & T-S diagrams: also derive its mathematical relations for work done during expansion
   3.4.3 The constant volume process with the help of P-V & T-S diagrams: also derive its mathematical relations for work done during expansion
   3.4.4 The constant temperature process with the help of P-V & T-S diagrams: also derive its mathematical relations for work done during expansion
   3.4.5 The adiabatic process with the help of P-V & T-S diagrams: also derive its mathematical relations for work done during expansion
   3.4.6 The polytrophic process with the help of P-V & T-S diagrams: also derive its mathematical relations for work done during expansion
3.5 Solve the problems by direct application of formulae for the above topics
3.6 Describe the following:
   3.6.1 Thermodynamic cycle with the help of P-V diagram
   3.6.2 Classification / Types of thermodynamic cycles
3.7 Describe the assumptions in thermodynamic cycles
3.8 Describe the Reversible & Irreversible cycles with help of PV diagram
3.9 Explain the construction and working of an ideal engine with the help of neat sketch
3.10 Explain the following
   3.10.1 CARNOT’S CYCLE with the help of P-V & T-S diagrams; also derive its mathematical relations for Air Standard Efficiency during the cycle of operation
   3.10.2 OTTO CYCLE with the help of P-V & T-S diagrams; also derive its mathematical relations for Air Standard Efficiency during the cycle of operation
   3.10.3 DIESEL CYCLE with the help of P-V & T-S diagrams; also derive its mathematical relations for Air Standard Efficiency during the cycle of operation
   3.10.4 DUAL COMBUSTION CYCLE with the help of P-V & T-S diagrams; also derive its mathematical relations for Air Standard
Efficiency during the cycle of operation

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

4. **Understand the Formation and properties of Steam**
   4.1 Describe the steam formation, its properties and classification
   4.2 State the important terms used for steam
   4.3 Describe the Temperature-Enthalpy and Temperature-Entropy diagrams for steam formation
   4.4 Describe the use of steam tables with help of examples
   4.5 Describe the following:
      4.5.1 Derive the formulae for the calculation of total heat of wet, Dry, and super heated steam
      4.5.2 Solve the problems by direct application of formulae for the above topics

5. **Understand the Steam Boilers & its performance**
   5.1 Describe the working and general construction of a boiler
   5.2 Describe the classification of boilers
   5.3 State the selection factors of a good steam boiler
   5.4 Describe the important terms used for steam boilers
   5.5 Explain the Following:
      5.5.1 The construction and working of Simple Vertical Boiler with the help of neat sketch
      5.5.2 The construction and working of COCHRAN Boiler (Multi tubular boiler) with the help of neat sketch
      5.5.3 The construction and working of MARINE Boiler (Scotch type) with the help of neat sketch
      5.5.4 The construction and working of Locomotive Boiler with the help of neat sketch
      5.5.5 The construction and working of Babcock and Wilcox Boiler with the help of neat sketch
   5.6 State the List of boiler mountings & accessories:
   5.7 Make a Comparison between Water tube and Fire tube boilers
   5.8 Describe the following with the help of mathematical expressions
      5.8.1 Performance of boiler
      5.8.2 Equivalent evaporation of boiler
      5.8.3 Efficiency of boiler
   5.9 Describe the Following:
      5.9.1 The formulae for the calculation of power /H.P and efficiency of boiler
      5.9.2 Solve the problems by direct application of formulae for above topics

6. **Understand the Steam and Gas Turbines**
   6.1 State the introduction and classification of turbines
   6.2 Explain the following:
      6.2.1 The construction and working of De-Level Impulse turbine with the help of neat sketch
      6.2.2 State the advantages of steam turbine over reciprocating steam engine
   6.3 Explain the following:
      6.3.1 The Construction and working of PARSON’S Reaction turbine with the helping neat sketch
      6.3.2 Make a comparison between Impulse and Reaction turbine
   6.4 Describe the following
      6.4.1 The introduction of Gas Turbines
      6.4.2 The classification/types of Gas turbines
6.4.3 The cycles of Gas turbine with help of diagram
6.4.4 State the uses of gas turbines
6.4.5 Make a Comparison of closed cycle and open cycle turbines
6.4.6 Make a Comparison of Gas turbine and steam turbine

7. **Understand the Internal Combustion Engines**
   7.1 State the introduction of I.C and E.C Engines (Internal and External combustion engines)
   7.2 Describe the classification of I.C Engines
   7.3 Describe the cycle of operations with the help of P-V diagram and important terms used for I.C Engines
   7.4 Make a comparison of two strokes cycle and four strokes cycle engines
   7.5 Explain the following:
      7.5.1 The Construction and working of PETROL Engine with the help of PV-diagram & neat sketch
      7.5.2 The valve timing diagrams for two strokes and four strokes cycle PETROL Engine
   7.6 Explain the following:
      7.6.1 The Construction and working of DIESEL Engine with the help of PV-diagram & neat sketch
      7.6.2 The valve timing diagrams for two strokes and four strokes cycle DIESEL Engine
   7.7 Describe the following also derive its mathematical formulae:
      7.7.1 Indicated power
      7.7.2 Brake power
      7.7.3 Friction power
      7.7.4 Efficiencies of I.C. engines
   7.8 Make a Comparison of I.C. and E.C. engines
   7.9 Make a Comparison of PETROL and DIESEL engines
   7.10 Solve problems for calculation of I.P, B.P, Friction Power and efficiencies of I.C. engines

8. **Understand the Air Compressors and their performance (Reciprocating & Rotary)**
   8.1 State the introduction of Air Compressors
   8.2 Describe the classification / types of Air Compressors (Reciprocating & Rotary)
   8.3 State the terms used for Air Compressors
   8.4 Explain the following:
      8.4.1 The Construction and working single cylinder - single stage double acting reciprocating air compressor with the help of P-V diagram and neat sketch
      8.4.2 The work has done single stage. Single cylinder reciprocating air compressor without and with clearance volume; also drive its Mathematical Expression.
   8.5 Describe the Multistage compression with the help of P-V diagram and its advantages
   8.6 Describe the two stage reciprocating air compressor with intercooler; also derive its mathematical Expression for the work done per cycle considering polytrophic law of compression
   8.7 Describe the power required to drive a single stage and two stages reciprocating Air compressors; also derive its formulae
8.8  Make a comparison of reciprocating and rotary air compressors
8.9  Describe the work done and power required to drive a rotary air compressor; also derive its formulae
8.10 Solution of the problems regarding work done and power required to drive the rotary and reciprocating air compressors

9.  **Understand the Refrigeration and Air Conditioning**
  9.1  State the concept of Refrigeration and Air conditioning
  9.2  Describe the Classification/types of Refrigeration systems
  9.3  State the Units and terms used for Refrigeration and Air Conditioning
  9.4  State the names and Properties of refrigerants
  9.5  Describe the simple mechanism of a vapor compression 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**

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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
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MACHINE DESIGN

Total Contact Hours:  
T P C  
2 3 3

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:

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

Details of Contents:

Simple Stresses in Machine Parts 8Hrs  

1.1 Load and its types  
1.2 Stress and strain  
1.3 Tensile stress and strain  
1.4 Compressive stress and strain  
1.5 Shear stress and strain  
1.6 Young’s Modulus of elasticity  
1.7 Modulus of rigidity or Shear Modulus  
1.8 Stress strain diagram  
1.9 Working stress  
1.10 Factor of safety  
1.11 Selection of Factor of Safety  
1.12 Poisson’s Ratio
1.13 Temperature stress
1.14 Volumetric strain and bulk modulus
1.15 Resilience and Toughness
1.16 Solution of problems of the above topics by direct application of formulae

2. Pressure Vessels

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

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

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

5.1 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

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

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

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

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

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

Instructional Objectives:

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

2. Pressure Vessels
   2.1 Describe pressure vessels
   2.2 Explain Classification of pressure vessels
       2.2.1 According to dimensions
       2.2.2 According to end – construction
   2.3 Explain Stresses in a thin cylindrical shell due to internal pressure
       2.3.1 Hoop stress
       2.3.2 Longitudinal stress
   2.4 Calculate thickness of cylinder by direct application of formula, while all parameters are provided (e.g., Pressure, Internal Dia, hoop or longitudinal stress and efficiency of joint are given)
   2.5 Calculate hoop or longitudinal stress by direct application of formula, while P, d, t and efficiency of joint are given
   2.6 Explain thin spherical shell subjected to internal pressure
   2.7 Calculate thickness of spherical shell when all other parameters are provided by direct application of formula
2.8 Explain Thick cylindrical shell subjected to internal pressure
2.9 Solve simple problem to Calculate of thickness of thick vessel made of brittle material by 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 Pulleys
      7.4.1 Flat belt and Pulleys
      7.4.2 V-belt and Pulleys
      7.4.3 Circular belt and Pulleys
   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)
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MACHINEDESIGN

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°of Cam rotation
  - (b) Dwell for next 30°of Cam rotation
  - (c) return Stroke during next 60°of Cam rotation
  - (d) Dwell of remaining 210°of Cam rotation
  - (e) Stroke of follower is 22 mm
  - (f) Minimum Radius of Cam is 50 mm
  - (g) Axis of Follower is passing through axis of Cam shaft
  - (h) Follower moves with uniform velocity during both out Stroke and return Stroke.
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MACHINEDESIGN

Practical objectives:

1. Calculate (tensile, compressive and shear), strain, modulus of elasticity, %age elongation, %age reduction in area, factor of safety for simple machine parts
   1.1 Stresses induced in machine parts
   1.2 Cross-sectional area of machine element under load
   1.3 modulus of elasticity of materials
   1.4 Calculate dimensions of component under specific load
   1.5 %age elongation and %age reduction in area of a component in a tensile test

2. Calculate force required to punch a hole
   2.1 Stresses induced in punch and plate
   2.2 Area of shear by the punch
   2.3 Calculate different cases of die and punch

3. Calculate thickness and diameter of thin cylinders for hoop and longitudinal stresses
   3.1 Difference between thin and thick shells
   3.2 Hoop and longitudinal stress in cylindrical shells
   3.3 Transverse and longitudinal failure of pressure vessel

4. Calculate thickness of thick cylinders
   4.1 Lame’s equations for brittle materials
   4.2 Calculate Different cases of thickness of thick shells of brittle material

5. Calculate thickness and diameter of spherical shell for circumferential stresses
   5.1 Stresses on thin spherical shells
   5.2 Stress on spherical shells considering pressure, internal diameter, thickness and joint efficiency

6. Design welded joints for transverse and parallel fillet under static loading only
   6.1 Transverse and parallel fillet weld
   6.2 Observe tensile and shear stresses in transverse and parallel fillet weld
   6.3 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 unprotected flange coupling for specific torque
    12.1 Unprotected 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.
    14.1 Understand helical springs of circular wire
    14.2 Understand terms used in helical springs
    14.3 Calculate deflection in helical spring
    14.4 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
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MATERIALS TESTING AND HEAT TREATMENT
Mech-362  MATERIALS TESTING AND HEAT TREATMENT

Total Contact Hours  

<table>
<thead>
<tr>
<th>Theory</th>
<th>Practical</th>
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<td>32</td>
<td>96</td>
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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 Britteness
      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:
3. Physical Metallurgy by AVNER
184

**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 Explain Compression 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 Metallurgy
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

8.1 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 3 Hrs
- Practice for tensile test on universal testing machine on standard specimen 6 Hrs
- Practice for Compression test on cast iron specimen 6 Hrs
- 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 3 Hrs

(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 6 Hrs
- 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

Total Contact Hours

T P C
Theory 32 1 3 2
Practical 96

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

   I. Solid Modeling
   II. CAM for Milling
   III. CAM for Turning
   IV. CAM for Wire Cut (EDM)
   V. CAM for EDM (Die Sinker)

Course Contents:

1. Introduction to 3D CAD 2 Hrs
2. Sketch 3 Hrs
3. Dimension and Constraint 2 Hrs
4. Solid Modeling 8 Hrs
5. Assembly Modeling 4 Hrs
6. Drawing View 1 Hrs
7. Presentation Module 1 Hrs
8. Sheet Metal Components 3 Hrs
9. CAM 8 Hrs
Detail of Course Contents:

1. **3D CAD** 2 Hrs
   - 1.1 Modules
   - 1.2 Toolbars
   - 1.3 Units and Dimensions
   - 1.4 Important Terms and Definitions

2. **Sketch** 3 Hrs
   - 2.1 Sketch Environment
   - 2.2 Drawing Display Tools
   - 2.3 Sketching Entities
   - 2.4 Pattern
   - 2.5 Tolerance
   - 2.6 Work Feature

3. **Dimension and Constraint** 2 Hrs
   - 3.1 Dimension
   - 3.2 Geometric Constraints

4. **Solid Modeling** 8 Hrs
   - 4.1 Modeling Tools
   - 4.2 Concept of Edit Feature
   - 4.3 Advanced Modeling Tools

5. **Assembly Modeling** 4 Hrs
   - 5.1 Types of Assembly
   - 5.2 Assembly Components
   - 5.3 Edit Assembly Constraint

6. **Drawing Views** 1 Hr
   - 6.1 Types of Views
   - 6.2 Drawing Standards
   - 6.3 Drawing Sheets
   - 6.4 Dimension Style
   - 6.5 Parts Lists

7. **Presentation Module** 1 Hr
   - 7.1 Presentation View
   - 7.2 Assembly Animation

8. **Sheet Metal Components** 3 Hrs
   - 8.1 Sheet Metal Components Parameter
8.2 Sheets Metal Components

9. CAM 8Hrs
   9.1 Introduction of CAM
   9.2 2-D CAM
   9.3 CAM Milling
   9.4 Rough Cutting Strategies
   9.5 Finish cutting Strategies

10. CAM Lathe
    - Facing
    - Boring
    - Grooving
    - Threading (Inside and Outside)
    - Cut off

11. CAM Wire Cut
    - Die Cutting
    - Punch Cutting
    - Taper Cutting
    - Axis Wiring Cutting
    - No Core Cutting

12. CAM Router
    - Contouring
    - Pocketing
    - Engraving
    - Chamfering
    - Raster to vector Translator
    - Nesting

13. CAM Multi-Axis

Recommended Textbooks:

1. The CNC Work Shop by Frank Nanfara (Publisher: SDC Publications, 2002)
TD-352

**Instructional Objectives:**

Instructors/Teachers must ensure to develop understanding of

1. 3D CAD  
   - Modules  
   - Toolbars  
   - Units and Dimensions  
   - Important Terms and Definitions  
   **2 Hrs**

2. Sketch  
   - Sketch Environment  
   - Drawing Display Tools  
   - Sketching Entities  
   - Pattern  
   - Tolerance  
   - Work Feature  
   **3 Hrs**

3. Dimension and Constraint  
   - Dimension  
   - Geometric Constraints  
   **2 Hrs**

4. Solid Modeling  
   - Modeling Tools  
   - Concept of Edit Feature  
   - Advanced Modeling Tools  
   **8 Hrs**

5. Assembly Modeling  
   - Types of Assembly  
   - Assembly Components  
   - Edit Assembly Constraint  
   **4 Hrs**

6. Drawing Views  
   - Types of Views  
   - Drawing Standards  
   - Drawing Sheets  
   - Dimension Style  
   - Parts Lists  
   **1 Hr**

7. Presentation Module  
   - Presentation View  
   - Assembly Animation  
   **1 Hr**

8. Sheet Metal Components  
   - Sheet Metal Components Parameter  
   - Sheets Metal Components  
   **3 Hrs**
9. CAM
   - 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:

1. 3D CAD Software (Solid Modeling) 50-set
2. 3D CAM Software (Milling, Turning, Turn/Mill, Wire Cut) 50
3. Simulation Software for G Code 50
4. Computer 50
DM – 312
TOOL TECHNOLOGY-I
DM – 312

TOOL TECHNOLOGY-I

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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

1. INTRODUCTION TO MOULDS 1 Hour
   - Importance of Tool Design
   - Introduction to Injection Mould
   - Injection Moulding (General)
   - Schematic diagram of Injection Moulding
   - Main parts of mould

2. Cavity and Punch 2 Hours
   - Cavities, Disposition in a mould
   - Layout of a multi cavity injection Mould in respect of balance
   - Cavity Mould layout
   - Multi Cavity Arrangement

3. Types of Runner 2 Hours
   - Cold Runner
   - Insulated Runner
   - Hot Runner

4. Types of Gates 2 Hours
   - Sprue gate
   - Edge gate
   - Diaphragm gate
   - Ring gate
   - Flash gate
   - Submarine (self shearing) gate
   - Submarine, Dimensions chords
   - Submarine, Dimensions height and section
• 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 1 Hour
• Introduction to ejector returns mechanism and its types
• Push backs
• Ejector return springs
• Ejector return cams

8. Ejector of Internal Threaded Components 1 Hour
• Unscrewing with rack and pinion
• Chain drive, gear train, motor drive
• Coarse spiral drive

9. Under Cuts and Sliders 1 Hour
• 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

*****************************************************************************
2. **Thermosetting Materials**
   - Phenolic
   - Urea
   - Melamine
   - Polyesters
   - Alkyds
   - Allylics
   - Epoxies
   - Silicones

1. **Methods of Processing**
   - Thermosetting
   - Compression Moulding Process
   - Compression Moulding Machines
   - Compression mould (parts)

2. **Parts of a Compression Mould**
   - Compression mould (parts)
   - Punch
   - Cavity
   - Parting line
   - Spacers
   - Ejectors – ejector systems
   - Ejector system typical design
   - Ejector returns
   - Heating, heater platters
   - Tool location
   - Miscellaneous

3. **Summary of Different Designs**
   - Basic designs
   - Multi-cavity moulds
   - Special features

4. **Compression Moulds (General Designs)**
   - Hand moulds
   - Flash moulds
   - Positive moulds
   - Positive moulds (vertical flash)
- 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

*******************
DM-312  Tool Technology -1

Practical 96 hrs. 

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- **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
DM - 322  TOOL TECHNOLOGY-II

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- Press Tool 18 Hours
- Bending Tool 14 Hours

AIMS: After going through this course, the student will be able to understand Types, Designing and working of Press tools and Bending Tools.

COURSE CONTENTS

1. Introduction to Press Tools 2 Hrs

2. Introduction to Cutting Tools 2 Hrs
   - Blanking
   - Piercing
   - Notching
   - Cropping
   - Parting
   - Lancing
   - Semi Notching
   - Trimming

3. Introduction to Non cutting tools 2 Hrs
   - Bending
   - Flanging
   - Coining
   - Semi piercing
   - Deep drawing
   - Crimping
   - Curling
   - Forming
   - Collar Drawing

4. Main Parts of Press Tools 2 Hrs
   - Describe the Press Tool Parts
   - Design of sheet metal cutting Tools
   - Explain Cutting operation
   - Explain Cutting clearance
   - Explain Angular clearance
   - Explain Cylindrical Relief
   - Introduction to stripping
7. **Types of Die Stops**  
- Plain Pin Stop  
- Headed Pin stop  
- Finger Stops  
- Trim Stops  
- Function of Trim stop  
- Solid stop

8. **Types of Pivot Stops**  
- Explain the following types of Pivot stops  
- Manual Pivot stop  
- Semi Auto Pivot stops  
- Automatic Pivot stop

9. **Types of Pilots**  
- Explain the following types of Pilots  
- Function of a Pilot  
- Pilot Mountings  
- Pilot Support, Nose profiles  
- Punch Pilots

10. **Strippers and Stock Guides**  
- Fixed strippers  
- Pressure Pad Strippers  
- Spring / Stripper Bolt Confinement  
- Guided Strippers  
- Shedders, Inverted, Compound Stripping

11. **Nest Guides**  
- Introduction to Nest Guides  
- Pin Nest Guides  
- Head Pin, Plate Nest Guides  
- Approximating, Pusher Nest Guides  
- Loading, Unloading  
- Fool Proofing

12. **Strip Layouts**  
- Describe Strip Layout  
- Terms  
- Factors Influencing Strip Layouts  
- Describe Narrow Run – wide Run  
- Explain Material Requirement  
- Gang Tool

14. **Explain Taking Impressions Punch / Die**  
- Explain Centering Punch and Die  
- Copying Tapped, Blind and long Holes  
- Stepped Punch Length  
- Explain Slug Mounting  
- Cold welding on Cutting Punches
• 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 bland 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**

• Typical press brake bends
• Press brake

1.9. **U – Bending tools**

• 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**

• Wiping tools
• Wiping tools (inverted and straight)

3. **Multi bending tool**

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

4. **Side action**

• Side action bending tools

5. **Curling tools**

• 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
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
DM - 335
Workshop Technology DM-1
DM - 335 Workshop Technology DM-1

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Total contact hours.
- Theory 96 Hours
- Practical 192 Hours

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

Accessories for Universal Cylindrical Grinding Machine

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

- 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

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

Pedestal Grinder

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

Cylindrical Grinding

- 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

- 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

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

Recommended Books:

- Clamping & Centering by PSTC, PCSIR
- Cemented carbides by PSTC, PCSIR
- Workshop Technology III by PSTC, PCSIR

**********************
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.
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 by PSTC, PCSIR
Spark Erosion machines 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 4th YEAR

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

Total contact Hours

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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.

1. Copy Milling 18 Hours
2. Profile Grinding 14 Hours
3. CNC Machines 32 Hours

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
4. **CNC Lathe and Milling Machines**  4 Hours
   - Introduction of system
   - Install and start controller
   - Introduction of control panel
   - Switching window
   - ISO Code manually program
   - Example

5. **Graphic Display Type Auto Programming System**  2 Hours
   - A Brief introduction
   - Operation
   - Basic Operation

6. **Programming Example**  2 Hours
   - C.N.C. Lathe
   - C.N.C. Milling

7. **General Information**  4 Hours
   - Introduction
   - MOD Functions
   - Coordinates
   - Linear and Angle Encoders

8. **Machine Operating Modes**  6 Hours
   - Switch – on
   - Manual operation
   - Setup
   - Electronic Hand wheel / Incremental Jog
   - Positioning with Manual data input
   - Program run
   - Re – Approaching

9. **Programming Modes**  6 Hours
   - Conversational Programming
   - File Management
   - Program selection
   - Tool Definition
   - Tool call
   - Feed rate F / rotational speed of C axis
   - Miscellaneous Functions M
   - Programmable stop / Dwell time
   - Path Movements
   - Linear movement Cartesian
   - Circular movement Cartesian
- Polar coordinates
- Contour approach and departure
- Predetermined M Function
- Program jumps
- Program calls
- Standard cycles
- Coordinate transformations
- Other cycles
- Parameter programming
- Programmed probing
- Actual position capture
- Test graphics
- Counting the Machining time
- External data transfer

**Recommended Books**

1. Copy Milling Published by PSTC, PCSIR
2. Profile Grinding Published by PSTC, PCSIR
3. CNC Machines Published by PSTC, PCSIR

***************
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

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

Total contact Hours  
Theory  64 Hours  
Practical  288 Hours

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

*******************
Instructional Objectives:
The teacher must ensure to:

COURSE CONTENTS
- 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
- 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
DM - 433
TOOL TECHNOLOGY-III
DM - 433  Tool Technology-III

<table>
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<th>Total contact Hours</th>
<th>T</th>
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<tr>
<td>Theory</td>
<td>64 Hours</td>
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<tr>
<td>Practical</td>
<td>96 Hours</td>
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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.

1. Jigs and Fixtures  32 Hours
2. Pressure Die Casting  32 Hours

COURSE CONTENTS

1. JIGS AND FIXTURES  4 Hours
  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  1 Hour
  2.1 Work piece supports (fixed)
  2.2 Adjustable rest pins (fixed jacks)

3. Introduction to Locating Nests  4 Hours
  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  3 Hours
  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.

5. **Introduction to Wedges** 1 Hours
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** 4 Hours
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** 5 Hours
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** 4 Hours
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** 6 Hours
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 08 Hours
   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 08 Hours
   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
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**2. Support and positioning of the WP**
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3.3 Inner shape locating pins
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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

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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.

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9.4 Closed drilling jigs
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Pressure Die Casting

Course Contents

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   1.4 Limitation of Gravity Die Casting
   1.5 Casting Machines types
   1.6 Book Mould Arrangement
   1.7 Manual Drive Arrangement
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   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

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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
DM - 443  TOOL TECHNOLOGY-IV

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

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**

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  
   **3 Hours**

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  
   **3 Hours**

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)** 2 Hours
   3.1. Ironing Tools
   3.2. Design Details
   3.3. Base Plate

4. **Drawing Dies, (Die Support, forming PAD Ejector)** 2 Hours
   4.1. Die Concepts
   4.2. Dies, Design Details

5. **Drawing Die Edge Shapes** 2 Hours
   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** 1 Hour
   6.1 Blank holders
   **6.2 Strippers** 1 Hour
   6.3 Strippers
   **6.3 Nesting the Blank** 1 Hour
   6.4 Nesting

7. **Drawing Beads** 2 Hours
   7.1. Tool with inflow bead
   7.2. Flow Braking Beads
   7.3. Shapes, Mountings of drawing beads

8. **Determining flat blank (Circular)** 3 Hours
   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

9. **Lubrication** 2 Hours
   9.1. Drawing Force, Blank holder Force
   9.2. Tables (Correction factor, drawing clearance)

10. **Drawing clearance Y** 3 Hours
   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 rations 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

Total contact Hours  T  P  C
Theory  96 Hours  3  6  5
Practical  192 Hours

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
   - 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

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Mould Making Hints  

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
DM-455 List of Practicals

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

Total Contact Hrs:  
Theory 64  
T  P  C  2  0  2

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:

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

Detail of Contents:

1. Organization of Production Enterprises 8 Hrs
   - Types of Organization
   - Commercial Division
   - Technical Division
   - Machine shop and Production shop
   - Tool Room
   - Quality inspection

2. Process and Flow Analysis 8 Hrs
   - Process Selection
   - Flow charting and Machine Sequencing
   - Machine Loading Chart

3. Estimation of Production Time 8 Hrs
   - Basic Preparation time and allowances
   - Setting-up time
   - Essential operation time
   - Auxiliary operation time
   - Execution time and allowances
4. Productivity Measurement and Improvement  8 Hrs
- Significance of Productivity
- Types of Productivity
- Single and Multiple Factor Productivity
- Approaches for Productivity Improvement

5. Cost Estimation and Control  16 Hrs
- Fixed costs
- Overhead costs
- Recurring costs
- Breakeven analysis
- Marginal analysis
- Budgeting and control

6. Store operations  4 Hrs
- Receipt of store items
- Records of store
- Issuance of store items

7. Management of Quality  12 Hrs
- Types of Quality
- Quality Dimensions
- Design for Quality
- Quality Management System

**Recommended Textbooks:**
1. Industrial Management by Prof. M.H. Zuberi
2. Industrial Engineering and Management System by Dr. Mansor Ali (Publisher: Urban Resource Center, 2001)
3. Factory and Production Management by Lockyer (Publisher: Pitman, 1974)
4. 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
   - Break-even 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