PUNJAB BOARD OF TECHNICAL EDUCATION

21-A, Kashmir Block Allama Iqbal Town, Lahore
www.pbte.edu.pk- R&D Section Tel # 042-99260273
SAY NO TO CORRUPTION

No: PBTE/R&D/2023/808 Dated:-18-12-23

NOTIFICATION

In pursuance of the letter No. F. 1(5)/2015-SS&C(Eq)-NVQF dated 05-10-2023, it is notified that following newly developed curriculum under Sino-Pak Joint Education Dual Diploma CCTE (2+1) Program has been approved by National Vocational & Technical Training Commission (NAVTTC) for its implementation in all institutes concerned.

"DAE Mechanical Manufacturing & Automation Technology (03 year)"

Punjab Board of Technical Education, Lahore will conduct the examinations of those students who have been enrolled under this program w.e.f. the academic session 2023-24 and onwards, accordingly. Soft copy of the curriculum of the said course may be downloaded from the website of PBTE i.e. http://www.pbte.edu.pk/Ptextbooks.aspx

SECRETARY

CC To.

1- PA to Chairman, PBTE, Lahore.
2- PA to DG Academics, TEVTA, Lahore.
3- PA to DG Operations, TEVTA, Lahore.
4- PA to Secretary, PBTE, Lahore.
5- PA to Controller of Examinations, PBTE, Lahore.
6- The Principals concerned.
7- Deputy Controller of Examinations (Conduct), PBTE, Lahore.
8- Deputy Controller of Examinations (Secrecy), PBTE, Lahore.
9- In-Charge P&S Section, PBTE, Lahore.
10- In-Charge Operation Wing, PBTE Lahore.
11- Assistant Controller of Examinations (Technical), PBTE, Lahore.
12- Assistant Controller of Examinations (Conduct), PBTE, Lahore.
13- Assistant Controller of Examinations (Secrecy), PBTE, Lahore.
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17- Assistant Secretary (Certificate), PBTE, Lahore.
18- Assistant Secretary (Registration), PBTE, Lahore.
19- Web Administrator, PBTE Lahore to upload on Board Website.

D.A.E – MM&AT

Mechanical Manufacturing and Automation Technology

Curriculum

Developed *(August-2023)*

(CCTE-Joint Edu. (2+1) Sino-Pak Dual Diploma program)

Entry Level: -	Matriculation (Science)
Duration of Course: -	Three Years
Credit Hours:	**72** (Annual System)
Methodology:	Theory 40%
	Practical 60%
Examination & Certification Body:	Punjab Board of Technical Education

SCHEME OF STUDIES

FIRST YEAR				
Code	**Subject**	**T**	**P**	**C**
Gen 111	Islamiat and Pak Studies	1	0	1
Eng 112	English	2	0	2
GenC- 112	Chinese Language-I	2	0	2
Math 113	Applied Mathematics	3	0	3
Phy 122	Applied Physics	1	3	2
Ch 112	Applied Chemistry	1	3	2
Comp 152	Computer Applications	1	3	2
MMAT 115	Workshop Practice- I (A) General Metal Work 0 3 (B) Welding and Forging 0 3 (C) Foundry 0 3 (D) Basic Machine Shop-1 0 3 Theory 1 0	1	12	5
MMAT 121	History of Mechanical Industry	1	0	1
MMAT 132	Basic Electrical and Electronics	1	3	2
MMAT 141	Automation in Manufacturing	1	0	1
Mech. 151	Occupational Health Safety & Environment	1	0	1
Mech. 173	Engineering Drawing and Graphics	1	6	3
TOTAL		**17**	**30**	**27**

SECOND YEAR				
Code	**Subject**	**T**	**P**	**C**
Gen 201	Islamiat and Pak Studies	1	0	1
Phy 212	Applied Mechanics	1	3	2
GenC 212	Chinese Language-II	2	0	2
MgmC 212	Understanding China	2	0	2

Math 212	Applied Mathematics- Ⅱ	2	0	2
Mgm 201	Communication Skills & Report Writing	1	0	1
MMAT 211	Advanced Manufacturing Technology	1	0	1
MMAT 222	Industrial Engineering And Quality Control	1	3	2
MMAT 232	Microcontroller & PLC For Automation	1	3	2
Mech. 244	Workshop Practice- Ⅱ (A) Basic Machine Shop-11 0 6 (B) Foundry and Pattern Making 0 3 (C) Advance Welding 0 3	0	12	4
MMAT 242	Electrical Actuators and Drives	1	3	2
MMAT 251	Metrology	0	3	1
MMAT 261	Process control	1	0	1
TOTAL		**14**	**27**	**23**

THIRD YEAR

Code	Subject	T	P	C
Gen 301	Islamiat and Pak Studies	1	0	1
MMAT-301	Industrial Enterprise Management	1	0	1
MMAT-312	Hydraulic and Pneumatic	1	3	2
MMAT-322	Fault diagnosis and maintenance of CNC machine tools	1	3	2
MMAT-331	Mechanical Manufacturing Technology	1	0	1
MMAT-342	Fundamentals of Mechanical Design	1	3	2
MMAT-352	Tooling design	1	3	2
MMAT-362	Engineering Materials and Heat Treatment	1	3	2
MMAT-375	Workshop Practice-Ⅲ (A) Special processing workshop 0 3 (B) Additive manufacturing 0 3 (C) Adv. Welding 0 3	2	9	5

	Theory 2 0			
MMAT-382	CAD/CAM	1	3	2
MMAT-392	NC Machine Tool Technology	1	3	2
TOTAL		**12**	**30**	**22**

Eng-112 **ENGLISH**

Total contact hours

		T	P	C
Theory	64			
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 hours**

1.1 First eight essays of Intermediate English Book-II

2 CLOZE TEST **4 hours**

2.1 A passage comprising 50-100 words will be selected from the text. Every 11th word or any word for that matter will be omitted. The number of missing word will range between 5-10. The chosen word may or may not be the one used in the text, but it should be an appropriate word.

ENGLISH PAPER "B"

3 GRAMMAR **26 hours**

3.1 Sentence Structure.
3.2 Tenses.
3.3 Parts of speech.
3.4 Punctuation.
3.5 Change of Narration.
3.6 One word for several
3.7 Words often confused

4. COMPOSITION **8 hours**

4.1 Letters/Messages
4.2 Job application letter
4.3 For character certificate/for grant of scholarship
4.4 Telegrams, Cablegrams and Radiograms, Telexes, Facsimiles
4.5 Essay writing
4.6 Technical Education, Science and Our life, Computers, Environmental Pollution, Duties of a Student.

5. TRANSLATION **10 hours**

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

RECOMMENDED BOOKS

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

Eng-112 ENGLISH

INSTRUCTIONAL OBJECTIVES

PAPER-A

1. DEMONSTRATE BETTER READING, COMPREHENSION AND VOCABULARY

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

2. UNDERSTAND FACTS OF THE TEXT

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

PAPER-B

3. APPLY THE RULES OF GRAMMAR IN WRITING AND SPEAKING

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

4. APPLY THE CONCEPTS OF COMPOSITION WRITING TO 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. APPLY 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.

GenC-112 **Chinese Language- I**

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

PART ONE

AIMS This course consists of 18 classes (including mid-term test and final test). After completing this part, students can master the primary Chinese language knowledge taught in the content of the course, and be able to achieve and exceed the **HSK level One**.

INSTRUCTION OBJECTIVE The course is mainly for zero-based learners. Through the study of this course, learners can lay a solid language foundation and have a preliminary understanding of Chinese language structure, including Pinyin, Chinese characters, words, grammar and other knowledge. After completing this course, learners can understand and use some basic words and sentences, and complete the most basic communication, such as greeting, asking, introducing, and shopping and so on.

COURSE CONTENTS

1. Lesson 1 Hello Vs Nǐhǎo **1 hour**

This lesson briefly introduces pinyin and spelling methods.

2. Hello! **1 hour**

This lesson briefly introduces the sentence patterns used in greeting, such as dialogue, greeting farewell, and introducing one's own name.

3. Lesson 3 I am Britain **2 hour**

Teach students to understand basic classroom language, learn to use "national + person" for simple communication dialogue, and introduce which country they come from.

4. Lesson 4 What's the date today **2 hour**

This lesson introduces the expression of numbers, years, months, etc., and teaches students to ask about a date and answer it.

5. Lesson 5 This is my brother **2 hours**

By introducing family members, students can understand the simple words when asking about family status and introduce them briefly.

6. Lesson 6 I'm nineteen years old **2 hours**

This lesson expands quantifiers and animal names, and introduces the expression of age, so that students can ask and answer each other's age correctly.

7. Lesson 7 What time is it **2 hours**

This lesson introduces the usage of hours, minutes and seconds, so that students can describe their lives with time points.

8. Lesson 8 What do you like to do on weekends **2 hours**

This lesson introduces the expressions of hobbies, interests, activities and other related nouns, so as to help students communicate with each other by using simple linking sentences.

Semi-MID-TERM REVIEW **2 hours**

Mid-term review is a summary of the knowledge learned in the past. The test paper uses the knowledge points learned in the past to design listening questions, answering questions by looking at pictures, connecting questions, filling in blanks, etc., which are illustrated with pictures and interesting, and can test students' learning effect.

9. Lesson 9 Introduce yourself **2 hours**

Explain the related expressions related to self-introduction, and students can correctly introduce their names, families, ages, hobbies, school majors, etc. 2

10.Lesson 10 My father is in Beijing **2 hours**

This lesson introduces the names of major cities in China, Britain and Europe, and introduces the use of "person + place" in sentences.

11.Lesson 11 I came to Beijing by plane **2 hours**

This lesson introduces the means of transportation and how to express long sentences in combination with the time and place learned before.

12.Lesson 12 I eat at the company 2 hours **2 hours**

This lesson introduces the polite expressions used in eating.

13.Lesson 13 The weather is fine on Monday **2 hours**

It shows the conversations and topics that may appear when you want to date.

14.Lesson 14 How much is it altogether **2 hours**

This lesson introduces the vocabulary and sentences commonly used in shopping, and how to use Chinese for daily shopping.

15.Lesson 15 What would you like to have **2 hours**

This lesson introduces the classic Chinese and Thai cuisine, the terms of treating guests, and the communicative terms of how to order food in restaurants.

16.Lesson 16 The bathroom is next to the pantry **2 hours**

This lesson introduces location and location words, and how to use location words to introduce the location of a place.

Semi- FINAL REVIEW **2 hours**

Similar to the mid-term test questions, it is a test of important knowledge points of the course to test students' learning effect. This lesson briefly introduces pinyin and spelling methods.

PART- TWO

AIMS After completing this part, students can master the basic Chinese language knowledge taught in the content of the course, and be able to reach and exceed **HSK level TWO.**

INSTRUCTION OBJECTIVE Learners can master the language knowledge and use some basic grammar and sentence patterns in communication, learn to express personal feelings and attitudes in Chinese, and can complete communicative functions such as gratitude, apology, introduction and farewell, and begin to understand Chinese cultural knowledge and cultivate interest in learning.

COURSE CONTENTS

1. Lesson 1 I was still sleeping at 7 o'clock **1 hour**

This lesson introduces the grammatical points of "still", so that students can correctly understand the meaning of sentences related to "still" and use this sentence pattern correctly for communication.

2. Lesson 2 It will be cloudy tomorrow **1 hour**

By introducing the weather in several Chinese cities, explain how to use temperature to answer weather questions.

3. Lesson 3 That one is five hundred dollars cheaper than this one **1 hour**

This lesson explains comparative sentences, and compares them in terms of price, height and temperature, so that students can understand comparative sentences thoroughly.

4. Lesson 4 This is a family photo **1 hour**

This lesson introduces family members in detail through appearance, clothing and occupation, so that students can master more detailed description methods.

5. Lesson 5 It is forbidden to take pictures here **2 hours**

This lesson leads students to understand the relevant knowledge points of expressing commands, such as forbidden and forbidden, so that students can correctly understand the meaning of words in daily life.

6. Lesson 6 I can't find something **2 hours**

This lesson introduces the use of language points in "V + should + result complement", so that students can correctly use relevant sentence patterns in communication.

7. Lesson 7 I have been to Sichuan and seen pandas **2 hours**

8. This lesson introduces Chinese culture through "V + have been to", such as the Great Wall, the Forbidden City, national treasures, etc., so that students can use this sentence pattern correctly in communication.

9. Lesson 8 I hope you can come to my wedding **2 hours**

10. By introducing Chinese weddings, this lesson enables students to master the verbal usage of banquet invitation, holiday blessing, emotional expression and euphemistic refusal.

Semi-MID-TERM REVIEW **2 hours**

This section leads students to review the knowledge points they have learned in the past and conduct mid-term tests through reading pictures, listening questions and connecting questions to test students' learning effect.

11.Lesson 9 Be ill, take more rest **2 hours**

This lesson introduces the vocabulary related to illness and the doctor's medication advice, sothat students can correctly describe and understand the doctor's meaning in the process of seeinga doctor.

12.Lesson 10 The station is just across the road **2 hours**

13. This lesson introduces the way of asking places and answers by asking directions, which helps students to use relevant sentence patterns for practical communication questions and answers.

14.Lesson 11 She sings very well **2 hours**

This lesson focuses on hobbies and introduces the correct use of related words in sentences.

15.Lesson 12 Did you do well in the exam **2 hours**

By describing the examination process and the situation of answering questions, students can correctly understand the instructions of the examination room, the distribution of questions andthe analysis of test paper problems

16.Lesson 13 Buy two and get one free **2 hours**

This lesson introduces the commodity names of supermarkets, as well as common terms such as promotional activities, discounts and price reductions.

17.Lesson 14 We're a new restaurant **2 hours**

This lesson helps students understand how to understand the waiter's recommendation and put forward the food requirements for ordering.

Lesson 15 The girl is dressed in white clothes **2 hours**

This lesson introduces others' clothes and how to use grammar points to describe the state of something through "V + be dressed in".

Lesson 16 You can be discharged from hospital next week **2 hours**

This lesson introduces a variety of expressions, such as hospitalization, visiting patients and discharge, so that students can understand the language of hospital scenes and strengthen their multi-scene communication ability.

Semi- FINAL REVIEW **2 hours**

This section is similar to the mid-term review, which leads students to review the knowledgepoints they have learned in the past and conduct final tests by looking at pictures, listening questions, connecting questions, etc., to test students' learning effect.

Recommended Book
Tang Chinese Course 1 for PART TWOTang Chinese Course 2 for PART TWO

Math-113 APPLIED MATHEMATICS

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

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

AIMS After completing the course the students will be able to

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

COURSE CONTENTS

1 QUADRATIC EQUATIONS **6 Hrs**

1.1 Standard Form
1.2 Solution
1.3 Nature of roots
1.4 Sum & Product of roots
1 .5 Formation
1.6 Problems

2 ARITHMETIC PROGRESSION AND SERIES **3Hrs**

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

3 GEOMETRIC PROGRESSION AND SERIES **3Hrs**

3.1 nth term
3:2 sum of the first n terms
3.3 Means
3.4 Infinite Geometric progression
3.5 Problems

4 BINOMIAL THEOREM **6 Hrs**

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

5 PARTIAL FRACTIONS **6 Hrs**

5.1 Introduction
5.2 Linear Distinct Factors Case I

5.3 Linear Repeated FactorsCase 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

1. A Text Book of Mathematics (Math-113) by TEVTA, authored by Sana ullah Kan, Tahir Hamid & Nasir ud-Din

Math-113 APPLIED MATHEMATICS-I

INSTRUCTIONAL OBJECTIVES

1 USE DIFFERENT METHODS FOR THE SOLUTION OF QUADRATIC EQUATIONS

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

2 UNDERSTAND APPLY CONCEPT OF ARITHMETIC PROGRESSION AND SERIES

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

3 UNDERSTAND GEOMETRIC PROGRESSION AND SERIES

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

4 EXPAND AND EXTRACT ROOTS OF A BINOMIAL

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

5 RESOLVE A SINGLE 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 sins and the law of cosines.
9.3 Explain elements of a triangle.
9.4 Solve triangles and the problems involving heights and distances.

10 USE PRINCIPLES OF MENSTRUATION IN FINDING SURFACES, 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 consines of a vector.
11.6 Derive analytic expression for dot product and cross product of two vector.
11.7 Deduce conditions of perpendicularly 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, ad joint and inverse of a matrix.
12.4 State properties of determinants.
12.5 Explain basic concepts.
12.6 Explain algebra of matrices.
12.7 Solve linear equation by matrices.
12.8 Explain the solution of a determinant.
12.9 Use Crammers Rule for solving linear equations

Phy-122 APPLIED PHYSICS

Total Contact Hours

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

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

COURSE CONTENTS

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

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

RECOMMENDED BOOKS

1. A Text Book of Physics , Phy-122 of TEVTA published by National Book Foundation(NBF)

Phy-122 APPLIED PHYSICS

INSTRUCTIONAL OBJECTIVES

1 USE CONCEPTS OF MEASUREMENT TO PRACTICAL SITUATIONS AND TECHNOLOGICAL PROBLEMS

1. 1 Write dimensional formulae for physical quantities
1.2 Derive units using dimensional equations
1.3 Convert a measurement from one system to another
1.4 Use concepts of measurement and significant figures in problem solving.

2 USE CONCEPTS OF SCALARS AND VECTORS IN SOLVING PROBLEMS INVOLVING THESE CONCEPTS

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

3 USE THE LAW OF CONSERVATION OF MOMENTUM AND CONCEPTS OF ANGULAR MOTION TO PRACTICAL SITUATIONS

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

4 USE CONCEPTS OF TORQUE, EQUILIBRIUM AND ROTATIONAL INERTIA TO PRACTICAL SITUATION/PROBLEMS

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

5 USE CONCEPTS OR WAVE MOTION IN SOLVING RELEVANT PROBLEMS

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

6 UNDERSTAND concepts OF SOUND

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

7 USE THE CONCEPTS OF GEOMETRICAL OPTICS TO MIRRORS AND LENSES

7.1 Explain laws of reflection and refraction
7.2 Use mirror formula to solve problems
7.3 Use the concepts of image formation by mirrors and lenses to describe working of optical instruments, e.g. microscopes, telescopes, camera and sextant.

8 UNDERSTAND WAVE THEORY OF LIGHT

8.1 Explain wave theory of light
8.2 Explain phenomena of interference, diffraction, polarization of light waves
8.3 Describe uses of polarization given in the course contents.

9 UNDERSTAND THE STRUCTURE, WORKING AND USES OF OPTICAL FIBER

9.1 Explain the structure of the Optical Fiber
9.2 Explain its principle of working
9.3 Describe use of optical fiber in industry and medicine.

Phy-122 APPLIED PHYSICS

LIST OF PRACTICALS

1. Draw graphs representing the functions:
a) $y=mx$ for $m=0, 0.5, 1, 2$
b) $y=x^2$
c) $y = l/x$
2. Find the volume of a given solid cylinder using vernier calipers.
3. Find the area of cross-section of the given wire using micrometer screw gauge.
4. Prove that force is directly proportional to (a) mass, (b) acceleration, using fletchers trolley
5. Verify law of parallelogram of forces using Grave-sands apparatus.
6. Verify law of triangle of forces and Lami's theorem
7. Determine the weight of a given body using
   a) Law of parallelogram of forces
   b) Law of triangle of forces
   c) Lami's theorem
8. Verify law of polygon of forces using Grave-sands apparatus.
9. Locate the position and magnitude of resultant of like parallel forces.
10. Determine the resultant of two unlike parallel forces.

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

12. Locate the centre of gravity of regular and irregular shaped bodies.
13. Find Young's Modules of Elasticity of a metallic wire.
14. Verify Hooke's Law using helical spring.
15. Study of frequency of stretched string with length.
16. Study of variation of frequency of stretched string with tension.
17. Study resonance of air column in resonance tube and find velocity of sound.
18. Find the frequency of the given tuning fork using resonance tube.
19. Find velocity of sound in rod by Kundt's tube

20, Verify rectilinear propagation of light and study shadow formation.

21. Study effect of rotation of plane mirror on reflection.
22. Compare the refractive indices of given glass slabs.
23. Find focal length of concave mirror by locating centre of curvature.
24. Find focal length of concave mirror by object and image method
25. Find focal length of concave mirror with converging lens.
26. Find refractive index of glass by apparent depth.
27. Find refractive index of glass by spectrometer.
28. Find focal length of converging lens by plane mirror.
29. Find focal length of converging lens by displacement method.
30. Find focal length of diverging lens using converging lens.
31. Find focal length of diverging lens using concave mirror.
32. Find angular magnification of an astronomical telescope.
33. Find angular magnification of a simple microscope (Magnifying Glass)
34. Find angular magnification of a compound microscope.
35. Study working and structure of camera.
36. Study working and structure of sextant.

37. Compare the different scales of temperature and verify the conversion formula.
38. Determine the specific heat of lead shots.
39. Find the coefficient of linear expansion of a metallic rod.
40. Find the heat of fusion of ice.
41. Find the heat of vaporization.
42. Determine relative humidity using hygrometer:

Ch-112 APPLIED CHEMISTRY

T	P	C
1	3	2

Total Contact Hours

Theory **32**
Practical **64**

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

AIMS : After studying this course a student will be able to;

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

COURSE CONTENTS

1	**INTRODUCTION AND FUNDAMENTAL CONCEPTS**	**2 Hrs**
1.1	Orientation with reference to this technology	
1.2	Terms used & units of measurements in the study of chemistry	
1.3	Chemical Reactions & their types	
2	**ATOMIC STRUCTURE**	**2 Hrs**
2.1	Sub-atomic particles	
2.2	Architecture of atoms of elements, Atomic No. & Atomic Weight	
2.3	The periodic classification of elements periodic law	
2.4	General characteristics of a period and group	
3	**CHEMICAL BOND**	**2 Hrs**
3.1	Nature of chemical Bond	
3.2	Electrovalent bond with examples	
3.3	Covalent Bond (Polar and Non-polar, sigma & Pi Bonds with examples	
3.4	Co-ordinate Bond with examples	
4	**WATER**	**2 Hrs**
4.1	Chemical nature and properties.	
4.2	Impurities	
4.3	Hardness of water (types, causes & removal)	
4.4	Scales of measuring hardness (Degrees Clark	
4.5	Boiler feed water, scales & treatment	
4.6	Sea-water desalination, sewage treatment	
5	**ACIDS, BASES AND SALTS**	**2 Hrs**
5.1	Definitions with examples	
5.2	Properties, their strength, basicity & Acidity	
5.3	Salts and their classification with examples	
5.4	pH-value and scale	

6	**OXIDATION & REDUCTION**	**2 Hrs**
6.1	The process, definition& examples	
6.2	Oxidizing and reducing agents	
6.3	Oxides and their classifications	
7	**NUCLEAR CHEMISTRY**	**2 Hrs**
7.1	Introduction	
7.2	Radioactivity (alpha, beta and gamma rays)	
7.3	Half life process	
7.4	Nuclear reaction & transformation of elements	
8	**CEMENT**	**2 Hrs**
8.1	Introduction	
8.2	Composition and manufacture	
8.3	Chemistry of setting and hardening	
8.4	Special purpose cements	
9	**GLASS**	**2 Hrs**
9.1	Composition and raw material	
9.2	Manufacture	
9.3	Varieties and uses	
10	**PLASTICS AND POLYMERS**	**2 Hrs**
10.1	Introduction and importance	
10.2	Classification	
10.3	Manufacture	
10.4	Properties and uses	
11	**PAINTS, VARNISHES AND DISTEMPER**	**2 Hrs**
11.1	Introduction	
11.2	Constituents	
11.3	Preparation and uses	
12	**CORROSION**	**2 Hrs**
12.1	Introduction with causes	
12.2	Types of corrosion	
12.3	Rusting of iron	
12.4	Protective measures against-corrosion	
13	**REFRACTORY MATERIALS AND ABRASIVE**	**2 Hrs**
13.1	Introduction to Refractories	
13.2	Classification of Refractories	
13.3	Properties and Uses	
13.4	Introduction to Abrasives	
13.5	Artificial and Natural Abrasives and their uses	
14	**ALLOYS**	**2 Hrs**
14.1	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. A Text Book of Chemistry (Ch-112) of TEVTA, published by National Book Foundation (NBF)

Ch-112 APPLIED CHEMISTRY

INSTRUCTIONAL OBJECTIVES

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

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

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

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

3 UNDERSTAND THE NATURE OF CHEMICAL BOND

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

4 UNDERSTAND THE CHEMICAL NATURE OF WATER

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

5 UNDERSTAND THE NATURE OF ACIDS, BASES AND SALTS

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

6 UNDERSTAND THE PROCESS OF OXIDATION AND REDUCTION

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

7 UNDERSTAND THE FUNDAMENTALS OF NUCLEAR CHEMISTRY

7.1 Define nuclear chemistry and radio activity

7.2 Differentiate between alphas, Beta and Gamma particles

7.3 Explain hall-life process

7.4 Explain at least six nuclei reactions resulting in the transformation of some elements

7.5" State important uses of isotopes

8 UNDERSTAND THE MANUFACTURE, SETTING AND HARDENING CEMENT

8.1 Define port land cement and give its composition

8.2 Describe the method of manufacture

8.3 Describe the chemistry of setting and hardening of cement

8.4 Distinguish between ordinary and special purpose cement

9 UNDERSTAND THE PROCESS OF MANUFACTURE OF GLASS.

9.1 Define glass

9.2 Describe its composition and raw materials

9.3 Describe the manufacture of glass

9.4 explain its varieties and uses

10 UNDERSTAND THE NATURE AND IMPORTANCE OF PLASTICS POLYMERS

10.1. Define plastics and polymers

10.2 Explain the mechanism of polymerization

10.3 Describe the preparation and uses of some plastics/polymers

11 KNOW THE CHEMISTRY OF PAINTS, VARNISHES AND DISTEMPERS

11.1 Define paints, varnishes and distemper

11.2 State composition of each

11.3 State methods of preparation of each and their uses

12 UNDERSTAND THE PROCESS OF CORROSION WITH ITS CAUSES AND TYPES

12.1 Define corrosion

12.2 Describe different types of corrosion

12.3 State the causes of corrosion

12.4 Explain the process of rusting of iron

J2.5 Describe methods to prevent/control corrosion

13 UNDERSTAND THE NATURE OF REFRACTORY MATERIALS AND ABRASIVE

13.1 Define refractory materials

13.2 Classify refractory materials

13.3 Describe properties and uses of refractories

13.4 Define abrasive.

13.5 Classify natural and artificial abrasives

13.6 Describe uses of abrasives

14 UNDERSTAND THE NATURE AND IMPORTANCE OF ALLOYS

14.1 Define alloy

14.2 Describe different methods for the preparation of alloys

14.3 Describe important properties of alloys

14 4 Enlist some important alloys with their composition, properties and uses

15 UNDERSTAND THE NATURE OF FUELS AND THEIR COMBUSTION

15.1 Define fuels

15.2 Classify fuels and make distinction of solid, liquid & gaseous fuels

15.3 Describe important Fuels

15.4 Explain combustion
15.5 Calculate air quantities in combustion, gases

16 UNDERSTAND THE NATURE OF LUBRICANTS.

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

17 UNDERSTAND THENATURE OF POLLUTION

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

CH-112 APPLIED CHEMISTRY 96 Hrs

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

COMP-152 COMPUTER APPLICATIONS

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

Pre-requisites: None

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

Course Contents:

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

2. MS-WINDOWS -2010 2 Hrs

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

3. MS-OFFICE (MS-WORD -2016) 8 Hrs

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

4. MS-OFFICE (MS-EXCEL -2016) 9 Hrs

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

5. MS. OFFICE (MS-POWER POINT- 2016) 4 Hrs.

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

6. INTERNET & E-MAIL 3Hrs

6.1 Introduction to Internet & browser window
6.2 Searching, Saving and Print a page from internet
6.3 Creating, Reading & Sending E-Mail
6.4 Drop Box / Online/ Sky drive/ Cloud data etc.
6.5 File attachment.
6.6 Uploading and downloading file(s) and software(s)
6.7 Explain some advance features over the internet and search engines
6.8 Difference between Internet, Intranet and Extranet

COMP-152 COMPUTER APPLICATIONS

Instructional Objectives:

1. UNDERSTAND ELECTRONIC DATA PROCESSING (E.D.P)

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

2. UNDERSTAND MS-WINDOWS-2010

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

3. UNDERSTAND MS-OFFICE (MS-WORD – 2016)

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

4. UNDERSTAND MS-OFFICE (MS-EXCEL- 2016)

4.1 Explain Introduction to MS-Excel & its Screen
4.2 Describe Entering data & apply formulas in worksheet
4.3 Describe Editing &Formatting the, Cells, Row & Column

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

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

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

6. UNDERSTAND INTERNET &E-MAIL

6.1 Explain Introduction to Internet and browser window
6.2 Explain Searching, Saving and Print a page from internet
6.3 Describe Creating, Reading & Sending E-Mail
6.4 Interpret Drop Box / Online/ Sky drive/ Cloud data etc.
6.5 File attachment.
6.6 Uploading and downloading file(s) and software(s)
6.7 Explain some advance features over the internet and how to search topics on different search engines
6.8 Enlist the Difference between Internet, Intranet and Extranet

Recommended Textbooks:

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

COMP-152 COMPUTER APPLICATIONS

List of Practical:

1. Identify key board, mouse, CPU, disk drives, disks, monitor, and printer 3 Hrs

2. MS WINDOWS 2010 12 Hrs

2.1 Practice of loading and shutdown of operating system
2.2 How to install Drivers & Windows
2.3 Creating items (icons, shortcut, folders etc) and modifying taskbar
2.4 Changing of wallpaper, screensaver, and resolution
2.5 Practice of control panel items (add/remove, time and date, mouse, and create user account)

3. MS OFFICE (MS-WORD 2016) 27 Hrs

3.1 Identifying the MS Word Screen and its menu
3.2 Practice of create a new document, saving and re-opening it from the location and spell check & grammar
3.3 Practice of Page Formatting (Borders, Character Spacing, Paragraph, Bullets & Numberings and Fonts)
3.4 Practice of different tool bars like standard, format& drawing tool bars
3.5 Practice of Insert pictures, clipart, and shapes
3.6 Practice of header and footer
3.7 Practice of insert table and also format of table
3.8 Practice of page setup, set the page margins, and printing documents

4. MS OFFICE (MS-EXCEL 2016) 27 Hrs

4.1 Identifying the MS EXCEL Screen and its menu
4.2 Practice of create a new sheet, saving and re-opening it from the location and spell check
4.3 Practice of insert and delete of row and columns (format of cell)
4.4 Practice of entering data and formulas in worksheet(Add, Subtract, Multiplying, and Divide & Average)
4.5 Repeating practical serial number04
4.6 Practice of insert chart and its types
4.7 Practice of page setup, set the page margins, and printing

5. MS OFFICE (MS-POWER POINT 2016) 15 Hrs

5.1 Identifying the MS POWER POINT Screen and its menu
5.2 Practice of create a new presentation and save
5.3 Practice of open saves presentations
5.4 Practice of inset picture and videos

6. INTERNET & E-MAIL 12 Hrs

6.1 Identifying internet explorer
6.2 Practice of searching data from any search engine
6.3 Practice of create an E-Mail account and how to send and receive mails, download attachments
6.4 File attachment.
6.5 Uploading and downloading file(s) and software(s)

MMAT-115 WORKSHOP PRACTICE - I

Total Contact Hours

		T	P	C
Theory:	32Hrs			
Practical:	384Hrs	1	12	5

Pre-requisites: None

AIMS: The students will familiarize with the Tools, Equipment, Machines used in the Metal work, Welding & Forging, Wood Work, Foundry and Basic machine shop. The student will achieve the Basic skills in the above fields by preparing specific jobs in each part of the subject.

Course Contents:

1.	A - General Metal work	08Hrs
2.	B - Welding and Forging	08Hrs
3.	C - Foundry	08Hrs
4.	D - Basic Machine Shop	08Hrs

Detail of Contents: (Theory)

A) General Metal Work

1. Introduction To Metal Work and Metal Working Tools 8 Hrs
   - 1.1 Observe safety precautions and proper care of Metal working tools and machines

2. Kinds of Tools and Machines
   - 2.1 Hand tools
   - 2.1.1 Measuring tools
   - 2.1.2 Layout tools
   - 2.1.3 Cutting tools
   - 2.1.4 Chisels
   - 2.1.5 Files and Filing
   - 2.1.6 Hacksaws and Hack sawing
   - 2.1.7 Drills & Reamers
   - 2.1.8 Taps, Taping and Threading dies
   - 2.2 Machines
     - 2.2.1 Drilling machines
     - 2.2.2 Power Hacksaw
     - 2.2.3 Bending machines
     - 2.2.4 Rolling machine
     - 2.2.5 Shearing machine
   - 2.3 Fasteners
     - 2.3.1 Introduction to Fasteners
     - 2.3.2 Screws, Nuts, Bolts, Rivets,
     - 2.3.2 Types and applications of related tools

B) Welding and Forging **8hrs**

3. Welding shop and Forging shop Machinery, Tools and Equipment
   - 3.1 Definition of welding
   - 3.2 Welding Processes
     - 3.2.1 Pressure welding
     - 3.2.2 Fusion welding process

- 3.3 Types of pressure welding process
  - 3.3.1 Forge welding
  - 3.3.2 Resistance welding
  - 3.3.2.1 Types of Resistance welding
- 3.4 Types of Fusion welding
  - 3.4.1 Oxy acetylene gas welding
  - 3.4.2 Arc welding
  - 3.4.3 Thermal welding
  - 3.4.4 TIG welding
  - 3.4.5 MIG welding
  - 3.4.6 Submerged Arc welding
  - 3.4.7 Oxy acetylene gas welding tools/equipment with Their uses
  - 3.4.8 Introduction to Arc welding machine
  - 3.4.8.1 List of Arc welding tools equipment with their uses

4 Welding Materials

- 4.1 Flux
- 4.2 Types of filler rod
- 4.3 Types of Electrode

5 Safety method in welding shop

- 5.1 Flash back and its remedy
- 5.2 Back fire and its remedy

6 Welding Defects & Tests (DPT, NDTs)

7 Welding Certifications

8 Forging

- 8.1 Introduction to Forging
- 8.2 Forging tools Equipments
- 8.3 Classification of forging
  - 8.3.1 Hand Forging
  - 8.3.2 Machine Forging
- 8.4 Forging equipments
  - 8.4.1 Forging Machine
  - 8.4.2 Forging Furnaces
- 8.5 Forging operations
  - 8.5.1 Drawing Down
  - 8.5.2 Up Setting
  - 8.5.3 Cutting
  - 8.5.4 Swaging
  - 8.5.5 Punching
  - 8.5.6 Twisting

C) Foundry 8hrs

9 Foundry

- 9.1 Introduction to foundry and basic steps in casting process.
- 9.2 Shop safety procedure
- 9.3 Pattern
- 9.4 Foundry tools and equipment
  - 9.4.1 Molding hand tools
- 9.5 Molding machines
  - 9.5.1 Sand mixing machine
  - 9.5.2 Shot blasting machines

9.5.3 Furnaces

9.6 Foundry sand

9.6.1 Green sand and its composition

9.6.2 Dry sand and its composition

9.7 Characteristics of foundry sand

9.7.1 Parting sand

9.7.2 Facing sand

(D) Basic Machine Shop-1 8hrs

10 Lathe construction

10.1 Parts of lathe

10.2 Lathe accessories

10.3 Lathe cutting tools and materials

10.3.1 Cutting tools material

10.3.2 Types of Lathe cutting tools

10.4 Cutting speed and feed

10.5 Cutting speed feed and depth of cut

10.6 Lathe operations

10.6.1 Centering of work piece

10.6.2 Facing

10.6.3 Straight Turning

10.6.4 Step turning

10.6.5 Knurling

10.6.6 Center Drilling & drilling

10.6.7 Taper turning

11 Tool grinder

12 Shaper machine

MMAT-115 WORKSHOP PRACTICE- I
Instructional Objectives:

A) General Metal Work

1. Introduction To Metal Work and Metal Working Tools
    - 1.1 Observe safety precautions and proper care of Metal working tools and machines

2. Kinds of Tools and Machines
    - 2.1 Understand Metal Working Hand tools
        - 2.1.1 Classify Metal Working Measuring tools
        - 2.1.2 Describe Layout tools and Practice
        - 2.1.3 Describe Cutting tools and Practice
        - 2.1.4 Describe Chisels and Chiseling
        - 2.1.5 Describe Files and Filing
        - 2.1.6 Describe Hacksaws and Hack sawing
        - 2.1.7 Describe Drills, Drilling and Reamers
        - 2.1.8 Describe Taps, Taping and threading dies
    - 2.2 Understand Metal Working Machines
        - 2.2.1 Explain Drilling machines
        - 2.2.2 Explain Power Hacksaw
        - 2.2.3 Explain Bending machines
        - 2.2.4 Explain Rolling machine
        - 2.2.5 Explain Shearing machine
    - 2.3 Understand Fasteners
        - 2.3.1 Introduction to Fasteners
        - 2.3.2 Explain Types of Screws, Nuts, Bolts, Rivets
        - 2.3.2 Explain Types and applications of related tools

B) Welding and Forging

3. Familiarized with Welding shop and Forging shop Machinery, Tools and Equipment's
    - 3.1. Define welding
    - 3.2. Describe Welding Processes
        - 3.2.1. Describe Pressure welding
        - 3.2.2. Describe Fusion welding process
    - 3.3. Describe Types of pressure welding process
    - 3.4. Describe Forge welding
    - 3.5. Describe Resistance welding of Spot welding, Seam welding, Flash welding
    - 3.6. Describe Types of Fusion welding
        - 3.6.1. Describe Oxy acetylene gas welding
        - 3.6.2. Describe Arc welding
        - 3.6.3. Describe Thermo welding
        - 3.6.4. Describe TIG welding
        - 3.6.5. Describe MIG welding
        - 3.6.6. Describe Submerged Arc welding
    - 3.7. Understand the use of Fusion Welding Tools (Oxy acetylene gas welding, Arc welding)
    - 3.8. Demonstrate oxy-acetylene gas welding
    - 3.9. Describe Tools and equipments
    - 3.10. Describe the function and proper uses of oxy-acetylene gas welding
    - 3.11. Demonstrate the pressure regulators function, Oxygen Cylinder, acetylene cylinder, injector and non-injector type of blow pipe

3.12. Understand the use of Arc welding machines and equipments
3.13. Describe the function of step down transformer

3.14. Describe the function of welding tools and their uses
3.15. Identification of Arc welding and their uses.
3.15.1. Describe the arc welding processes

4 Describe Welding Materials
4.1 Definition of Flux, its uses and advantages
4.2 Describe types of filler rod
4.3 State types of Electrode

5 Apply the safety method in welding shop
5.1 Describe the flash back, causes of flash back
5.2 Explain the back fire, its causes and how to avoid
5.3 Explain the safety precautions applied during Arc weIding,gas welding, forging and grinding

6. Describe the welding defects like
6.1 Describe Lack of penetration
6.2 Describe Slag inclusion
6.3 Describe Undercut
6.4 Describe Blow holes

7. Explain the diffent types of welding cetifications

8. Forging Operation
8.1. Describe the forging
8.2. Difference between hot and cold forging
8.3. Understand the forging tools and equipment
8.4. Explain the working procedure of forge furnace and names its parts
8.5. Identify the forging equipments, tools and their uses
8.5.1 Describe the proper use of equipments and tools
8.6. Explain the building and maintaining the forge fire
8.7. Describer the different forge fuels
8.8. Understand the forging processes
8.8.1 Describe hand forging and machine forging
8.9. Describe the advantages of forging
8.9.1 Explain safety rules applied in forging shop
8.10. Describe the forging operations
8.10.1 Cutting of hot metal with chisel
8.10.2 Cutting of hot metal with hardy
8.10.3 Explain the drawing down and up setting process
8.10.4 Demonstrate the drawing down operations and use of flatter
8.11. Describe the fullering and swaging .Apply the proper tools for swaging operation

C) Foundry

9. Foundry
9.1 Introduction to foundry and basic steps in casting process
9.2 Describe Shop safety procedure
9.3 Describe Pattern
9.3.1 Describe types of a pattern
9.3.2 Describe pattern materials

10. Foundry tools and equipment
10.1 Describe Molding hand tools

10.2 Describe Jolting and Squeezing Molding machines
10.3 Introduction to Sand mixing machine
10.4 Describe Sand and Shot blasting machines
10.5 Describe Pit Furnaces and Tilting Furnaces

11. Foundry sand
11.1 Describe Green sand and its composition
11.2 Describe Dry sand and its composition
11.2.1 Binders for foundry sand
11.2.2 Describe preparation of sand for COC molding process
11.3 Describe Characteristics of foundry sand
11.4 Describe Parting sand
11.5 Describe Facing sand

D) Basic Machine Shop-I

12. Lathe construction
12.1 List the parts of Lathe
12.1.1 Explain the function of each part
12.1.2 Name the "Lathe accessories"
12.1.3 Describe the use of each accessory
12.2 List the materials used for cutting tools
12.2.1 Describe the characteristics of each material
12.2.2 Name the types of cutting tools according to their use.
12.3 Cutting speed and feed
12.3.1 Define cutting speed, feed and depth of cut for lathe work
12.3.2 Describe calculations of cutting speed
12.3.3 Factors effecting cutting speed and feed
12.4 List the lathe operations
12.4.1 Define Centering of work piece on four jaws independent chuck
12.4.2 Describe the importance of centering the work piece
12.4.3 Define facing
12.4.4 Describe the method of facing a work piece held in a chuck
12.4.5 Define straight turning
12.4.6 Describe the method of rough and finish turning
12.4.7 Define step turning
12.4.8 Define shoulder
12.4.9 Describe the types of shoulder
12.4.10 Define knurling
12.4.11 Describe the purpose of knurling
12.4.12 Describe the types of knurling according to shape and grade
12.4.13 Define center drilling
12.4.14 Define drilling
12.4.15 Describe the method of drilling and center drilling on lathe machine
12.4.16 Define taper and taper turning
12.4.17 Describe the compound slide method of taper turning
12.5 List parts of tool grinder
12.5.1 Describe each part
12.6 List parts of shaper
12.6.1 Describe each part

MMAT-115 WORKSHOP PRACTICE-1

LIST OF PRACTICALS 384 hrs

A) General Metal Work

1. Preparation of name plate
2 Sawing exercise
3. Preparation of inside caliper
4. Preparation of Bottle opener
5. Preparation of dove-tail joint
6. Preparation of small size Try-square
7. Preparation of Coat hook
8. Preparation of funnel (sheet)
9. Preparation Pin tray (sheet)
10. Preparation of Drawer handle
11. Preparation of bevel square
12. Preparation of spanner (small size)

B) Welding and Forging (OXY ACETYLENE)

1. Flame making gas welding

(a) Harsh Flame (b) Carburizing Flame (c) Neutral Flame (d) oxidizing

2. Pool making
3. Bead making
4. Edge joint
5. Open square butt joint (MS Flat 3mm thick)
6. Open square butt joint (MS Flat 5mm thick)
7. 'V' Groove butt joint (Flat Position)
8. Corner joint
9. Open square brazing butt joint (MS Flat 3mm thick)

(ARC WELDING)

10. Types of Arc welding machines and their operation with current adjustment
11. Arc making
12. Bead making
13. Open square Butt joint (MS Flat 5mm thick)
14. 'V' Groove Butt joint
15. Lap joint
16. Corner joint (Vertical Position)
17. Spot welding practice (0.5 mm M.S Sheet)
18. Seam welding practice (0.5 mm M.S Sheet)

(FORGING)

19. Practice of drawing down
20. Practice of up setting

C) Foundry Shop

1. Introduction and layout of foundry shop
2. Introduction to foundry sand
   - 2.1 Dry sand molding
   - 2.2 Green Sand Moulding
   - 2.2 Binding materials
3. Introduction to hand molding tools, equipment and molding boxes/flasks.
4. Introduction and practice of sand cleaning and mixing machines
5. Sand preparation and tempering practice
6. Practice of mould making
   - 6.1 Dry sand molding
   - 6.2 Green sand molding

7. Practice use of single piece patterns (one piece patterns)
   - 7.1 English letters (Alphabet)
   - 7.2 Paper weight
   - 7.3 Simple square, triangular and hexagonal patterns)
8. Practice use of split patterns (two piece patterns)
   - 8.1 Anvil
   - 8.2 Journal bearing body
   - 8.3 Pulley

D) Basic Machine Shop-I

1. Practice of cleaning and oiling the lathe machine
2. Practice of centering the job by tool method
3. Practice of centering the job held in a four jaw chuck or face plate by surface gauge
4. Practice of facing
5. Practice of straight turning
6. Practice of center drilling
7. Practice of drilling on lathe
8. Practice of step turning
9. Practice of knurling
10. Practice of boring a straight hole
11. Practice of tool grinding
12. Practice of taper turning by compound rest method
13. Practice of cutting metric threads on lathe machine
14. Practice of Chamfering
15. Preparation of center punch

Recommended Textbooks:

1. Technology of Machine Tools by Steve F. Krar, Albert F. Check
2. Machine Tools Technology by Willard J. McCarthy, Dr. Victor E. Repp
3. Machine Tools Metal working by Jhon L. Feirer
4. Shop Theory by James Anderson, Earl E. Tatro, Latest Ed.
5. Workshop Practices By Ludwig

MMAT-121	**History of Mechanical Industry**			
Total Contact Hours		T	P	C
Theory	32	1	0	1
Practical	0			

AlM: After going through this course, student will be able to:
Ⅰ. Introduce the main development lines of mechanical invention, mechanical science and technology;
Ⅱ. Describe the development of the mechanical industry and the development of mechanical engineering education;
Ⅲ. Describe the development process of China's mechanical manufacturing industry

Course Contents:

1.	**Introduction**	**2Hrs**
2.	**The Development of Ancient Machinery**	**2Hrs**
3.	**Social and technological progress in Europe before the Industrial Revolution**	**2Hrs**
4.	**The Industrial Revolution**	**2Hrs**
5.	**The Second Industrial Revolution**	**2Hrs**
6.	**Further Development of Mathematics and Mechanics during the Industrial Revolution**	**2Hrs**
7.	**Overview of the Third Technological Revolution**	**2Hrs**
8.	**The New Appearance of Mechanical Design in the New Era**	**2Hrs**
9.	**The New Face of Mechanical Manufacturing in the New Era**	**2Hrs**
10.	**Historical Development of Rough Production Technology**	**2Hrs**
11.	**Modern Higher Mechanical Engineering Education**	**4Hrs**
12.	**Mechanical Engineering in Modern and Contemporary China**	**8Hrs**

Detail of Contents:

1. Introduction **2Hrs**

1.1 Periodization of Machinery Development

1.2 Several important relationships between nature, society, science, and technology

1.3 About the Technological Revolution and Industrial Revolution

1.5 About the Discipline of Mechanical Engineering

2.	**The Development of Ancient Machinery**	**2Hrs**
	2.1 Overview	
	2.2 Introduction to the Development of Various Ancient Machinery	
	2.3 Ancient Machinery Manufacturing Technology	
3.	**Social and technological progress in Europe before the Industrial Revolution**	**2Hrs**
	3.1 Social Development from the Renaissance to the Industrial Revolution	
	3.2 Mechanical Science and Technology in Europe from the Renaissance to the Industrial Revolution	
	3.3 Creation and development of Classical mechanics	
	3.4 Establishment of calculus theory and differential Theory of equation	
4.	**The Industrial Revolution**	**2Hrs**
	4.1 Overview of the Development of the First Industrial Revolution	
	4.2 Invention of Steam engine and transportation revolution	
	4.3 Mechanical inventions in the Industrial Revolution	
	4.4 The Birth and Early Development of Modern Machinery Manufacturing Industry	
	4.5 Theoretical solution of Perpetual motion problem	
5.	**The Second Industrial Revolution**	**2Hrs**
	5.1 Overview of the Second Industrial Revolution	
	5.2 The Invention of Internal Combustion Engines and the New Transportation Revolution	
	5.3 Mechanical inventions during the Second Industrial Revolution	
	5.4 Machinery manufacturing during the Second Industrial Revolution	
	5.5 Several Trends in Mechanical Development	
6.	**Further Development of Mathematics and Mechanics during the Industrial Revolution**	**2Hrs**
	6.1 Progress in Areas of mathematics closely related to mechanical engineering	
	6.2 Further Development of Mechanics	
7.	**Overview of the Third Technological Revolution**	**2Hrs**
	7.1 The Scientific Foundation of the Third Technological Revolution	

7.2 Background and Overview of the Third Technological Revolution

7.3 Main contents of the third technological revolution

7.4 Information Technology

7.5 New Material Technology

7.6 New advancements in mathematics and mechanics related to mechanical engineering

8. The New Appearance of Mechanical Design in the New Era 2Hrs

8.1 Overview of Mechanical Design in the New Era

8.2 Theory and Method of Mechanical Innovative Design

8.3 Computer Graphics and Computer-aided design

8.4 Modern design methods to ensure the main performance of products

8.5 Dynamic Design and Vibration Control

8.6 Other modern design methods

9. The New Face of Mechanical Manufacturing in the New Era 2Hrs

9.1 Overview of Mechanical Manufacturing in the New Era

9.2 Automation - The Mainline of Advanced Manufacturing Technology Development

9.3 Progress in Cutting Technology

9.4 Processing techniques for special surfaces

9.5 The emergence and development of special processing technology

9.6 Incremental Manufacturing Technology

9.7 Green Manufacturing Technology

9.8 Informatization, Intelligence, and Networking of Enterprise Activities

10. Historical Development of Rough Production Technology 2Hrs

10.1 Historical Development of Casting Technology

10.2 Historical Development of Pressure Processing Technology

10.3 Historical Development of Welding Technology

10.4 Historical Development of Other Blank Forming Methods and Heat Treatment Technologies

11. Modern Higher Mechanical Engineering Education 4Hrs

11.1 The Birth and Development of Modern Engineering Education (19th

Century)

11.2 Development of Modern Engineering Education (20th Century)

11.3 Two Modern Engineering Education Models

12. Mechanical Engineering in Modern and Contemporary China 8Hrs

12.1 Mechanical engineering in the Westernization Movement

12.2 Mechanical Engineering during the Republic of China Period

12.3 Mechanical Engineering in Contemporary China

Recommended Textbooks:

1. The History of Mechanical Industry by Zhang Ce (Publisher: China tsinghua university press, 2015)

2. The Volume of Chinese Mechanical History and Technology by China Society of Mechanical Engineering (Publisher: China Science and Technology Press, 2014)

3. The Atlas Volume of Chinese Mechanical History by China Society of Mechanical Engineering (Publisher: China Science and Technology Press, 2014)

MMAT-121 History of Mechanical Industry

Instructional Objectives:

1. Introduction

1.1 Describe Periodization of Machinery Development

1.2 Describe Several important relationships between nature, society, science, and technology

1.3 Describe About the Technological Revolution and Industrial Revolution

1.5 Explain About the Discipline of Mechanical Engineering

2. The Development of Ancient Machinery

2.1 Describe Overview

2.2 Describe Introduction to the Development of Various Ancient Machinery

2.3 Explain Ancient Machinery Manufacturing Technology

3. Social and technological progress in Europe before the Industrial Revolution

3.1 Describe Social Development from the Renaissance to the Industrial Revolution

3.2 Explain Mechanical Science and Technology in Europe from the Renaissance to the Industrial Revolution

3.3 Describe Creation and development of Classical mechanics

3.4 Describe Establishment of calculus theory and differential Theory of equation

4. The Industrial Revolution

4.1 Describe Overview of the Development of the First Industrial Revolution

4.2 Explain Invention of Steam engine and transportation revolution

4.3 Describe Mechanical inventions in the Industrial Revolution

4.4 Describe The Birth and Early Development of Modern Machinery Manufacturing Industry

4.5 Describe Theoretical solution of Perpetual motion problem

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5.1 Describe Overview of the Second Industrial Revolution

5.2 Describe The Invention of Internal Combustion Engines and the New Transportation Revolution

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5.4 Describe Machinery manufacturing during the Second Industrial Revolution

5.5 Describe Several Trends in Mechanical Development

6. Further Development of Mathematics and Mechanics during the Industrial Revolution

6.1 Describe Progress in Areas of mathematics closely related to mechanical engineering

6.2 Describe Further Development of Mechanics

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7.2 Describe Background and Overview of the Third Technological Revolution

7.3 Describe Main contents of the third technological revolution

7.4 Describe Information Technology

7.5 Describe New Material Technology

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9.1 Describe Overview of Mechanical Manufacturing in the New Era

9.2 Describe Automation - The Mainline of Advanced Manufacturing Technology Development

9.3 Describe Progress in Cutting Technology

9.4 Describe Processing techniques for special surfaces

9.5 Describe The emergence and development of special processing technology

9.6 Describe Incremental Manufacturing Technology

9.7 Describe Green Manufacturing Technology

9.8 Describe Informatization, Intelligence, and Networking of Enterprise Activities

10. Historical Development of Rough Production Technology

10.1 Describe Historical Development of Casting Technology

10.2 Describe Historical Development of Pressure Processing Technology

10.3 Describe Historical Development of Welding Technology

10.4 Describe Historical Development of Other Blank Forming Methods and Heat Treatment Technologies

11. Modern Higher Mechanical Engineering Education

11.1 Describe The Birth and Development of Modern Engineering Education (19th Century)

11.2 Explain Development of Modern Engineering Education (20th Century)

11.3 Explain Two Modern Engineering Education Models

12. Mechanical Engineering in Modern and Contemporary China

12.1 Describe Mechanical engineering in the Westernization Movement

12.2 Explain Mechanical Engineering during the Republic of China Period

12.3 Explain Mechanical Engineering in Contemporary China

MMAT-132 BASIC ELECTRICAL AND ELECTRONICS **T P C**

1 3 2

Aims:

- To impart basic knowledge of electrical quantities and provide working knowledge for the analysis of DC and AC circuits.
- To understand the construction and working principle of DC and AC machines.
- To facilitate understanding of basic electronics and operational amplifier circuits.

COURSE CONTENTS

1. Introduction to Electrical Engineering: 6 hrs

1.1. Current and Voltage sources

1.2. Resistance

1.3. Inductance and Capacitance

1.4. Ohm's law

1.5. Kirchhoff's law

1.6. Energy and Power

1.7. Series parallel combination of R, L, C components, Voltage Divider and Current Divider Rules

1.8. Super position Theorem

1.9. Network Analysis – Mesh and Node methods- Faraday's Laws of Electro-magnetic Induction

1.10. Magnetic Circuits

1.11. Self and Mutual Inductance

1.12. Generation of sinusoidal voltage

1.13. Instantaneous, Average and effective values of periodic functions

1.14. Phasor representation

1.15. Introduction to 3-phase systems, Introduction to electric grids.

2. Electrical Machines: 6 hrs

2.1. DC Motor:

2.1.1.Construction

2.1.2. Principle of operation

2.1.3. Different types of DC motors

2.1.4. Voltage equation of a motor

2.1.5. Significance of back EMF

2.1.6. Speed and Torque

2.1.7. Torque-Speed characteristics

2.1.8. Output Power

2.1.9. Efficiency and applications.

2.2. Single Phase Transformer:

2.2.1. Construction

2.2.2. Principle of operation

2.2.3. EMF Equation

2.2.4. Regulation and Efficiency of a Transformer

2.3. Induction Machine:

2.4. Three Phase Induction Motor:

2.4.1. Construction and Principle of Operation

2.4.2. Slip and Torque

2.4.3. Speed

2.4.4. Characteristics.

2.5. Stepper motor:

2.5.1. Construction

2.5.2. Principle and mode of operation.

3. Fundamental of Electronics: 6hrs

3.1. Semi-conductor theory, doping, P & N type materials

3.2. PN Junction diode, potential barrier, forward and reverse bias

3.3. Use of PN Diode as rectifier

3.4. VI Characteristics

3.5. Rectifiers:

3.5.1. Half wave

3.5.2. Full wave

3.5.3. Bridge

3.5.4. Zener Diode- characteristics

3.6. Optoelectronic devices

3.7. BJT – characteristics and configurations

3.8. Transistor as a Switch

3.9. Junction Field Effect Transistors - operation and characteristics

3.10. Thyristor – Operation and characteristics

3.11. Fundamentals of DIAC and TRIAC.555 Timer, Integrated circuits

3.12. Operational Amplifiers:

3.12.1. Inverting and Non-inverting amplifier

3.12.2. Instrumentation amplifiers.

4 Protection Devices And Electrical Safety: 4 hrs

4.1 Fuse and their types

4.2 Circuit breaker and their types

4.3 Relay and their types

4.4 Starter and their types

5 Measuring Instruments 4 hrs

5.1 (A) Basic Electrical measuring instruments

5.2 Ammeter, Voltmeter, Ohm meter, Multimeter, Watt meter Energy Meter and their connections

5.3 Use of multimeter

5.4 Use of megger

5.5 (B) DOMESTIC WIRING

5.6 Introduction to wiring and their types

6. BOOLEAN ALGEBRA. (04 Hours)

6.1 Boolean Expressions.

6.1.1 Boolean Expressions and Truth Tables.

6.1.2 Minterm Expressions, Sum of Products

6.1.3 Maxterm Expressions, Product of Sums.

6.1.4 Un-simplified Boolean Expression and Schematic Circuits

6.2 Logic Simplifications.

6.2.1 Boolean Simplification.

6.2.2 DeMorgan's Theorems.

6.2.3 Karnaugh Mapping

7. **NUMBER SYSTEM.** **2 hrs**

7.1. Conversion

7.1.1. Binary to Decimal.
7.1.2. Decimal to Binary.
7.1.3. Hexadecimal to Binary.
7.1.4. Binary to Hexadecimal.
7.1.5. Hexadecimal to Decimal.
7.1.6. Decimal to Hexadecimal.

8. LOGIC GATES. **4hrs**

8.1 Logic Gates.

8.1.1 Symbols, Circuits and functions of OR, AND, NOT, NAND, NOR Gates.

8.1.2 Truth Table and Boolean expression of each above mentioned Gates.

8.1.3 Creating Multiple Input Gates.

8.2 Duality of Logic Functions.

8.2.1 Using NOR Gates to emulate all Logic Functions.

8.2.2 Using NAND Gates to emulate all Logic Functions.

8.3 The Exclusive OR and Exclusive NOR Functions.

8.3.1 Symbols, Circuits and functions of XOR, XNOR Gates.

8.3.2 Truth Table and Boolean expression of both above mentioned Gates.

Total **36 hrs**

TEXT / REFERENCE BOOKS.

1. Bird J O — *Electrical and Electronic Principles and Technology, Second Edition* (Newnes, 2004) ISBN 0750665505
2. Bird J O — *Electrical Circuit Theory and Technology* (Newnes, 2004) ISBN 0750657847
3. Grob, Bernard, *Basic Electronics*, Eight Edition.
4. Floyd "Digital Fundamentals"

5. Edward Hughes. “Electrical and Electronic Technology”, 10th Edition, Pearson Education Asia, 2019.
6. David A. Bell, “Electronic Devices and Circuits”, 5th Edition, Oxford University Press, 2008.
7. AC & DC circuits B. Grob
8. Digital Electronics by Morse Moyno

MMAT-132 BASIC ELECTRICAL AND ELECTRONICS

INSTRUCTIONAL OBJECTIVES:

1. Introduction to Electrical Engineering:

1.1. Describe Current and Voltage sources

1.2. Describe Resistance

1.3. Explain Inductance and Capacitance

1.4. Describe Ohm’s law

1.5. Describe Kirchhoff’s law

1.6. Describe Energy and Power

1.7. Explain Series parallel combination of R, L, C components, Voltage Divider and Current Divider Rules

1.8. Explain Super position Theorem

1.9. Explain Network Analysis – Mesh and Node methods- Faraday’s Laws of Electro-magnetic Induction

1.10. Describe Magnetic Circuits

1.11. Describe Self and Mutual Inductance

1.12. Describe Generation of sinusoidal voltage

1.13. Describe Instantaneous, Average and effective values of periodic functions

1.14. Explain Phasor representation

1.15. Understanding to Introduction to 3-phase systems, Introduction to electric grids.

2. Electrical Machines:

2.1. Explain DC Motor in terms of following given below:

2.1.1. Construction

2.1.2. Principle of operation

2.1.3. Different types of DC motors

2.1.4. Voltage equation of a motor

2.1.5. Significance of back EMF

2.1.6. Speed and Torque

2.1.7. Torque-Speed characteristics

2.1.8. Output Power

2.1.9. Efficiency and applications.

2.2. Describe Single Phase Transformer in terms of following given below:

2.2.1. Construction

2.2.2. Principle of operation

2.2.3. EMF Equation

2.2.4. Regulation and Efficiency of a Transformer

2.3. Explain Induction Machine in terms of following given below:

2.3.1. Three Phase Induction Motor:

2.3.2. Construction and Principle of Operation

2.3.3. Slip and Torque

2.3.4. Speed

2.3.5. Characteristics.

2.4. Describe Stepper motor in terms of following given below:

2.4.1. Construction

2.4.2. Principle and mode of operation.

3. Fundamental of Electronics:

3.1. Explain the concept of Semi-conductor theory, doping, P & N type materials

3.2. Describe the following:

3.2.1. PN Junction diode

3.2.2. potential barrier

3.2.3. forward and reverse bias

3.3. Explain the use of PN Diode as rectifier

3.4. Describe its VI Characteristics

3.5. Describe Rectifiers in terms of following given below:

3.5.1. Half wave

3.5.2. Full wave

3.5.3. Bridge

3.5.4. Zener Diode- characteristics

3.6. Explain Optoelectronic devices

3.7. Describe BJT – characteristics and configurations

3.8. Describe Transistor as a Switch

3.9. Explain Junction Field Effect Transistors - operation and characteristics

3.10. Describe Thyristor – Operation and characteristics

3.11. Fundamentals of DIAC and TRIAC.555 Timer, Integrated circuits

3.12. Explain Operational Amplifiers in terms of following given below:

3.12.1. Inverting and Non-inverting amplifier

3.12.2. Instrumentation amplifiers.

4 UNDERSTAND PROTECTION DEVICES AND ELECTRICAL SAFETY

4.1 Define Fuse and its current rating, fusing factor, Types of fuses, Re-wirable and HRC

4.2 Explain working of circuit breaker, Types of C.B, High power circuit breaker and their types, Domestic Circuit breakers

4.3 Difference between MCB and MCCB, Types of MCB w.r.t. poles

4.4 Define relay and explain its working

4.5 State types of relays w.r.t working

4.6 Describe starter and its types

4.7 Explain the working of following starter, 3Point, 4Point and star delta starter and soft starter)

4.8 Understand personal safety while working on electricity)

5 INSTRUMENTS AND BASIC WIRING

5.1 Define instrument and their types, Use of instruments and their connections)

5.2 Define secondary analog digital and working effect

5.3 Explain types of meters, there uses and connection in a circuit , Ammeter, Voltmeter, Ohm meter, Multimeter, Watt meter and Energy Meter

5.4 Define electric wiring and enlist the accessories used in Domestic wiring

5.5 Describe batten wiring, conduit PVC, and casing capping wiring, advantages and disadvantages of each.

6 BOOLEAN ALGEBRA

6.1 Use Boolean Expressions.

6.1.1 Use Boolean Expressions and Truth Tables
6.1.2 Use Minterm Expressions, Sum of Products
6.1.3 Use Maxterm Expressions, Product of Sums.
6.1.4 Describe Un-simplified Boolean Expression & develop Schematic Circuits

6.2 Apply Logic Simplifications.

6.2.1 Use Boolean Simplification.
6.2.2 Use DeMorgan's Theorems.
6.2.3 Use Karnaugh Mapping

7. NUMBER SYSTEM.

7.2 Convert one number system to another system

7.3 Convert Binary numbers into Decimal numbers.

7.4 Convert Decimal numbers into Binary numbers.

7.5 Convert Hexadecimal numbers into Binary numbers.

7.6 Convert Binary numbers into Hexadecimal numbers.

7.7 Convert Hexadecimal numbers into Decimal numbers.

7.8 Convert Decimal numbers into Hexadecimal numbers.

7. LOGIC GATES.

7.1 Explain Logic Gates.

7.2 Draw Symbols of OR gate.

7.2.1 Draw Circuit of two input OR gate.

7.2.2 Discuss function of OR gate.

7.2.3 Describe Truth Table of OR gate.

7.2.4 Describe Boolean expression for OR gate.

7.3 Repeat instructional objectives no. 11.1.1 to 11.1.5 for AND gate.

7.4 Repeat instructional objectives no. 11.1.1 to 11.1.5 for NOT circuit.

7.5 Repeat instructional objectives no. 11.1.1 to 11.1.5 for NOR gate.

7.6 Repeat instructional objectives no. 11.1.1 to 11.1.5 for NAND gate.

7.7 Create Multiple Input Gates.

7.8 Describe duality of Logic Functions.

7.8.1 Use NOR Gates to emulate all Logic Functions.

7.8.2 Use NAND Gates to emulate all Logic Functions.

7.8.3 Understand Exclusive OR and Exclusive NOR Functions.

7.9 Draw Symbols of XOR gate.

7.9.1 Draw Circuit of two input XOR gate.

7.9.2 Discuss function of XOR gate.

7.9.3 Describe Truth Table of XOR gate.

7.9.4 Describe Boolean expression for XOR gate.

7.9.5 Repeat instructional objectives no. 11.1.1 to 11.1.5 for XNOR gate.

MMAT-132 BASIC ELECTRICAL AND ELECTRONICS

List of practicals **96 Hours**

1. Study of electrical measuring instruments, handling precautions, methods of connection.
2. Verification of Ohm law.
3. Verification of laws of combination of resistances.
4. Measurement of power by volt-ammeter and wattmeter.
5. Measurement of energy.
6. Study of thermal and magnetic relays/contractors.
7. Study of magnetic fields due to current carrying conductors, coils
8. Verification of Faradays laws of electromagnetic induction.
9. Verification of self and mutual induction.
10. Study of magnetic relays.
11. Study of A.C. and D.C. generators, voltage build-up-excitation. .
12. Study of transformers, determination of voltage ratio.
13. Starting single phase induction motors, reversal.

14. Starting three phase induction motors, reversal.

15. Connections of magnetic starters with motors.

16. Connections of 3-point (forward-stop-reverse) starters.

17. Study and connections of PN diodes as rectifiers.

18. Study connections and biasing of PNP and NPN transistors.

19. Determination of current and voltage gains of CE amplifier.

20. Study and connections of Zener diode as voltage regulator.

21. Study and connections of photodiode as light sensing device.

22. Study and connections of DIAC and TRIAC as switch circuits.

23. Study and connections of SCR as a power switch.

24. Study of phase control of SCR.

25. Draw the forward & reverse characteristics of a P.N. junction diode.

26. Assemble a half wave diode rectifier circuit and observe its input and out put waveforms.

27. Assemble a full wave diode rectifier circuit with center tab transformer and observe its input and output waveforms.

28. Assemble a full wave bridge rectifier circuit and observe its input and out put waveforms.

29. Demonstrate the working of diode as a switch with LED as a load.

30. Assemble two inputs OR gate with the help of discrete components and verify its logic operation.

31. Assemble two inputs AND gate with the help of discrete components and verify its logic operation.

32. Verify its operation. NOT, OR and AND IC Gates.

33. Verify the operation of NAND gate.

34. Verify the operation of NOR gate.

35. Use NOR and NAND gates to emulate all logic functions.

36. Assemble XOR gate and verify its operation.

37. Assemble XNOR gate and verify its operation.

MMAT-141 AUTOMATION IN MANUFACTURING

	T	P	C
Total contact hours:	1	0	1

Theory: 32 Hours

Pre-requisite: none

AIMS: After studying the subject the student will be able to:

- To impart the basic knowledge in automation of industrial manufacturing processes.
- To learn the different automated flow lines in manufacturing industries.
- To explore the material handling and part identification techniques.
- To learn about control system, assembly system and testing in modern manufacturing industries.

CONTENTS

1.) INTRODUCTION TO MANUFACTURING AND AUTOMATION 6 hrs

1.1 Manufacturing and Automation

1.2 Production systems

1.3 Automation in production systems

1.4 Automation principles and strategies

1.5 Manufacturing operations

1.6 Production facilities

1.7 Basic elements of an automated system

1.8 Levels of automation

2.) **MATERIAL HANDLING AND IDENTIFICATION TECHNOLOGIES 6 hrs**

2.1 The material handling function,

2.2 Types of Material handling equipment,

2.3 Analysis for Material Handling Systems

2.4 Basic components for Design of the System,

2.5 Types of Automated storage systems, AS/RS,

2.6 Automated Storage/Retrieval Systems and Work-in-process Storage

2.7 Interfacing Handling and Storage with Manufacturing

2.8 Automatic identification systems Barcode and RFID

3. MANUFACTURING SYSTEMS AND AUTOMATED PRODUCTION LINES 6hrs

3.1 Manufacturing systems

3.2 Components of a manufacturing system

3.3 Single station manufacturing cells

3.4 Manual Assembly lines

3.5 Mixed model Assembly lines

3.6 Alternative Assembly systems

3.7 Automated production lines & Applications

3.8 Analysis of transfer lines

4.) AUTOMATED ASSEMBLY SYSTEMS: 6hrs

4.1 Fundamental Design for Automated Assembly

4.2 Types of Automated Assembly Systems

4.3 Part Feeding Devices

4.4 Analysis of Multi-station Assembly Machines,

4.5 Analysis of a Single Station Assembly Machine.

4.6 Cellular manufacturing,

4.7 Inspection and testing,

5.) QUALITY CONTROL AND TESTING 8hrs

5.1 Quality in Design and manufacturing

5.2 inspection principles and strategies

5.3 Automated inspection and testing

5.4 Statistical Quality Control

5.5 Automated Inspection Principles and Methods

5.6 Sensor Technologies for Automated Inspection

5.7 Coordinate Measuring Machines

5.8 Contact Inspection Methods,

5.9 Machine Vision

5.10 Optical Inspection Methods.

Total 32 hrs

REFERENCES/TEXT BOOKS

1. Automation, production systems and computer integrated manufacturing/ Mikell.P Groover/PHI/3rd edition/2012,

2. System Approach to Computer Integrated Design and Manufacturing/ Singh/John Wiley /96.

3. Computer Aided Manufacturing/Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang/ Pearson/ 2009

4. Manufacturing and Automation Technology / R Thomas Wright and Michael Berkeihiser / Good Heart/Willcox Publishers

5. Tiess Chiu Chang & Richard A. Wysk, "An Introduction to Automated Process Planning Systems". Prentice-Hall, 1985.

6. Viswanandham N & Narahari Y, Performance Modeling of Automated Manufacturing

Systems, PHI, 1st Edition, 2009.

WEB RESOURCES:

1. https://nptel.ac.in/content/storage2/courses/108105063/pdf/L-01(SM)(IA&C)%20((EE)NPTEL).pdf

MMAT-141 AUTOMATION IN MANUFACTURING

Instructional Objectives:

1. Understanding the basics of automation and analyze the cost effective of automated system

2. identify the suitable flow lines and understand the computer simulation for the automation of given application

3. Describe material handling and relevant technologies for the automation

4. Differentiate various control aspects of automation.

5. Demonstrate the automation for assembly line and testing of manufacturing industry

1. UNDERSANDING TO MANUFACTURING AND AUTOMATION

1.1 Define the Manufacturing and Automation technology

1.2 Explain the Production systems and its types

1.3 Uses of Automation in production systems

1.4 Understand the Automation principles and strategies

1.5 What are manufacturing operations?

1.6 Explain the Production facilities

1.7 Define Basic elements of an automated system

1.8 Describe the Levels of automation

2.) MATERIAL HANDLING AND IDENTIFICATION TECHNOLOGIES

2.1 Describe the material handling function

2.2 Differentiate the Types of Material handling equipment

2.3 Analysis for Material Handling Systems

2.4 Explain the Basic components for Design of the System,

2.5 Understand the Types of Automated storage systems, AS/RS,

2.6 Define the Automated Storage/Retrieval Systems and Work-in-process Storage

2.7 Explain the Interfacing Handling and Storage with Manufacturing

2.8 Describe in detail the Automatic identification systems Barcode and RFID.

3.) MANUFACTURING SYSTEMS AND AUTOMATED PRODUCTION LINES

3.1 Explain Manufacturing systems

3.2 Describe the Components of a manufacturing system

3.3 What are Single station manufacturing cells?

3.4 Define Manual Assembly lines

3.5 Differentiate mixed model Assembly lines

3.6 Describe Alternative Assembly systems

3.7 What are the automated production lines & Applications?

3.8 Analysis of transfer lines

4.) AUTOMATED ASSEMBLY SYSTEMS:

4.1 To understand the Fundamental Design for Automated Assembly

4.2 Differentiate the Types of Automated Assembly Systems

4.3 Understanding of Part Feeding Devices

4.4 Analysis of Multi-station Assembly Machines

4.5 Analysis of a Single Station Assembly Machine

4.6 Explain Cellular manufacturing

4.7 Define and explain the Inspection and testing in manufacturing process

5.) QUALITY CONTROL AND TESTING

5.1. Explain Quality in Design and manufacturing

5.2. Describe the inspection principles and strategies

5.3. Define automated inspection and testing

5.4. What is Statistical Quality Control System?

5.5. Understanding of Automated Inspection Principles and Methods

5.6. Elaborate the Sensor Technologies for Automated Inspection

5.7. Use of Coordinate Measuring Machines for quality assurance

5.8. Describe the Contact Inspection Methods

5.9. What is Machine Vision?

5.10. Explain the Optical Inspection Methods in detail

Mech-151 OCCUPATIONAL HEALTH, SAFETY AND ENVIRONMENT

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

Pre-requisites: None

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

1. Adopt safety standards, codes, rules, etc., to be desired in Mechanical Workshop / Labs of Industries.
2. Understand methods of prevention of accident.
3. Provide first aid and rescue in case of any accident.

Course Contents:

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

Detail of Contents:

1. Introduction and Importance of Safety 1Hr

1.1 Introduction to safety and House keeping

1.2 Importance in Institute workshops /labs

1.3	Importance in industry	
1.4	Accident cost	
2.	**Accidents in Chemical Industry**	**2 Hrs**
2.1	Accidents in petroleum, paint and fertilizer industry	
2.2	Explosive vapors and gases	
3.	**Accidents in Mechanical Industry**	**3 Hrs**
3.1	Due to material handling and transportation	
3.2	Accidents due to hand tools	
3.3	Accidents in machines shop	
3.4	Accidents in Metal workshop	
3.5	Accidents in wood working shop	
3.6	Accidents in foundry, welding and forging shop	
3.7	Safety in CNC machines operation	
4.	**Accidents in Flow Production Industry**	**2 Hrs**
4.1	Accidents in textile mills, paper mills & food Industries	
5.	**Accidents in other Industries**	**2Hrs**
5.1	Accidents in mines	
5.2	Accidents in leather industries	
5.3	Accidents in power plant	
6.	**Electric shocks & Earthling (Prevention and its remedy)**	**2Hrs**
6.1	Electricity as danger	
6.2	Electric shock phenomena	
6.3	Reasons of electric shock	
6.4	Prevention of electric shock	
6.5	First aid in electric shock	
7.	**Fire accidents and their prevention**	**3 Hrs**
7.1	Fire accidents and their prevention	
7.2	Fire hazard and their types	
	7.2.1 Causes of fire hazard	
7.3	Firefighting equipment, and fire extinguishers	

7.4 Plant lay out for fire safety

7.5 How to store flammable & hazardous materials

7.6 Disposal of flammable & hazardous materials

7.7 Fire Exercise with Rescue-1122

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

8.5 Implementation of 3S and 5S in Workplace

9. Personal Protective Equipment (PPE) **2 Hrs**

9.1 Useful protective device

9.2 Personal protective device and its importance

9.3 Protection from chemicals and gases

10. Environmental Safety **3 Hrs**

10.1 Environmental Safety

10.2 Industrial ventilation

10.3 Exhaust systems

10.4 Industrial noise

10.5 Illumination for safety and comfort

10.6 Industrial hygiene and plant sanitation

10.7 Thermal radiation

10.8 Waste Disposal, Dust and fumes, Over Crowding

10.9 The Artificial humidification

10.10 Drinking water

11. Pollution **2 Hrs**

11.1 Atmosphere

11.2 Water pollution

11.3 Solid waste management

12. First Aid **2 Hrs**

12.1 Importance

12.2 Procedure and training

12.3 Extended medical services

13. Analyzing Causes of Accidents 3 Hrs

13.1 Accident prevention fundamentals

13.2 Plant inspections and accidents investigation

13.3 Safety inventory, auditing, records and annual reports

14. Promoting Safety Culture 2 Hrs

14.1 Employees training culture

14.2 Displays

14.3 Guidance

14.4 Introduction to Sustainability

15. Safety Regulations & adherence to International Safety Standards 2Hrs

15.1 Safety Regulations & adherence to International Safety Standards

15.2 Pakistan Factory Act (laws concerning to safety)

15.3 Workman compensation act

15.4 Industrial insurance and social security

15.5 Legal aspects of safety

15.6 Introduction to NEBOSH & OSHA

Mech-151 OCCUPATIONAL HEALTH, SAFETY & ENVIRONMENT

Instructional Objectives:-

Note: (i) Practical's should be demonstrated during classes (Lectures) with the help of actual exercise, charts and video etc.

(ii) Safety lab should be established and the period should be conducted in the same lab

1. Know importance of safety practices and its necessity in the industry

1.1 Describe importance of housekeeping, Safety and accidents

1.2 Describe the importance of safety practices in Institute shops/labs

1.3 Describe the hazards for not observing safety

1.4 State necessity/importance of observing safety in the industry at the Cost of accident

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

2.1 State the type and causes of accidents in petroleum, fertilizer, plaint and chemical based industry

2.1.1 Enlist causes and preventions of chemical based industrial accidents

2.2 Describe accidental causes and effects of explosive gases and vapors

2.2.1 Describe toxic chemicals and their effects on human

2.2.2 List of preventions for accidental causes due to explosive gases and vapors

3. Know causes and prevention of accidents in mechanical industry

3.1 List of accidents in material handling and transportation in industry

3.1.1 Describe the methods of prevention of accident due to material and machine handling in manufacturing Industry

3.2 Explain proper use of hand tools to prevent accident

3.3 Describe accidents in machines shop

3.4 Describe accidents in Metal workshop

3.5 Describe accidents in wood working shop

3.6 Describe accidents in foundry, welding and forging shop

3.7 Describe Safety in CNC machines operation

4. Know causes and methods of prevention of accident in flow process industry

4.1 State the types of accident in flow process industry

4.1.1 List the accident in textile mills, paper and board mills and food industry

4.1.2 Describe the methods of prevention of accidents in above listed industries

5. Describe accidents and their remedy

5.1 Describe accidents in Mines

5.2 Describe accidents in Leather industries

5.3 Describe accidents in Power plant (Steam)

6. Electric shocks & Earthling (Prevention and its remedy)

6.1 Describe Electricity as danger

6.2 Describe Electric shock phenomena

6.3 Describe Reasons of electric shock

6.4 Describe Prevention of electric shock

6.5 Describe First aid in electric shock

7. Fire Accidents and their prevention

7.1 Describe prevention of fire accidents on plant

7.2 Know the causes of fire hazard

7.2.1 Identify fire hazard and their types

7.2.2 List the causes of accidents due to fire

7.3 Know Steps to control fire/fire fighting

7.3.1 Training of fire fighting with the help of Rescue 1122

7.3.2 Know the types of fire extinguishers and their use

7.4 Identify the fire safety points in plant layout

7.5 Describe how to store flammable & hazardous materials

7.6 Understand disposal of flammable & hazardous materials

7.7 Explain the steps of Fire Exercise with Rescue-1122

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 equipment by considering safety aspect

8.4 Explain the instructions use of electricity

8.5 Interpret Implementation of 3S and 5S in Workplace

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 equipment

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 spittns 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

14.4 Identify the factor & phenomenon of Sustainability

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

15.6 Understand the terms of NEBOSH & OSHA

Mech-173 ENGINEERING DRAWING & GRAPHICS

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

Pre-requisites : None

AIMS: At the end of this course the students will be able to understand the Fundamentals of Engineering Drawing used in the various fields of industry especially in the Mechanical Technology. The students will be familiarizing with the use of conventional drawing equipment as well as the modern techniques used for this subject.

Details of course contents:

(PART-A) BASIC ENGINEERING DRAWING (50%)

1. Introduction of Technical Drawing/Drafting 1Hr

1.1 Importance of Technical Drawing

1.2 Uses/Applications of Technical Drawing

1.3 Type of Drawing used in Engineering

2. Drafting Instruments and Accessories 2Hrs

2.1. Introduction and importance of drafting instruments

2.2. List of drawing Instruments

2.3. Construction, uses and care of all instruments and accessories

3. Lines and Symbols 2Hrs

3.1. Basic lines

3.2. Importance of lines and Symbols

3.3. Common Types (Alphabets) of lines

3.4. Common Symbols used in Industry

4. Lettering 1Hr

4.1. Importance of good lettering

4.2. General Proportion/ Composition of letters

4.3. Uses of Guide lines in Lettering

4.4. Classification of lettering

5. Drafting Geometry and Curves 4Hrs

5.1. Introduction to geometry, plane and solid type

5.2. Definition of terms

5.3. Basic geometric constructions

5.4. Introduction to engineering curve

5.5. Application of engineering curves

5.6. Cone and conic section

5.7. Geometrical Solid and its types

5.8. Geometrical Surfaces and its types

6. Freehand Sketching 1Hr

6.1. Introduction to sketching techniques

6.2. Sketching of basic lines and shapes

6.3. Sketching of pictorial drawings

7. Theory of Projections 4Hrs

7.1. Introduction to the plane and its types

7.2. Dihedral and Trihedral angles

7.3. Projection of point, lines, plane and solids

7.4. Perceptual views of plan of projections

7.5. Orthographic projections

7.6. 1st angle and 3rd angle projection

7.7. Principal views and its arrangements

7.8. Multi-view drawings and missing lines

8. Dimensioning 1Hr

8.1. Dimensioning and its types

8.2. Principles of Dimensioning

8.3. Methods of indicating Dimensions

(PART-B) ADVANCED ENGINEERING DRAWING (50%)

9. Introduction to Pictorial drawing 3Hrs

9.1. Uses of pictorial /3D Views

9.2. Classification of pictorial views

9.3. Isometric drawing and its types

9.4. Oblique drawing and its types

9.5. Perspective drawing and its types

10. Development and Intersection 3Hrs

10.1. Introduction and importance of development

10.2. Applications of development in industry

10.3. Methods to develop the surfaces

10.4. Frustum and truncation of solids

10.5. Introduction and importance of intersection

10.6. Applications of intersection in industry

10.7. Methods to develop the intersection

11. Sectioning 1Hr

11.1. Sectioning and its purposes

11.2. Cutting Plane, Section Lines

11.3. Type of sectional views

11.4. Parts not sectioned

11.5. Conventional Breaks

12. Fasteners and its Types 6Hrs

12.1. Fasteners and their types

12.2. Threads nomenclature

12.3. Screw Threads, their types

12.4. Rivet, Rivet heads

12.5. Riveted joints

12.6. Caulking and fullering in riveting

12.7. Key and its types

12.8. Cotters and its types

12.9. Bearing and its types

12.10. Shaft Coupling

12.11. Types of coupling

13. Working / Production Drawings 2Hrs

13.1. Working / production drawing

13.2. Types of production drawings

13.3. Importance of detail and assembly drawings

13.4. Title blocks

13.5. Essentials Requirements for making detail and assembly drawings

14. Study of Drawings standards (with related sheet example) 1Hr.

14.1 Japanese

14.2 Chinese

14.3 European

14.4 American

14.5 British

14.6 Standards

Recommended Textbooks:

1. Engg. Drawing By N.D Bhatt, 53rd Edition (2014)
2. A First year Engg. Drawing By A.C Parkinson; Pitman Publisher, Latest Edition
3. Mechanical Drawing (12th Addition) by French. Svensen, Helsel and Urbanick
4. Drafting Fundamentals by scot. Foy, Schwendan
5. Text Book of machine Drawing by R.K. Dhawan
6. Engineer Drawing by M.B. Shah (B.C.Rana)

Course objectives

(PART-A) BASIC ENGINEERING DRAWING (50%)

1. Introduction of Technical Drawing/Drafting

1.1 Describe the Importance of Technical Drawing

1.2 Explain the Uses/Applications of Technical Drawing

1.3 Describe the type of Drawing used in Engineering

2. Drafting Instruments and Accessories

2.1. State the Introduction and importance of drafting instruments

2.2. State a List of drawing Instruments

2.3. Explain construction, uses and care of all instruments and accessories

3. Lines and Symbols

3.1. Describe Basic lines

3.2. Explain the Importance of lines and Symbols

3.3. Describe Common Types (Alphabets) of lines

3.4. Explain Common Symbols used in Industry

4. Lettering

4.1. Describe the Importance of good lettering

4.2. Explain General Proportion/ Composition of letters

4.3. Explain Uses of Guide lines in Lettering

4.4. Describe Classification of lettering

5. Drafting Geometry and Curves

5.1. Describe the Introduction to geometry, plane and solid type

5.2. State the Definition of terms

5.3. State Basic geometric constructions

5.4. Describe Introduction to engineering curve

5.5. Describe Application of engineering curves

5.6. Define Cone and explain conic section

5.7. Describe Geometrical Solid and its types

5.8. Explain Geometrical Surfaces and its types

6. Freehand Sketching

6.1. Describe Introduction to sketching techniques

6.2. Explain Sketching of basic lines and shapes

6.3. Explain Sketching of pictorial drawings

7. Theory of Projections

7.1. Describe Introduction to the plane and state its types

7.2. Explain Dihedral and Trihedral angles

7.3. Explain Projection of point, lines, plane and solids

7.4. Explain Perceptual views of plan of projections

7.5. Explain Orthographic projections

7.6. Compare 1st angle and 3rd angle projection

7.7. State Principal views and its arrangements

7.8. Explain Multi-view drawings and missing lines

8. Dimensioning

8.1. Define Dimensioning and describe its types

8.2. Explain Principles of Dimensioning

8.3. Explained Methods of indicating Dimensions,

(PART-B) ADVANCED ENGINEERING DRAWING (50%)

9. Introduction to Pictorial drawing

9.1. Explain Uses of pictorial /3D Views

9.2. Explain the Classification of pictorial views

9.3. Describe Isometric drawing and its types

9.4. Describe Oblique drawing and its types

9.5. Describe Perspective drawing and its types

10. Development and Intersection

10.1. Describe Introduction and importance of development

10.2. Explain Applications of development in industry

10.3. Explain Methods to develop the surfaces

10.4. Distinguish Frustum and truncation of solids

10.5. Explain the Introduction and importance of intersection

10.6. Explain Applications of intersection in industry

10.7. Describe the Methods to develop the intersection

11. Sectioning

11.1. Define Sectioning and describe its purposes

11.2. State Cutting Plane, Section Lines

11.3. Explain type of sectional views

11.4. State Parts not sectioned

11.5. Describe Conventional Breaks

12. Fasteners and its Types

12.1. Describe Fasteners and their types

12.2. State Threads nomenclature

12.3. Describe Screw Threads, their types

12.4. Define Rivet, state Rivet heads

12.5. Explain Riveted joints

12.6. State Caulking and fullering process in riveting

12.7. Define Key and state its types

12.8. State Cotters and its types

12.9. Describe Bearing and its types

12.10. Describe Shaft Coupling

12.11. Explain Types of coupling

13. Working / Production Drawings

13.1. Explain Working / production drawing

13.2. Describe Types of production drawings

13.3. Explain Importance of detail and assembly drawings

13.4. State Title blocks

13.5. Explain Essentials Requirements for making detail and assembly drawings

14. Study of Drawings standards

14.1 Explain Japanese drawing standards.

14.2 Explain Chinese drawing standards.

14.3 Explain European drawing standards.

14.4 Explain American drawing standards.

14.5 Explain common Standards.

Mech-173 ENGINEERING DRAWING & GRAPHICS

Practical: 192Hrs

List of Practical

(PART-A) BASIC ENGINEERING DRAWING

1. Practice of single stroke capital **vertical** lettering on graph and drawing sheet
2. Practice of single stroke capital **Inclined** lettering on graph and drawing sheet

Practice of single stroke capital **vertical & Inclined** lettering on drawing sheet (Home Assignment)

3. Double stroke lettering on self developed graph.
4. Practice to draw horizontal, vertical and inclined lines (use of tee square and set squares)
5. Drawing of lines, centers, curves, and crossing of lines
6. Construction of angles and triangles
7. Construction of quadrilaterals and circles elements
8. Construction of parallel-lines, perpendiculars, bisects line, angles and equal division of lines
9. Different types of drawing lines
10. Plumbing and Piping Symbols.
11. Welding Symbols & Threads Symbols
12. Material Symbols and Conventional Breaks.
13. Construction of inscribe and circumscribe figures (square, triangle and hexagon)
14. Construction of Pentagon, Hexagon & Octagon, by general and different methods
15. Construction of Tangents of circles (Inside & Outside)
16. Construction of Ellipse by four different methods
17. Construction of Parabola and Hyperbola curves.
18. Construction of Archimedean spiral, cycloid & involute curve of square, circle.
19. Orthographic projection 1 and 3rd angle wooden block-1
20. Orthographic projection 1 and 3rd angle wooden block-2
21. Orthographic projection 1 and 3rd angle wooden block-3

(Part-B) ADVANCED ENGINEERING DRAWING

22. Orthographic projection and Isometric Drawing-I
23. Orthographic projection and Isometric Drawing-II
24. Orthographic projection and Oblique Drawing
25. Construction of perspective drawing. (One Point and Two Point)
26. Development of Right and Truncated Prisms (Square, Hexagon)
27. Development of Right Pyramids and Frustum & Truncated Pyramid (Square, Hexagon)
28. Development of right and oblique Cones (Frustum & Truncated)
29. Development of right and oblique Cylinders (Truncated)
30. Line of Intersection of Plane Surfaces (Two square prism)
31. Line of Intersection of curved surfaces (Two Cylinders Having unequal dia)
32. Nut & Bolt (Hex. & Square Type)
33. Threads forms and multiple threads, (Locking devices Home Assignment)
34. Lap Joints (Single & Double Riveted) Chain and Zigzag type
35. Butt Joints (Single & Double Riveted) Chain and Zigzag type Rivets head Home Assignment)
36. Sketching of Keys and Cotters
37. Bushed Bearing (Half Section)
38. Multi view drawing of Gland
39. Split Muff Coupling and Oldham coupling
40. Flanged Coupling and Hook's Coupling
41. Plummer Block (Details and Assembly)
42. Screw Jack (Details and Assembly)
43. Tail stock (Detail)-I & II
44. Tail Stock (Assembly)-I & ll

Practical Objective (Part-A)

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

1.1 Draw the Border Line and title strip

1.2 Construct the letters and numerals in correct shape and size using graph paper and drawing sheet

1.3 Develop skill to letter in proper sequence of strokes

1.4 Construct the letters and numerals in single stroke

1.5 Draw guidelines and maintain spacing between letters and numerals

2. Practice of single stroke capital Inclined lettering on graph and drawing sheet

2.1 Develop the skill for border line and title strip

2.2 Construct the letters and numerals in single stroke inclined at an angle of 67 ½ degree

2.3 Draw guideline (Horizontal and inclined) to maintain space between letters and numerals

Practice of single stroke capital vertical & Inclined lettering on Sheet (Home Assignment)

2.4 Draw the border line and title strip

2.5 Draw the parallel lines, vertical & inclined guide lines

2.6 Construct the vertical and inclined letters and numerals with correct shape and size

2.7 Develop skills to letters in proper sequence of stroke

3. Double stroke lettering on self developed graph.

3.1 Draw the border line and title strip

3.2 Draw the horizontal and vertical parallel lines

3.3 Use smoothly tee, set square and compass

3.4 Draw the curves, semi circles and inclined lines

3.5 Develop skill to double stroke letters in proper shape and size

3.6 Maintain the uniform thickness of letters and numerals

4. Practice to draw horizontal, vertical and inclined lines (use of tee square and set squares)

4.1 Draw the Horizontal and vertical lines

4.2 Draw the inclined lines at any angle.

4.3 Develop the skill to construct the figures having Horizontal, vertical and inclined lines

5. Drawing of lines, centers, curves, and crossing of lines

5.1 Develop the skill for border line and title strip

5.2 Draw the Horizontal, vertical and inclined lines

5.3 Develop the skill to construct the figures having circles, curves and different radius

6. Construction of angles and triangles

6.1 Draw the different angles

6.2 Draw the different triangles

7. Construction of quadrilateral's and circles elements

7.1 Draw different types of quadrilaterals and circle elements

7.2 Develop the skill to use of drawing instruments.

7.3 Identify the above said 2D-figures

8. Construction of parallel-lines, perpendiculars, bisects line, angles and equal division of lines

8.1 Draw the lines parallel lines, arcs

8.2 Bisect the lines, angles and arcs

8.3 Develop the skill to use of drawing instruments

9. Different types of drawing lines

9.1 Draw the alphabet of lines

9.2 Develop the proper line weight & shape.

10. Plumbing and Piping Symbols.

10.1 Draw the plumbing and piping symbols

10.2 Identify the Plumbing and Piping Symbols

11. Welding Symbols & Threads Symbols

11.1 Draw the welding and thread symbols

11.2 Identify the Welding and Thread Symbols

12. Material Symbols and Conventional Breaks.

12.1 Draw the material symbols and conventional breaks

12.2 Identify the Material Symbols & Conventional Breaks

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

13.1 Draw the inscribed square, triangle and hexagon

13.2 Draw the circumscribed square, triangle and hexagon

13.3 Develop the skill to use of drawing instruments

14. Construction of different Polygons, by general and different methods

14.1 Draw the polygon by general method 1

14.2 Draw the pentagon, Hexagon, Heptagon, Octagon etc. by the general method 2

14.3 Develop the skill to use of drawing instruments

15. Construction of Tangents of circles (Inside & Outside)

15.1 Draw the tangent of the circles internally and externally

15.2 Develop the skill to use of drawing instruments

16. Construction of Ellipse by four different methods

16.1 Develop the skill for border line and title strip

16.2 Construct the "Ellipse" by different method

17. Construction of Parabola Hyperbola and curves,

17.1 Develop the skill for border line and title strip

17.2 Construct the "Parabola" by different method

17.3 Construct the "Hyperbola" by different method

18. Construction of Archimedean spiral and cycloid curves & involute curve of square and circle.

18.1 Construct the spiral Curve & Involutes

18.2 Draw the skill to construct the Archimedean spiral curve

18.3 Understand and draw the cycloid curve

19. Orthographic projection 1st and 3rd angle wooden block-1

19.1 Placement of views properly

19.2 Draw the Orthographic views of simple block in first angle and third angle projection

19.3 Dimension the views

20. Orthographic projection 1st and 3rd angle wooden block-2

20.1 Draw the Orthographic views of step block in first angle and third angle projection

20.2 Dimension and placement of views properly

21. Orthographic projection 1st and 3rd angle wooden block-3

21.1 Draw the Orthographic views of given block in first angle and third angle projections

21.2 Understand the theory of first angle and third angle of projection

21.3 Understand the dimension on pictorial views

Practical Objective (Part-B)

22. Orthographic projection and Isometric Drawing-I

22.1 Visualize multi-view and constructions of isometric drawing

22.2 Understand the steps for constructing isometric drawing

22.3 Constructing isometric drawing of simple objects

23. Orthographic projection and Isometric Drawing-II

23.1 Visualize views and select suitable direction for construction of isometric drawings

23.2 Construct isometric drawing using learned steps in previous activity

23.3 Identify the steps for isometric circles using four center methods

23.4 Construct isometric circle in isometric drawings

24. Orthographic projection and Oblique Drawing

24.1 Visualize multi views for construction of oblique drawing

24.2 Understand the steps for constructing Oblique drawing

24.3 Constructing Oblique drawing of simple objects

25. Construction of perspective drawing. (One and Two Point)

25.1 Understand and draw one and two point perspective of a simple object.

25.2 Understand the Horizon, vanishing point, station point and picture plane

25.3 Understand and draw the projection lines for parallel perspective

26. Development of Right and Truncated Prisms (Square, Hexagon)

26.1 Identify prism and its terminology

26.2 Draw development of prism (Square Hexagon)

26.3 Apply the procedure of parallel line development

27. Development of Right, Frustum & Truncated Pyramids (Square, Hexagon)

27.1 Identify the terminology of pyramid

27.2 Construct true length diagram

27.3 Develop the layout of right pyramids

28. Development of right and oblique Cone (Frustum & Truncated)

28.1 Identify the terminology of right cone

28.2 Develop the lateral surface of the cone (Right & Oblige)

29. Development of right and oblique Cylinder (Truncated)

29.1 Identify cylinder and its terminology

29.2 Develop the surface of cylinder (Right Oblige)

30. Line of Intersection of Plane Surfaces (Two Square Prism)

30.1 Draw the intersection of plane surfaces like prism & pyramid

30.2 Generate the line of Intersection

31. Line of Intersection of curved surfaces (Two cylinders having unequal Dia)

31.1 Draw the development of curve surfaces like cylinder and cone

31.2 Generate the curved of Intersection

32. Nut & Bolt (Hex. & Square Type)

32.1 Draw the three views of Hexagonal and Square nuts

32.2 Draw the three views of Hexagonal and Square bolts

33. Threads forms and multiple threads (Locking devices Home Assignment)

33.1 Draw the different forms of thread

33.2 Develop skills to draw the vee and square multiple threads

34. Lap Joints (Single & Double Riveted) Chain and Zigzag type

34.1 Identify and draw the Rivet Heads with their proportions

34.2 Draw the views of single Riveted and double Riveted Lap joint (Chain and Zigzag type)

35. Butt Joints (Single & Double Riveted) Chain and Zigzag type, Rivets head (Home Assignment

35.1 Draw the views of Butt joint in single and double Riveted Shape (Chain and Zigzag type)

35.2 Identify the type of Joints

36. Sketching of keys and cotters

36.1 Develop the skill to sketch the different types of keys and cotters

36.2 Identify the keys & cotters types.

37. Bushed Bearing (Full Section)

37.1 Draw the Full sectional, Front, Side and Top view of Bushed bearing assembly

37.2 Identify the parts and their material

38. Construction of Multi view drawing of Gland (Half Section)

38.1 Draw the Half sectional, Front, Side and Top view of gland

38.2 Draw the three views of the gland

39. Plummer Block (Detail)(Full Section)

39.1 Know the various parts of Plummer block

39.2 Draw the detail of Plummer Block

39.3 Draw the assembly of Plummer Block in full sections

40. Split Muff Coupling and Oldham coupling

40.1 Draw the views of Split Muff Coupling

40.2 Develop the skill to draw the detail and assembly of Old Hum Coupling

40.3 Develop the skill to dimension the views accordingly.

41. Flanged Coupling and Hook's Coupling

41.1 Draw the views of Flanged Coupling (Protective and non-protective type)

41.2 Draw the detail views of Hooks Coupling parts

42. Screw Jack (Details and Assembly)

42.1 Know and draw the parts detail of Screw Jack

42.2 Draw the assembly drawing of Screw Jack

42.3 Identify the parts of Screw Jack

43. Tail stock (Detail)

43.1 Develop the skill to draw the views of Tail Stock parts

43.2 Identify the parts of Tail Stock

43.3 Dimension the parts

44. Tail Stock (Assembly)

44.1 Draw the assembly of Tail stock in full section showing its parts

44.2 Draw the assembly of various parts

44.3 Identify the material of various parts of Tail Stock

Phy-212 APPLIED MECHANICS

T	P	C
1	3	2

Total Contact Hours
Theory 32 Hours
Practical 96 Hours

AIMS

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

COURSE CONTENTS

1. MEASUREMENTS 4 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 2hours
   - 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: 4 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:

- 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 Moduli of Elasticity
- 11.2 Loaded Beams, Types of Beam & Loads
- 11.3 Bending Stress
- 11.4 S.F & B.M diagram
- 11.5 Torsion and Torsional Stresses

12. Simple Mechanism

- 12.1 Introduction
- 12.2 Kinematic link or element
- 12.3 Kinematic pair and types
- 12.4 Kinematic chains and type

13. Velocityin 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

BOOKS RECOMMENDED:

1.A Text Book of Applied Mechanics (Mech-212) of TEVTA, published by National Book Foundation

2.Applied Mechanics by R.S. Khurmi

Phy. 212 APPLIED MECHANICS

INSTRUCTIONAL OBJECTIVES

1. USE THE CONCEPTS OF MEASUREMENT IN PRACTICAL SITUATIONS/PROBLEMS

1.1 Explain Dimensional formula

1.2 Explain systems of measurement

1.3 Use concept of significant figures and degree of accuracy to solve problems

2. USE THE CONCEPT OF ADDITION AND RESOLUTION OF VECTORS TO PROBLEMS ON EQUILIBRIUM INVOLVING CONCURRENT FORCES

2.1 Describe concurrent forces

2.2 Explain resolution of vectors

2.3 Use the analytical method of addition of vectors for solving problems.

2.4 Use the graphical method of addition of vectors for solving problems.

2.5 Solve problems on forces with emphasis on roof trusses, cranes simple frames and framed structures.

3. USE THE PRINCIPLE OF MOMENTS AND CONCEPT OF COUPLE TO SOLVE PROBLEMS.

3.1 Describe the principle of moments.

3.2 Use the principle of moments to solve problems on compound levers, safety valve, steel-yard.

3.3 Describe couple and torque.

3.4 Use the concept to solve problems on torque.

4. USE THE LAWS OF TOTAL EQUILIBRIUM OF FORCES TO SOLVE PROBLEMS INVOLVING FORCES IN EQUILIBRIUM.

4.1 Distinguish between concurrent and non-concurrent forces.

4.2 Prepare a free body diagram of an object or a structure.

4.3 Explain Varignon’s theorem

4.4 Explain second condition of equilibrium

4.5 Use laws of total equilibrium to solve problems on forces involving framed structure and ladders.

5. USE CONCEPTS OF MOMENT OF INERTIA TO PRACTICAL SITUATIONS AND PROBLEMS.

5.1 Explain moment of inertia.

5.2 Explain the theorems of Parallel and perpendicular Axis.

5.3 Describe the M.I. of regular bodies

5.4 Explain M.I. of Fly wheel

5.5 Explain Energy stored by Fly Wheel

5.6 Use these concepts to solve simple problems.

6. UNDERSTAND THE CONCEPTS AND LAWS OF SOLID AND FLUID FRICTION.

6.1 Define Coefficient of friction between a body placed on an inclined plane and the surface.

6.2 Explain motion of a body placed on an inclined plane

6.3 Calculate the force needed to move a body up and down an inclined plane.

6.4 Explain rolling friction and use of ball bearings.

6.5 Describe fluid friction and Stoke's law.

7. UNDERSTAND WORK, ENERGY AND POWER.

7.1 Derive work-energy relationship

7.2 Use formulae for work done by a variable force to solve problems.

7.3 Explain Power, I.H.P, B.H.P and efficiency.

7.4 Describe dynamometers.

7.5 Lise 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 8.3Understand transmission of power through ropes and belts

8.4 Write formula for power transmitted through ropes and belts

8.5 Describe transmission of power through friction gears and write formula

8.6 Describe transmission of power through chains and toothed wheels/gears

8.7 Use the formula to solve/problem on transmission of power

8.8 Describe types and functions of clutches with applications

9. USE THE CONCEPTS OF MACHINES TO PRACTICAL SITUATIONS.

9.1 Explain theoretical, actual mechanical advantage and efficiency of simple machines.

9.2 Use the concept to calculate efficiency of an inclined plane.

9.3 Describe reversibility of machines.

9.4 Calculate the efficiency of:

i. Single purchase crab.

ii. Double purchase crab.

iii. Worm and worm wheel.

iv. Differential screw jack, Diff. Pulley, Wheel and Axle.

9.5 Use the formulae to solve the problems involving efficiency, M.A of the above machines.

10. USE THE CONCEPTS OF VIBRATORY MOTION TO PRACTICAL SITUATIONS.

10.1 Define vibratory motion giving examples.

10.2 Describe circular motion and its projection on diameter of the circular path.

10.3 Relate rotatory motion to simple vibratory motion.

10.4 State examples of conversion of rotatory motion to vibratory motion and vice versa.

10.5 Derive formulae for position, velocity and acceleration of a body executing SSH.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 moduli of elasticity.

11.2 Describe types of beams and loads.

11.3 Explain shearing force and bending moment.

11.4 Use these concepts to calculate S.F and B.M in a given practical situation for point loads, uniformly distributed loads.

11.5 Prepare S.F and B.M diagram for loaded cantilever and simply supported beams.

11.6 Describe torsion and 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 PRACTICAL

1. Find the weight of the given body using Law is theorem.
2. Find unknown forces in a given set of concurrent forces in equilibrium using Grave-sands apparatus
3. Set a jib crane and analyze forces in its members
4. Set a Derrick Crane and analyze forces in its members
5. Study forces shared by each member of a Toggle Joint
6. Set a Roof Truss and find forces in its members
7. Verify Principle of Moments in a compound lever
8. Calibrate a steelyard
9. Find the Reactions at the ends of a loaded beam
10. Use reaction of beams apparatus to study resultant of parallel forces
10. Find the Moment of Inertia of a Flywheel
11. Find the angle of reaction for a wooden block placed on an inclined plane
12. Find the B.H.P. of a motor
13. Find M.A. and Efficiency of worm and worm wheel
14. Study the transmission of power through friction gears
15. Study the transmission of power through belts
16. Study the transmission of power through toothed wheels
17. Study the function of clutches
18. Find M.A. and efficiency of differential wheel and axle
19. Find the efficiency of a screw
20. Find the efficiency of a differential pulley
21. Verify Hooke's Law using Helical Spring
22. Study conversion of rotatory motion to S.H.M using S.H.M Model/apparatus
23. Study conversion of rotatory motion to vibratory motion of piston in a cylinder
24. Study the reciprocating motion

25. Study the working of cams

26. Study the quick return motion

27. Compare the Elastic constants of the given wires

28. Verify Hooke's Law using Helical Spring

29. Find the coefficient of Rigidity of a wire using Maxewell's needle

30. Find the coefficient of rigidity ofa round bar using torsion apparatus

31. Find the coefficient of Rigidity of a rectangular bar using Deflection of Beam Apparatus

32. Determine S.F. and B.M. in a loaded canti-lever (Point Loads)

33. Determine S.F. and B.M. in a simply supported Beam (Point Loads)

34. Determine S.F. and B.M. in a simply supported Beam (Point loads and uniformly distributed load)

35. Determine S.F. and B.M. in a simply supported Beam (Point loads a uniformly distributed)

36. Study working and function of link mechanism of different types

GenC-212 Chinese Language-II

Total contact hours

Theory 64

T P C

Practical 0

2 0 2

AIMS There are 20 lessons (including 4-unit reviews) in this course. It is recommended to complete 8 lessons and the unit reviews in 32 class hours. After completing this course, students can master the advanced-basic Chinese language knowledge in the content of the course, and be able to reach and exceed **HSK level THREE**.

COURSE CONTENTS

Lesson 1 Pickup international students at the airport 3 hours

This lesson introduces grammatical knowledge such as "flexible use of interrogative pronouns" and "basic forms of clutch words", which requires students to use sequential words correctly and understand the contextual meaning of some special words.

1. Lesson 2 What would you like to drink 3 hours

This lesson introduces the rhetorical question form "can…?" and the related words "not only… but also...", and learn to express your needs correctly in communication.

2. Lesson 3 I'm kidding you 4 hours

This lesson explains the fixed structures "more and more", "more A, more B", etc., and understands how to praise in Chinese and how to deal with others' praise.

3. Lesson 4 I like winter best 4 hours

Through the description of weather, students can learn the usage of adverbs such as "often" and "always", which express frequency, and compare and describe similar phenomena.

UNIT REVIEW 1 (INCLUDING TESTS) 2 hours

Summarize the contents of Lesson 1-4, review key words and grammar knowledge, and help learners really consolidate their mastery. There are tests designed, which can detect what has been learned before, so as to check for leaks and fill gaps.

4. Lesson 5 I caught a cold 3 hours

This lesson learns the basic usage of "active" sentence, understands the expressions related to illness and medical treatment, and learns the language communication in hospital scenes.

5. Lesson 6 You are really careless 3 hours

Learn and summarize the usage of simple directional complements "V come" and "V leave", and master the basic expression of request and evaluation functions in daily communication.

6. Lesson 7 English black tea is healthy and delicious 4 hours

Understand how to express approximate numbers in Chinese, how to persuade others and how to express their basic attitude.

7. Lesson 8 I'm not a shopaholic 4 hours

This lesson is related to online shopping. Learn the expression "A is A, that is" and learn how to express your views from different angles.

UNIT REVIEW 2 (INCLUDING TESTS) 2 hours

This section leads students to review the knowledge points they have learned in the past, and conduct mid-term tests to test students' learning effect.

8. Lesson 9 Why did grandparents move 3 hours
This lesson introduces a life event related to "moving house", the expression of learning conditions and the extended meaning of directional complement through events.

9. Lesson 10 Eat hot pot for the first time 3 hours
This lesson introduces the way of having dinner in China through "hot pot" and some basic situations of Chinese restaurants, so as to help learners get a preliminary understanding of Chinese dining customs.

10.Lesson 11 Teacher Wang is going to change the house 4 hours
This lesson is related to "housing" in "food, clothing, housing and transportation". While understanding the story, students can learn language knowledge such as hypothetical relationship and overlapping of disyllabic verbs.

11.Lesson 12 Single Li Wenchao 4 hours
This lesson introduces emotional problems, learn about young people's concepts of marriage and love, and learn how to compare them in Chinese.

UNIT REVIEW 3 (INCLUDING TESTS) 2 hours

Review the previous knowledge, students answer questions through the platform, check the learning situation, and help teachers and students analyze their learning situation.

12.Lesson 13 This is her new home 3 hours
This lesson introduces the living conditions of young people at present, and understands how to describe the living environment, learn the Chinese expression of concepts such as location and existence.

13.Lesson 14 Allen's weekend 3 hours
This lesson introduces school life, understand the sentence structure expressing complete negation, and summarize the usage of three auxiliary words "adjective", "adverb" and "should".

14.Lesson 15 Fall in love with public square dancing 4 hours
By introducing the living conditions of the elderly in China, students can learn Chinese comparative structure, enumerating relations and various usages of complements.

15.Lesson 16 Taste English afternoon tea 4 hours
This lesson introduces grammatical knowledge such as "passive" sentence and "adjective reduplication". Through the study of this lesson, students can understand the dining habits of restaurant ordering and national dishes.

UNIT REVIEW 4 (INCLUDING TESTS) 2 hours

This section is a review test class, leading students to review the knowledge points learned in the past for final tests to test students' learning effect.

INSTRUCTIONAL OBJECTIVES:-

Through this course, learners can systematically learn the language knowledge at this stage and cope with general communication, and can communicate on familiar topics and meet the basic communication needs of daily life and study, and gradually understand and be familiar with Chinese communication etiquette, cultural customs, etc.

Recommended Book

Tang Chinese Course- 3

MgmC-212 Understanding China

Course Code: **MgmC-212** **T P C**

Course Name: Understanding China **2 0 2**

A course about understanding Chinese culture and introducing China's national conditions. It aims to enable international students in China to better understand China, learn Chinese language and culture, enhance understanding of different cultures, and learn about China's geographical history, philosophy, religion, political economy, etc. It covers Chinese geography and history, philosophy and religion, politics and economy, literature and art, science and technology education, medicine, and sports, etc.

Course Objectives

At the end of the course, the students are expected to be able to:

- Master the basic overview of China
- Enhance knowledge of Chinese language
- Broaden horizon
- Learn the integration and communication between different cultures

COURSE OUTLINE

COURSE CONTENTS	**Hours**
1. Geography	**4**
1.1 China from the perspective of the world	
1.2 China's natural environment	
1.3 China's mountains and rivers (1)	
1.4 China's mountains and rivers (2)	
1.5 City Highlight - Beijing	
1.6 City Highlight - Shanghai	
1.7 City Highlight - Hongkong	
1.8 Natural Landscape (1) Five Mountains, Jiuzhaigou Valley and Zhangjiajie	
1.9 Natural Landscape (2) Xinjiang	
1.10 Natural Landscape (3) Tibet	

1.11 Cultural Tour

2. History **8**

2.1 Chinese Ancestors

2.2 Emperor Qin Shihuang

2.3 Emperor Wu in Han Dynasty

2.4 Silk Road in Western Han Dynasty

2.5 Prosperous Period of Tang Dynasty

2.6 Riverside Scene at Qingming Festival

2.7 Genghis Khan and Kublai Khan

2.8 Ming Taizu (the First Emperor of the Ming Dynasty)

2.9 The Great Voyages of Zheng He

2.10 Prosperous Period of Qing dynasty (from Kangxi to Qianlong)

2.11 Opium War

2.12 Sun Yat-sen and Kuomintang

2.13 The Communist Party of China (CPC)

2.14 Mukden Incident (9.18 Incident)

2.15 Mao Zedong and the Founding of the PRC

2.16 Diplomatic Relations of the PRC

2.17 Deng Xiaoping and Reform and Opening-up

2.18 New Era of Socialism with Chinese Characteristics

3. Philosophy **4**

3.1 The representative figure of Confucianism - Confucius

3.2 The representative figure of Confucianism - Mencius

3.3 The core concept of Confucianism - ritual

3.4 The core concept of Confucianism - benevolence and benevolent governance

3.5 The core concept of Confucianism - Taoism, reason, and knowledge acquirement by investigation

3.6 Taoism - Lao Tzu’s Tao and inaction

3.7 Taoism - Chuang Tzu’s equality of things and unfettered

3.8 Other schools of thought - Legalism

3.9 Other schools of thought - Military Strategist

4. Religion **4**

4.1 Folk Beliefs and Ancestor Worship

4.2 Taoism

4.3 Buddhism in China

4.4 Buddhist Doctrine, Zen, and Buddhist scenic spots

4.5 Other Religions and China's Religious Policies

5. National Governance **4**

5.1 National Flag, National Anthem, and National Emblem

5.2 Administrative divisions

5.3 National Institutions (1)

5.4 National Institutions (2)

5.5 Political Parties (1)

5.6 Political Parties (2)

5.7 Foreign policy

6. Literature and Art **4**

6.1 Stages and Genres of Chinese literature

6.2 Pre-Qin Literature

6.3 Tang Poetry

6.4 Song Ci

6.5 Four Great Classical Novels

6.6 Modern Chinese Contemporary Literature (1)

6.7 Modern Chinese Contemporary Literature (2)

6.8 Chinese Opera (1)

6.9 Chinese Opera (2)

6.10 Chinese Opera (3)

6.11 Concept of Chinese Traditional Music

6.12 Characteristics of Chinese Traditional Music and Music Appreciation

6.13 Diversified Modern Chinese Music

7. Language and Literature

7.1 Mandarin and Dialect

7.2 Ancient Chinese and Modern Chinese

7.3 Idioms

7.4 Origin and Development of Chinese Characters

7.5 Six Categories of Chinese Characters

7.6 Simplified and Traditional Chinese Characters

8. Calligraphy and Painting **4**

8.1 Definition of Calligraphy
8.2 The Evolution of Chinese Calligraphy - Bone inscriptions and bronze inscriptions
8.3 The Evolution of Chinese Calligraphy - Regular script
8.4 The Evolution of Chinese Calligraphy - Cursive script
8.5 The Evolution of Chinese Calligraphy - Running script
8.6 Calligraphy Creation and the Charm of Calligraphy
8.7 Four Treasures of the Study
8.8 Calligraphy and Other Arts
8.9 Basic Knowledge of Chinese Painting
8.10 Artistic Features of Chinese Painting
8.11 Appreciation of Three Major Themes and Representative Works of Chinese Painting

9. Economy **4**

9.1 Agriculture
9.2 Industry
9.3 Three Major Industries in China
9.4 “Internet plus” - New engine of the Chinese economy
9.5 Digital Economy 2.0
9.6 Belt and Road Initiative

10. Science and Technology **4**

10.1 Four Great Ancient Inventions
10.2 Bronze Ware
10.3 Seismograph
10.4 Ceramics
10.5 Hybrid Rice
10.6 Five-hundred-meter Aperture Spherical Radio Telescope (FAST)
10.7 China High Speed Rail
10.8 Jiaolong Manned Submersible
10.9 Supercomputer Sunway TaihuLight
10.10 Aerospace Science and Technology
10.11 Internet Payment

11. Education **4**

11.1 Imperial Examination System
11.2 Chinese Literature
11.3 China's Examination
11.4 Teaching Chinese to Speakers of Other Languages

12. Medical and Health **4**

12.1 Medical and Health Service System in China
12.2 Traditional Chinese Medicine (TCM)
12.3 History of TCM
12.4 Core Concept of TCM
12.5 Acupuncture and Massage
12.6 TCM and Life (1)
12.7 TCM and Life (2)
12.8 Understanding Chinese Medicine
12.9 Mystery of TCM Treatment
12.10 International Communication of TCM

13. Sports and Wushu (Chinese Martial Art) **4**

13.1 Traditional Sports - Kite
13.2 Traditional Sports - Archery
13.3 Chinese Women and the Olympic Games
13.4 Taiji Boxing
13.5 Overview of Wushu Films and Dramas
13.6 Wushu Elements in Wushu Films and Dramas
13.7 Cultural Connotation of Chinese Wushu

14. Traditional Festivals and Chinese Cuisine **4**

14.1 Chinese Traditional Festivals
14.2 Chinese Traditional Festivals-The Spring Festival&The Lantern Festival
14.3 Chinese Traditional Festivals-The Dragon Boat Festivall&The Mid-Autumn 14.4 Festival
14.5 Chinese Cuisine

15. Historical and Cultural Heritage **4**

15.1 Human Civilization: "Peking Man" Site at Zhoukoudian
15.2 Dunhuang Mogao Grottoes
15.3 Great Engineering: Great Wall and Dujiangyan Irrigation System
15.4 Royal Tombs: Xiaoling Mausoleum and Imperial Tombs of the Ming and Qing Dynasties
15.5 The Largest Bronze Ware: Simuwu Great Tripod
15.6 Warring States Court Musical Instrument: Chime-Bells of Marquis Yi of the Zeng State
15.7 Types of Chinese Ancient Buildings
15.8 Royal Architecture: The Forbidden City

15.9 Ancient Residential Buildings: Quadrangles
15.10 Chinese Gardens

16. Intangible Cultural Heritage 4

16.1. Current Status of Intangible Cultural Heritage
16.2 Gesar
16.3 Guqin
16.4 Rural Music and Dance
16.5 Shadow Play
16.6 Cantonese Opera
16.7 Chinese Seal Cutting
16.8 Nanjing Yunjin Brocade
16.9 Twenty-four Solar Terms
16.10 Crosstalk
16.11 Acrobatics
16.12. Protection of Intangible Cultural Heritage

Total Hours: 64

References:-

- Understanding China(Digital and Paper format), edited by Cheng Aimin, jointly developed by Peking University、Beijing Normal University、Zhejiang University、Tianjin University、Harbin Institute of Technology、Xi'an Jiaotong University、Wuhan University、Chongqing University、Shanghai International Studies University、Dalian Medical University、South China Normal University、Jiangsu Normal University and Tang International Education Group, published by Shanghai Foreign Language Education Press, recommended by China Association for International Education (CAFSA)

MgmC-212 – Understanding China

INSTRUCTIONAL OBJECTIVES

1. Understand the basic geography of China and some famous Chinese cities

2. Understand the unique natural and cultural landscape

3. Master basic knowledge of Chinese history and important historical figures

4. Understand the basic context and major issues in the development of Chinese history

5. Understand the main schools of Chinese traditional philosophy and their representatives

6. Understand the relevant core concepts

7. Master the influence of Chinese philosophy on the mindset and lifestyle of Chinese people

8. Understand the development and spread of Taoism, Buddhism, Islamism and Christianity

9. Understand the current status and policies of religious in China

10. Master the basic knowledge in seven videos

11. Describe the main contents of China's political system in Chinese

12. Compare the similarities and differences between China's political system and home country

13. Correct and comprehensive understanding of China's political system

14. Understand knowledge related to Chinese literature

15. Understand the inheritance and absorption of Chinese contemporary music to traditional music culture

16. Experience the characteristics of Chinese language

18. Understand the language and text of China as a whole

19 Understand the evolution of Chinese calligraphy

20. Understand the basic knowledge of Chinese painting and appreciation of representative works

21. Learn knowledge and information in related fields

22. Understand the logic and reasons behind the development of China's economy

23. Understand the ancient and modern Chinese scientific and technological civilization

24. Understand the unique and long-standing Chinese education

25. Master the core concepts of harmony between man and nature, five elements of qi, yin and yang and the basic principles of health preserving in four seasons

26. 5. Familiarize with the efficacy of acupuncture and massage and the nature and function of traditional Chinese medicine

27. Understand the Chinese medical service system; Characteristics of Tibetan medicine, Mongolian medicine, Hui medicine and Zhuang medicine

28. Understand the development history of TCM

29 International communication of traditional Chinese medicine science

30. Learn the development history of Chinese traditional sports

31. Master Chinese traditional sports such as kite and archery and their related cultural connotations

32. Understand the characteristics and advantages of modern competitive sports in China

33. Understand the spiritual connotation of Chinese Wushu

34. Understand the diet of traditional Chinese festivals

35. Understand the basic situation of Chinese historical and cultural heritage

36. Know important ancient sites and cultural relics: Peking Man Site Zhoukoudian, Dunhuang Mogao Grottoes, Great Wall, Dujiangyan Irrigation System, 37. Imperial Tombs of the Ming and Qing Dynasties, Simuwu Great Tripod, Chime-Bells of Marquis Yi of the Zeng State, etc.

38. Understand the historical and cultural value of cultural heritage

39. Master the basic situation, basic characteristics, and main types of Chinese ancient buildings

40. Familiarize with representative ancient buildings, and know important ancient sites and cultural relics: Peking Man Site Zhoukoudian, 41. Dunhuang Mogao Grottoes, Great Wall, Dujiangyan Irrigation System, Imperial Tombs of the Ming and Qing Dynasties, Simuwu Great Tripod, Chime-Bells of Marquis Yi of the Zeng State, etc.

42. Understand the historical and cultural value of ancient buildings

43. Able to distinguish different architectural and garden styles and features

44. Able to read and explain relevant key words

45. Understand the development, current situation, and protection of China's intangible cultural heritage

MATH-212 **Applied Mathematics-II**

	T	P	C
Total Contact Hours:			
	2	0	2

Theory: 64 Hours.

Aims & Objectives:

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

COURSE CONTENTS:

1. FUNCTIONS & LIMITS. 4 **Hours**

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

2. DIFFERENTIATION. **4 Hours**

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

3. DIFFERENTIATION OF ALGEBRIC FUNCTION.

4Hours

3.1 Explicit function
3.2 Implicit function
3.3 Parametric forms
3.4 Problems

4. DIFFERENTATION OF TRIGNOMETRIC FUNCTION.

4Hours

4.1 Differentional coefficient of sin x ,cos x ,tang x from first principle.
4.2 Differentional coefficient of Cosec x, Sec x, Cot x.
4.3 Differentiation of inverse trigonometric function.

4.4 Problems.

5. DIFFERENTIATION OF LOGARITHIMIC & EXPONENTIAL FUNCTION. 4 Hours

5.1 Differentiation of In x
5.2 Differentiation of log ax
5.3 Differentiation of ax
5.4 Differentiation of ex
5.5 Problems.

6. RATE OF CHANGE OF VARIABLE. 4 Hours

6.1 Increasing and decreasing function
6.2 Maxima and Minima values
6.3 Criteria for maximum and minimum values.
6.4 Method of finding maxima and minima.
6.5 Problems.

7. INTEGRATION. 8 Hours

7.1 Concept
7.2 Fundamental Formulas
7.3 Important Rules
7.4 Problems.

8. METHOD FOR INTEGRATION. 6 Hours

8.1 Integration by substitution
8.2 Integration by parts
8.3 Problems.

9. DEFINITE INTEGRALS. 6 Hours

9.1 Properties
9.2 Application to Area
9.3 Problems

10. PLANE ANALYTIC GEOMETRY & STRAIGHT LINE. 6 Hours

10.1 Coordinate System
10.2 Distance Formula
10.3 The Ratio Formulas
10.4 Inclination and slope of a line
10.5 The Slope Formula
10.6 Problems.

11. EQUATION OF STRAIGHT LINE. 6 Hours

11.1 Some Important Forms
11.2 General form
11.3 Angle formula
11.4 Parallelism and perpendicularity

11.5 Problems

12. THE EQUATION OF THE CIRCLE. 8 Hours

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

REFREFNCE BOOKS

1 Thomas finny –Calculus and analytic geometry
2 GhulamYasinMinhas –Technical mathematics Vol II, IlmiKitabkhana ,Lahore.
3 Prof .Riazali khan –Poly technique mathematics series vol I & II, Majeed sons Faisal Abad .
4 Prof. SanaUllahBhatti –Calculus and analytic geometry , Punjab Text Book Board Lahore.

MATH -212 APPLIED MATHEMATICS –II

INSTRUCTIONAL OBJECTIVES

1. USE THE CONCEPT OF FUNCTION AND THEIR LIMITS IN SOLVING SIMPLE PROBLEMS

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

2. UNDERSTAND THE CONCEPT OF DIFFERENTIAL COEFFICIENT

2.1 Derive mathematics expression for a differential coefficient.
2.2 Explain geometrical interpretation of different ional 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, ofinflection.
6.3 Explain criteria for maxima and minima values of a function.
6.4 Solve problems involving rate of change of variables.

7. APPLY CONCEPT OF INTEGRATION IN SOLVING TECHNOLOGICALPROBLEMS

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

8. UNDERSTAND DIFFERENT METHODS OF INTEGRATION.

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

9. UNDERSTAND THE METHOD OF SOLVING DEFENITE INTEGRALS.

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

10. UNDERSTAND THE CONCEPT OF PLANE ANALYTIC GEOMETRY.

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

11. USE EQUATIONS OF STRAIGHT LINE IN SOLVING PROBLEMS.

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

12. SOLVE TECHNOLOGICAL PROBLEMS USING EQUATION OF CIRCLE.

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

Mgm-201 COMMUNICATION SKILLS & REPORT WRITING

T	P	C
1	0	1

Total contact hours

Theory 32 Hrs.

Prerequisites: The students shall already be familiar with the language concerned.

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

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

COURSE CONTENTS

1. COMMUNICATION PROCESS & ORAL COMMUNICATION SKILLS 6hr
   - 1.1 Purposes of communication
   - 1.2 Communication process
   - 1.3 Distortions in communication
   - 1.4 Consolidation of communiqué
   - 1.5 Communication flow
   - 1.6 Communication for self-development
   - 1.7 Significance of speaking.
   - 1.8 Verbal and non-verbal messages.
   - 1.9 Strategic steps of speaking.
   - 1.10 Characteristics of effective oral messages.
   - 1.11 Communication Trafficking.
   - 1.12 Oral presentation.

2. QUESTIONING SKILLS. & INTERVIEWING SKILLS 4hr
   - 2.1 Nature of question.

2.2 Types of questions.

2.3 Characteristics of a good question.

2.4 Questioning strategy

2.5 Significance of interviews.

2.6 Characteristics of interviews.

2.7 Activities in an interviewing situation

2.8 Types of interviews.

2.9 Interviewing strategy.

3. LISTENING SKILLS & READING COMPREHENSION 6hr

3.1 Principles of active listening.

3.2 Skills of active listening.

3.3 Barriers to listening.

3.4 Reasons of poor listening.

3.5 Giving Feedback.

3.6 Reading problems.

3.7 Four Reading skills.

4. REPORT WRITING. 8hr

4.1 Goals of report writing

4.2 Report format.

4.3 Types of reports.

4.4 Report writing strategy.

4.4.1 Graphs/ Charts and their Analysis

4.5 Technical Reports:

4.5.1 Meaning & Classification.

4.5.2 Main Parts of the report.

4.5.3 OrganizationaI & outline of the report.

4.5.4 Sources of information

4.6 Business & Market Reports:

4.6.1 Definition.

4.6.2 Scope.

4.6.3 Importance.

4.6.4 Contents.

4.6.5 Market Terms

5. GROUP COMMUNICATION. 6hr

5.1 Purposes of conducting meetings.

5.2 Planning a meeting.

5.3 Types of meetings.

5.4 Selection of a group for meeting.

5.5 Group leadership skills.

5.6 Running a successful meeting.

5.7 Active participation techniques.

6. INTERPERSONAL & INTRAPERSONAL SKILLS 2hr

6.1 Interpersonal Skills

6.2 Intrapersonal Skills

RECOMMENDED BOOKS

1. Sh. Ata-ur-Rehman Effective Business Communication & Report Writing.

2. Ulman J.N. Could JR. Technical Reporting.

Mgm-201 COMMUNICATION SKILLS & REPORT WRITING.

INSTRUCTIONAL OBJECTIVES

1. UNDERSTAND THE COMMUNICATION PROCESS THE PROCESS OF ORAL

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.

1.6 Identify speaking situations with other peoples.

1.7 Identify the strategy steps of speaking.

1.8 Identify the characteristics of effective speaking.

1.9 State the principles of one-way communication.

1.10 State the principles of two-way communication.

1.11 Identify the elements of oral presentation skills.

1.12 Determine the impact of non-verbal communication on oral communication.

2. DETERMINE THE USES OF QUESTIONING SKILLS TO GATHER AND CLARIFY INFORMATION IN THE ORAL COMMUNICATION PROCESS AND DETERMINE THE APPROPRIATE INTERVIEW TYPE FOR THE SPECIFIC WORK-RELATED SITUATION AND CONDUCT A WORK-RELATED INTERVIEW.

2.1 Identify different types of questions.

2.2 Determine the purpose of each type of question and its application.

2.3 Identify the hazards to be avoided when asking questions.

2.4 Demonstrate questioning skills.

2.5 State the significance of interviews.

2.6 State the characteristics of interviews.

2.7 Explain the activities in an interviewing situation.

2.8 Describe the types of interviews.

2.9 Explain the interviewing strategy.

2.10 Prepare instrument for a structured interview.

3. DEMONSTRATE THE USE OF ACTIVE LISTENING SKILL IN THE ORAL COMMUNICATION PROCESS and DEMONSTRATE READING COMPREHENSION

3.1 State the principles of active listening.

3.2 Identify skills of active listening.

3.3 Identify barriers to active listening.

3.4 State the benefits of active listening.

3.5 Demonstrate listening skills.

3.6 Explain the importance of giving and receiving feedback.

3.7 Identify major reading problems.

3.8 Identify basic reading skills.

3.9 State methods of previewing written material.

3.10 Identify methods of concentration when reading.

3.11 Demonstrate reading comprehension.

4. Understand REPORT WRITING

4.1 Interpret Goals of report writing

4.2 Explain Report format.

4.3 Enlist Types of reports.

4.4 Describe Report writing strategy.

4.4.1 Graphs/ Charts and their Analysis

4.5 Understanding Technical Reports:

4.5.1 Meaning & Classification.

4.5.2 Main Parts of the report.

4.5.3 Organizational & outline of the report.

4.5.4 Sources of information

4.6 Understanding Business & Market Reports:

4.6.1 Definition.

4.6.2 Scope.

4.6.3 Importance.

4.6.4 Contents.

4.6.5 Market Terms

5. UNDERSTAND THE PRINCIPLES OF GROUP COMMUNICATIONS.

5.1 State the purpose and characteristics of major types of meeting.

5.2 Explain responsibilities of a meeting/committee.

5.3 Identify problems likely to be faced at meeting and means to overcome these problems.

5.4 Distinguish between content and process at meetings.

5.5 Explain the key characteristics of a good group facilitator.

6. UNDERSTAND INTERPERSONAL & INTRAPERSONAL SKILLS

6.1 Explain Interpersonal Skills

6.2 Describe Intrapersonal Skills

MMAT- 211 **Advanced Manufacturing Technology**

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

AIMS: After going through this course, student will be able to:

Ⅰ.Introduce rapid prototyping manufacturing technology
Ⅱ.Introduction to additive manufacturing technology
Ⅲ.Introduction to virtual manufacturing technology
Ⅳ.Describe manufacturing automation technology
Ⅴ.Describe intelligent manufacturing technology
ⅤⅠ.Describe advanced manufacturing models
ⅤⅡ. Describe advanced processing technology
ⅤⅢ.Introduction to Future Manufacturing Technology Prospects

Course Contents:

1.	**Introduction**	**4Hrs**
2.	**Rapid Prototyping Manufacturing Technology**	**4Hrs**
3.	**Additive manufacturing technology**	**4Hrs**
4.	**Virtual Manufacturing Technology**	**4Hrs**
5.	**Manufacturing automation technology**	**4Hrs**
6.	**Intelligent manufacturing technology**	**6Hrs**
7.	**Advanced Manufacturing Mode**	**2Hrs**
8.	**Advanced processing technology**	**2Hrs**
9.	**Future Manufacturing Technology Prospects**	**2Hrs**

Detail of Contents:

1. Introduction **4Hrs**

1.1 Overview
1.2 Overview of Advanced Manufacturing Technology
1.3 Characteristics and Development Trends of Advanced Manufacturing Technology

2. Rapid Prototyping Manufacturing Technology **4Hrs**

2.1 Overview of Rapid Prototyping Manufacturing Technology
2.2 Rapid prototyping process
2.3 Application of Rapid Prototyping Manufacturing

3. Additive manufacturing technology **4Hrs**

3.1 Overview of Additive Manufacturing Technology
3.2 3D printing technology
3.3 Development and Prospects

4. Virtual Manufacturing Technology **4Hrs**

4.1 Overview of Virtual Manufacturing
4.2 Virtual Manufacturing System
4.3 Application of Virtual Manufacturing

5. Manufacturing automation technology **4Hrs**

5.1 CNC technology
5.2 Computer-aided design and Manufacturing
5.3 Industrial robots
5.4 Flexible Manufacturing System Technology

6. Intelligent manufacturing technology **6Hrs**

6.1 Overview of Intelligent Manufacturing
6.2 Principles and Characteristics of Intelligent Manufacturing
6.3 Intelligent Technology and Equipment
6.4 Application of Intelligent Devices

7. Advanced Manufacturing Mode **2Hrs**

7.1 Computer Integrated Manufacturing Technology
7.2 Concurrent Engineering
7.3 Agile Manufacturing Technology
7.4 Lean manufacturing
7.5 Green Manufacturing

8. Advanced processing technology **2Hrs**

8.1 Electrical machining
8.2 Laser processing
8.3 Electron beam processing
8.4 Ion beam processing
8.5 Electrolytic grinding
8.6 Ultrasonic processing
8.7 Vibration cutting
8.8 High speed machining
8.9 Water cutting processing

9. Future Manufacturing Technology Prospects **2Hrs**

9.1 micron technology
9.2 Nanotechnology
9.3 Biotechnology
9.4 New Material Technology
9.5 Low carbon technology

Recommended Textbooks:

1. The Advanced manufacturing technology (2rd Edition) by Li Zongyi (Publisher: China Machinery Industry Press, 2023)
2. The Advanced manufacturing technology by Guo Qiong (Publisher: China Machinery Industry Press, 2023)
3. The Advanced manufacturing technology (3rd Edition) by Wang Longtai (Publisher: China Machinery Industry Press, 2023)

MMAT- 211 Advanced manufacturing technology

Instructional Objectives:

1. **Introduction**
   - 1.1 Describe Overview
   - 1.2 Describe Overview of Advanced Manufacturing Technology
   - 1.3 Describe Characteristics and Development Trends of Advanced Manufacturing Technology
2. **Rapid Prototyping Manufacturing Technology**
   - 2.1 Describe Overview of Rapid Prototyping Manufacturing Technology
   - 2.2 Understand Rapid prototyping process
   - 2.3 Understand Application of Rapid Prototyping Manufacturing
3. **Additive manufacturing technology**
   - 3.1 Describe Overview of Additive Manufacturing Technology
   - 3.2 Understand 3D printing technology
   - 3.3 Understand Development and Prospects
4. **Virtual Manufacturing Technology**
   - 4.1 Describe Overview of Virtual Manufacturing
   - 4.2 Understand Virtual Manufacturing System
   - 4.3 Understand Application of Virtual Manufacturing
5. **Manufacturing automation technology**
   - 5.1 Understand CNC technology
   - 5.2 Understand Computer-aided design and Manufacturing
   - 5.3 Understand Industrial robots
   - 5.4 Understand Flexible Manufacturing System Technology
6. **Intelligent manufacturing technology**
   - 6.1 Describe Overview of Intelligent Manufacturing
   - 6.2 Understand Principles and Characteristics of Intelligent Manufacturing
   - 6.3 Understand Intelligent Technology and Equipment
   - 6.4 Understand Application of Intelligent Devices
7. **Advanced Manufacturing Mode**
   - 7.1 Understand Computer Integrated Manufacturing Technology
   - 7.2 Understand Concurrent Engineering
   - 7.3 Understand Agile Manufacturing Technology
   - 7.4 Understand Lean manufacturing
   - 7.5 Understand Green Manufacturing
8. **Advanced processing technology**
   - 8.1 Understand Electrical machining
   - 8.2 Understand Laser processing
   - 8.3 Understand Electron beam processing
   - 8.4 Understand Ion beam processing
   - 8.5 Understand Electrolytic grinding
   - 8.6 Understand Ultrasonic processing
   - 8.7 Understand Vibration cutting
   - 8.8 Understand High speed machining
   - 8.9 Understand Water cutting processing

9. Future Manufacturing Technology Prospects

9.1 Describe micron technology
9.2 Explain Nanotechnology
9.3 Understand Biotechnology
9.4 Understand New Material Technology
9.5 Explain Low carbon technology

MMAT-222 INDUSTRIAL ENGINEERING AND QUALITY CONTROL

Total Contact Hours

		T	P	C
Theory	32			
Practical	96	1	3	2

AIMS:

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

a) Understand the fundamentals of planning of the industrial concern

b) Understand and appreciate the methods generally employed in various categories of manufacturing operations for economic production.

COURSE CONTENTS

1. INDUSTRIAL ENGINEERING: 2 hrs
   - 1.1. Need of industrial Engineering
   - 1.2. Nature and scope

2. Plant Location and Layout: 4 hrs
   - 2.1. Plant location.
   - 2.2. Plant Layout.
   - 2.3. Objective and Principles
   - 2.4. Factors influencing Plant Location and Plant Layout

3. Operations Research: 6 hrs
   - 3.1. Operations Research and its applications
   - 3.2. Define Linear Programming Problem
   - 3.3. Evaluation of Project completion time
   - 3.4. Maintenance plan
   - 3.5. Production plan, methods and management
   - 3.6. Cost estimation

4. Inventory Control: 4 hrs
   4.1. Inventory and inventory control
   4.2. Objective
   4.3. Classification.
   4.4. Functions.
   4.5. Economic Order Quantity for Basic model
   4.6. ABC analysis.

5. Plant maintenance: 2 hrs
   5.1. Plant maintenance.
   5.2. Duties, functions and responsibilities
   5.3. Types of maintenance

6. Inspection and Quality Control: 6 hrs
   6.1. Inspection and Quality control.
   6.2. Planning of inspection.
   6.3. Types of inspection.
   6.4. Factors influencing the quality.
   6.5. Concept of statistical quality control

7. Contemporary Quality Management concepts: 8 hrs
   7.1. Concept of total quality management (TQM)
   7.2. ISO-9000, concept & its evolution & implications
      7.2.1. ISO9000: Universal Standards of Quality: ISO around the world, The ISO9000 ANSI/ASQCQ-
   7.3. Series Standards
   7.4. benefits of ISO9000 certification
      7.4.1. the third party audit
      7.4.2. Documentation ISO9000 and services
      7.4.3. The cost of certification implementing the system.

Total **32 hrs**

Recommended books /sites:

- Industrial Engineering & Management by Dhanpat Rai & Sons
- Industrial Engg & Production Management by S. Chand
- Total Quality Management / Joel E.Ross/Taylor and Franscis Limited
- Total Quality Management/P.N.Mukherjee/PHI
- Beyond TQM / Robert L.Flood
- Total Quality Management- A Practical Approach/H. Lal
- Quality Management/Kanishka Bedi/Oxford University Press/2011
- Integrated use of management system standards, ISO1)
- www.iso.org/tc176/sc02/public
- www.iso.org/tc176/ISO9001AuditingPracticesGroup

MMAT-222 INDUSTRIAL ENGINEERING AND QUALITY CONTROL

INSTRUCTIONAL OBJECTIVES:

1. **INDUSTRIAL ENGINEERING**
   - 1.1. Describe the need of industrial Engineering
   - 1.2. Define and Explain the Nature and scope of Industrial Engineering
2. **Plant Location and Layout:**
   - 2.1. Describe the features governing plant location.
   - 2.2. Define plant layout.
   - 2.3. Describe the objective and principles of plant layout.
   - 2.4. Explain Process Layout, Product Layout and Combination Layout.
   - 2.5. Explain the factors influencing Plant Location and Layout
3. **Operations Research:**
   - 3.1. Explain the introduction of Operations Research and its applications
   - 3.2. Define Linear Programming Problem, Solution of L.P.P. by graphical method
   - 3.3. Describe and Explain the Evaluation of Project completion time by Critical Path Method and PERT (Simple problems).
   - 3.4. Explain distinct features of PERT with respect to CPM
   - 3.5. Explain the maintenance plan
   - 3.6. Describe the Production plan, methods and management
   - 3.7. Explain the cost estimation
4. **Inventory Control:**
   - 4.1. Define inventory and inventory control
   - 4.2. Describe the Classification of inventory.
   - 4.3. Define the objective of inventory control.
   - 4.4. Describe the functions of inventories.
   - 4.5. Explain and Derive economic order quantity for Basic model.
   - 4.6. Define and Explain ABC analysis.
5. **Plant maintenance:**
   - 5.1. Describe the objectives of plant maintenance.
   - 5.2. Describe the duties, functions and responsibilities of plant maintenance department.
   - 5.3. Describe the types of maintenance: Preventive, Breakdown, Scheduled and Predictive maintenance.

6. **Inspection and Quality Control:**
   - 6.1. Define Inspection and Quality control.
   - 6.2. Describe planning of inspection.
   - 6.3. Describe types of inspection.
   - 6.4. Describe the Study of factors influencing the quality of manufacture.
   - 6.5. Explain the Concept of statistical quality control, Control charts (X, R, P and C - charts). Solve related problems.

7. **Contemporary Quality Management concepts:**
   7.1. Understand the Concept of total quality management (TQM)?
   7.2. Describe ISO-9000, concept & its evolution & implications?
      7.2.1. Explain ISO9000: Universal Standards of Quality: ISO around the world, The ISO9000 ANSI/ASQCQ?
   7.3. Explain ISO 9001:2015 Series Standards in terms of following:
      7.3.1. Benefits of ISO 9001:2015 certification
      7.3.2. The third party audit
      7.3.3. Documentation ISO 9001:2015 and services
      7.3.4. The cost of certification implementing the system.

MMAT-222 INDUSTRIAL ENGINEERING AND QUALITY CONTROL

LIST OF PRACTICAL 96 Hours

1. Sketch layout of shops of Technology
2. Planning of shop layout
3. Draw and discuss administrative chart
4. Study of Institutes stores
5. Preparation of process chart/flow chart
6. Preparation the chart of symbols:

a) ASME (American society of mechanical engineering)

b) Understanding of Therbligs manual chart

7. Preparation of activity chart
8. Problems on time study
9. Preparation of process charts
10. Preparation of operation chart
11. Visit to production factory, paper and board mills, cycle, fan, pump, and sewing machine Factory, etc.
12. Preparations of a chart for calculating the actual time spent on the job.
13. Preparation of an observation chart
14. Preparation of a job analysis sheet
15. Design P-chart for fraction defectives
16. Design C- chart for number of defectives (constant sample size)
17. Design Operating characteristics curve of single sampling attributes plan
18. Perform Test for normality of sample means(normal distribution)
19. Perform Test for normality of sample means(universal distribution rectangular)
20. Test X , R – charts & process capability
21. Study Pin Board Experiment
22. Design a multiple Activity Chart (Or) Man Machine Chart

MMAT 232 MICROCONTROLLER AND PLC FOR AUTOMATION

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

AIM:

•To introduce students with the architecture and operation of typical microcontrollers and PLC.

•To familiarize the students with the programming and interfacing of microcontrollers, PLC and SCADA systems

•To provide strong foundation for designing real world applications using microcontrollers, PLC, SCADA

CONTENTS

1. **MICROPROCESSOR AND MICROCONTROLLER** **8hrs**

- 1.1. Introduction to microprocessor and microcontroller
- 1.2. Comparison Microprocessors and Microcontrollers
- 1.3. Z-80, 8051, PIC Micro Controllers,
- 1.4. PIC Development Tools.
- 1.5. 4Bit, 8Bit, 16 Bit and 32 Bit Micro Controllers
- 1.6. Develop Systems for Micro Controllers
- 1.7. Micro Controllers Architecture
- 1.8. 8051 Architecture,
- 1.9. PIC Architecture
- 1.10. 8051 Micro Controller Hardware
- 1.11. Input/output Pins
- 1.12. Ports and Circuits
- 1.13. External Memory,
- 1.14. Counter and Timers
- 1.15. Serial Data Input/Output, (SLE: Interrupts)

2. MICRO CONTROLLER PROGRAMMING & APPLICATIONS 4Hrs

2.1 Simple programming exercises
2.2 Key board and display interface
2.3 Control of servo motor
2.4 Stepper motor control
2.5 Application to automation systems.

3. INTRODUCTION TO PLC 4HRS

3.1. Fundamentals of programmable logic controller PLCs
3.2. Functions of PLCs
3.3. Features of PLC
3.4. Selection of PLC module
3.5. Architecture
3.6. Types of PLC
3.7. PLC modules
3.8. PLC hardware components
3.9. Configuring a PLC
3.10. PLC Wiring

4. PLC PROGRAMMING AND INDUSTRIAL APPLICATIONS 8HRS

4.1 PLC programming procedures
4.2 Types of programming
4.3 Logic ladder diagrams
4.4 Communication in PLCs
4.5 Programming Timers and counters
4.6 Auxiliary commands and functions
4.7 Data Handling
4.8 Programming devices
4.9 PLC programming Simple instructions
4.10 Applications of PLC
4.11 Simple materials handling applications,
4.12 Automatic control of traffic signal light
4.13 Automatic control of conveyor belt
4.14 PLC Steper and Servo motor control system
4.15 PLC water level control system

5. INTRODUCTION TO SCADA 8HRS

5.1 Introduction to computer-based industrial automation-
5.2 Direct Digital Control (DDC),
5.3 Distributed Control System (DCS),
5.4 supervisory control and data acquisition (SCADA)
5.5 basic architectures and HMI Components,
5.6 HMI Development,

5.7 Data Processing,
5.8 Control Algorithm & Programming,
5.9 Data Acquisition PLCs/RTUs,
5.10 Database Connectivity and Report generating.
5.11 OPC Configuration with RTUs (PLC)
5.12 Cyber Security for Industrial Control Systems.

Total **32 hrs**

RECOMMENDED BOOKS/WEBSITES

1. Stamatios Manesis and George, Nikolakopoulos, Introduction to Industrial Automation, CRC Press, 2020.
2. Frank D. Petruzella, Programmable Logic Controllers, 5th edition, Mc Graw Hill, 2019
3. *Programmable logic controllers. Tata McGraw-Hill Education, 2005.Gupta, Virtual Instrumentation Using LabVIEW 2E, Tata McGraw-Hill Education, 2010.*
4. Frank Lamb, "Industrial Automation Hands-on" The McGraw-Hill, 2013.
5. Tracy Adams, P.E., "SCADA System Fundamental", CED engineering.com.
6. Frank D. Petruzella, "Programmable Logic Controller", 4th Edition, The McGraw-Hill, 2011
7. Mandal S.K , "Microprocessors and Microcontrollers", WBUT Series by TMH.
8. https://nptel.ac.in/content/storage2/courses/112103174/pdf/mod3.pdf

MMAT232 MICROCONTROLLER AND PLC FOR AUTOMATION

INSTRUCTIONAL OBJECTIVES:

1. To introduce and train the students to use microcontroller for industrial applications
2. To acquire knowledge on PLC for actuation and control of speed of motors.
3. Be able to apply microcontroller for controlling different actuators.
4. Gain the knowledge on microcontroller and its programming.
5. Acquire knowledge on PLC and do simulation using PLC for different industrial applications.
6. Gain knowledge on SCADA

CONTENTS

1. MICROPROCESSOR AND MICROCONTROLLER

1.1. Introduction to microprocessor and microcontroller
1.2. To Comparison of Microprocessors and Microcontrollers
1.3. Describe the Z-80, 8051, PIC Micro Controllers,
1.4. Explain the PIC Development Tools.
1.5. What are 4Bit, 8Bit, 16 Bit and 32 Bit Micro Controllers
1.6. To develop Systems for Micro Controllers
1.7. Describe Micro Controllers Architecture
1.8. Understand the 8051 Architecture,
1.9. Explain the PIC Architecture
1.10. Describe 8051 Micro Controller Hardware
1.11. Recognize the Input/output Pins
1.12. Understand the Ports and Circuits
1.13. Explain the External Memory,
1.14. Describe Counter and Timers
1.15. To understand the Serial Data Input/Output, (SLE: Interrupts)

2. MICRO CONTROLLER PROGRAMMING & APPLICATIONS

2.1 Demonstrate the Simple programming exercises

2.2 Explain the Key board and display interface

2.3 Describe Control of servo motor

2.4 Explain the Stepper motor control

2.5 Explain Application of automation systems.

3. INTRODUCTION TO PLC

3.1. Understand the Fundamentals of programmable logic controller PLCs

3.2. Describe the Functions of PLCs

3.3. explain the Features of PLC -

3.4. Define the Selection of PLC module

3.5. Understand the Architecture of PLC system

3.6. Explain the Types of PLC

3.7. Describe the PLC modules

3.8. Identify the PLC hardware components

3.9. Explain the Configuring a PLC

3.10. Demonstrate the PLC wiring

4. PLC PROGRAMMING AND INDUSTRIAL APPLICATIONS

4.1 Understand the PLC programming procedures

4.2 What are different Types of programming?

4.3 Understand the Logic ladder diagrams

4.4 Describe the Communication in PLCs

4.5 Differentiate the Programming Timers and counters

4.6 Describe the Auxiliary commands and functions

4.7 What is Data Handling?

4.8 Understanding of Programming devices

4.9 Understand the PLC programming with Simple instructions

4.10 Explain different Applications of PLC

4.11 Identify the Simple materials handling applications

4.12 Master the Automatic control of traffic signal light

4.13 Master the concept of Automatic control of conveyor belt

4.14 To design a PLC Steper and Servo motor control system

4.15 To understand a PLC water level control system

5. INTRODUCTION TO SCADA

5.1 Understand the computer-based industrial automation

5.2 Explain the Direct Digital Control (DDC)

5.3 Describe the Distributed Control System (DCS)

5.4 Define the supervisory control and data acquisition (SCADA)

5.5 Explain the basic architectures and HMI Components

5.6 Describe the HMI Development

5.7 Explain the Data Processing for SCADA system

5.8 Elaborate Control Algorithm & Programming,

5.9 Understanding the Data Acquisition PLCs/RTUs

5.10 Differentiate the Database Connectivity and Report generating.

5.11 Explain the OPC Configuration with RTUs (PLC)

5.12 Importance of Cyber Security for Industrial Control Systems

MMAT- 232 MICROCONTROLLER AND PLC FOR AUTOMATION
Practical 96hrs

LIST OF PRACTICALS

1. Assembly language programming and simulation of 8051 in Keil IDE.
2. Alphanumeric and Graphic LCD interfacing using X8051 & PIC Microcontroller.
3. Sensor interfacing with ADC to X8051 & PIC.
4. DAC & RTC interfacing to X8051 & PIC.
5. PLC programming for traffic light control system
6. PLC programming for conveyor belt control system
7. PLC programming for bottling plant automation
8. Speed control of AC servo motor using PLC system in lab
9. Installation of software for PLC programming and building automation system
10. Industrial visit for SCADA implementation for boiler plant and write a technical report
11. Industrial visit for SCADA implementation in cement industries
12. On-line Monitoring and Control of a Pilot plant using DCS
13. Develop the PLC program to control the traffic light system
14. To Interface the Input and output devices with PLC in Lab
15. To visit a nearby industrial setup to understand the concepts of SCADA and its applications
16. PLC programing to control the water level system
17. Installation and programing on PLC trainer to control a Elevator
18. To design a basic ladder program on logic ladder
19. Interface the Stepper motor with PLC to control rotary Position
21. Identification and configuration of SCADA Systems after downloading the software on HMI

Mech-244 WORKSHOP PRACTICE-II

T	P	C
0	12	4

Practical: 384 Hrs

Pre-requisites: WORKSHOP PRACTICE-I

AIMS: At the end of this course, the student will be able to know and practice following:-

A) Basic Machine Shop-II:

1) Operate iathe, driil press, shaper, planner , tool grinder

2) Perform different operations on these machines

3) Prepare different jobs using these machines

4) Observe safety to operate machines

B) Foundry & Pattern Making:

1) Use different molding Techniques

2) Prepare core

3) Operate Cupola furnace

4) Detect the different casting defects

5) Prepare the pattern

C) Advance Welding:

1) Perform the Arc welding and oxyacetylene welding

2) Observe different welding defects and their remedies

3) Perform TIG and MIG welding on different metals

4) Reworking

5) Non-destructive testing

Mech-244 WORKSHOP PRACTICE-II

A) Machine Shop: List of Practical:

1.	Centering the job by dial indicator method	6 Hours
2.	Taper turning by tail stock off-set method	12Hours
3.	Taper turning by taper turning attachment	12Hours
4.	Eccentric turning practice	12Hours
5.	Practice of reaming	3 Hours
6.	Practice of boring	6 Hours
7.	Practice of counter boring	3 Hours
8.	Practice of taper boring	3 Hours
9.	Practice of grinding tool for thread cutting	6 Hours
10.	Practice of cutting metric v-thread	6 Hours
11.	Practice of cutting square thread	9 Hours
12.	Practice of cutting acme thread	12Hours
13.	Practice of cutting worm thread 9 Hours	12Hours
14.	Practice of cutting multi-start v-thread	12Hours
15.	Practice of cutting internal metric v-thread	12Hours
16.	Practice of preparing milling arbor	12Hours
17.	Practice of drill grinding	12Hours
18.	Practice of shaping V-Block	36Hours

Mech-246 WORKSHOP PRACTICE-II

B) Foundry and Pattern Making:

Practical List:

(Part a: Foundry)

1. MOLDING 12Hrs

   1.1 Practice of bedding in molding method

   1.2 Practice of molding with irregular pattern by CO2 Molding process

   1.3 Practice of molding with three piece pattern by CO2 Molding process

2. CORE MAKING 9Hrs

   2.1 Practice of making round core

   2.2 Practice of making half core

   2.3 Practice of baking cores and assembling of half cores

3. CASTING 12Hrs

   3.1 Practice use of pyrometer

   3.2 Practice of complete operation of cupola furnace (charging, melting, pouring, casting etc.)

   3.3 Practice of Casting of non-ferrous metals (Aluminum, Brass, Lead)

4. CLEANING AND FINISHING OF CASTING 6Hrs

   4.1 By hand with the help of

      4.1.1 Hammer and chisel

      4.1.2 Steel wire brush

      4.1.3 Hand Hacksaw

   4.2 By Machines

      4.2.1 Sand blasting

      4.2.2 Hand grinding

      4.2.3 Tumbling barrel machine

      4.2.4 Surface Roughness Meters

5. SAND TESTING 15Hrs

5.1 Moisture contents test

5.2 Clay contents test

5.3 Permeability number test

5.4 Green compressive strength test

5.5 Fineness number of various sand Samples

6. TESTING OF CASTING 6Hrs

6.1 Practice of detecting the casting defects, like Mismatch, Blow holes, Miss-run, Fins etc.

(Part b: Pattern Making)

7. Practice of making a pattern for casting a pipe 50mm, 25mm and length 100 mm providing core prints 6Hrs

8. Practice of making a pattern, on CNC Router Machine, of surface plate 250mmx300mm providing supporting ribs 35mm projected with draft allowance. Also provide shrinkage, Machining and distortion allowances. Ribs must be provided at periphery and diagonally 6Hr

9. Practice of making a single piece pattern of any English word from a wood plate 1 x 4 x 7cm providing draft and machining allowances 6Hrs

10. Application of CNC Router for complex shaped pattern 6Hrs

11. Preparation of a pattern of Bell or Vase on Rapid Prototyping Machine 6Hrs

12. Preparation of a pattern of Mobile Case on Rapid Prototyping Machine (3D Printers) 6Hrs

Mech-246 WORKSHOP PRACTICE-II

C) Advanced Welding:

List of Practical:

1.	Double "V" Butt Joint by Arc welding	10 Hour
2.	Fillet joint inside corner by Arc welding	9 Hour
3.	"T" Fillet joint	9 Hour
4.	Pipe welding having Nominal size é 3 Inch Sch. 40	12 Hour
5.	Visual examination of pipe welded joint	8 Hour
6.	Aluminum Butt joint (oxyacetylene gas welding)	9 Hour
7.	Cast Iron Butt Joint by Oxyacetylene gas welding	9 Hour
8.	Oxy-acetylene Gas cutting of mild steel (Ferrous metals)	6 Hour
9.	TIG Welding	6 Hour
10.	MIG Welding	6 Hour
11.	PLASMA ARC CUTTING (Ferrous & Non- ferrous metals)	8 Hour

MMAT 242 ELECTRICAL ACTUATORS AND DRIVES **T P C**

Theory 32hrs **1 3 2**

Practical 96hrs

Pre requisite: Electrical and Electronics Fundamentals

AIM:

1. To understand the basic principles of DC motor and AC motor

2. To acquire basic concepts of power semiconductor devices and power electronic circuits.

3. To apply various speed control techniques for DC motor drives, AC motor drives and special machine drives.

CONTENTS

3. AC Motors **6 hours**

3.1. 3-phase induction motors:
- 3.1.1. Construction
- 3.1.2. Working principle
- 3.1.3. Classification
- 3.1.4. Torque equation
- 3.1.5. Electrical and mechanical characteristics
- 3.1.6. Speed control techniques
- 3.1.7. Applications

3.2. Synchronous motors:
- 3.2.1. Construction
- 3.2.2. Working principle
- 3.2.3. Torque equation
- 3.2.4. Speed control
- 3.2.5. Techniques
- 3.2.6. Applications

4. Fundamentals of Power Electronics and Power Converters **4 hours**

4.1. Switching characteristics of thyristors
4.2. Power BJT
4.3. Power MOSFET and power IGBT
4.4. Single phase and three phase AC –DC
4.5. DC-AC converters
4.6. DC-DC converters

5. DC Motor Drives **4 hours**

5.1. Fundamentals of electrical drives
5.2. Converter fed DC motor drive
5.3. Chopper fed DC motor
5.4. Drive
5.5. Braking
5.6. Applications

6. AC Motor Drives **4 hours**

6.1. Inverter fed induction motor drive and synchronous motor drive
6.2. Slip power recovery
6.3. Schemes
6.4. Braking
6.5. Applications

7. Special Machine Drives **6 hours**

7.1. Working principle and control of stepper motor
7.2. Brushless DC motor
7.3. Permanent magnet
7.4. Synchronous motor (PMSM)
7.5. Linear motor
7.6. Applications

TOTAL **32 HRS**

Reference Books:

1. Electrical Machines and Drives: Fundamentals and Advanced Modeling, Melkebeek J A, Springer publishing, 5th edition, 2018.
2. Electric Machines - D.P. Kothari, I.J. Nagrath, McGraw Hill Education, 5th Edition, 2017
3. Fundamentals of Electrical Drives – G.K. Dubey, Narosa Publisher, 2nd Edition, Reprint2020.
4. Electric Machinery Fundamentals - Stephen J. Chapman Mcgraw Hill publishing, 4th Edition, 2019.
5. Power Electronics: Circuits, Devices & Applications – M.H. Rashid, Pearson, 4th Edition, 2014.
6. Special Electrical Machines - K. Venkataratnam, Universities Press (India). E.Edition,2019

MMAT 242 ELECTRICAL ACTUATORS AND DRIVES

Instructional Objectives:

- To learn about non-electrical actuators
- To learn about electrical actuators
- To learn about drives that control non-electrical actuators
- To learn about drives that control electrical actuators.

CONTENTS

3.1.7. Applications

3.2. Explain Synchronous motors in terms of following headings given below:

3.2.1. Construction

3.2.2. Working principle

3.2.3. Torque equation

3.2.4. Speed control

3.2.5. Techniques

3.2.6. Applications

4. **To Learn the Fundamentals of Power Electronics and Power Converters**

4.1. Write the Switching characteristics of thyristors?

4.2. Describe Power BJT?

4.3. Explain Power MOSFET and power IGBT?

4.4. Describe Single phase and three phase AC –DC?

4.5. Explain DC-AC converters?

4.6. Explain DC-DC converters?

5. DC Motor Drives

5.1. Describe Fundamentals of electrical drives?

5.2. Explain Converter fed DC motor drive?

5.3. Describe Chopper fed DC motor?

5.4. Describe Drive?

5.5. Explain Braking?

5.6. What are Applications of DC motor drive?

6. **AC Motor Drives**

6.1. Explain Inverter fed induction motor drive and synchronous motor drive?

6.2. Describe Slip power recovery?

6.3. Describe Schemes?

6.4. Describe Braking?

6.5. What are Applications AC Motor Drives?

7. Special Machine Drives

7.1. Describe Working principle and control of stepper motor?

7.2. Explain Brushless DC motor?

7.3. Explain Permanent magnet?

7.4. Describe Synchronous motor (PMSM)?

7.5. Describe Linear motor?

7.6. What are the Applications of Special Machine Drives?

MMAT 241 ELECTRICAL ACTUATORS AND DRIVES

List of practical 96 hrs

1. Performance characteristics of DC shunt motor
2. Load test on single phase transformer
3. Performance characteristics of 3-phase squirrel cage induction motor
4. Study the switching characteristics of power MOSFET
5. Measure the performance parameters of fully controlled single phase AC-DC converter with SCR
6. Measure the performance parameters of 3- phase DC-AC converter with self-commutating power semiconductor device.
7. Control the speed of DC shunt motor by duty cycle control by employing power electronic converters with MOSFET/IGBT
8. Control the speed of 3-phase induction motor under constant flux operation and variable flux operation
9. Control the speed of PMSM motor by employing power electronic converters
10. Linear induction motor control
11. Study on various kinds of sensors and its characteristics.
12. Experimentation on voltage, current, power, and frequency measurement.
13. Study of torque transducer & applications.
14. Experimentation with tactile sensor for force and touch detection.
15. Study of pressure sensor.
16. Use of LVDT & acoustics ranging.
17. Study of hall-effect sensor and ultrasonic distance measurement applications.
18. Use of different temperature sensors.
19. Optical transducers Characterization.
20. Data Acquisition & Instrument Control

MMAT 251 METROLOGY

T	P	C
0	3	1

Total Contact Hours

Theory: nil

Practical: 96Hrs

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

AIMS:

The list of practical 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 for machine tool design and accuracy in manufacturing. These Tools are also used to control and maintain the quality standards.

1. Practice of following graduated tools and take the sample measurements
    - 1.1 Steel Rule
    - 1.2 Hook Rule
    - 1.3 Folding Rule
    - 1.4 Trammels
2. Practice of combination set and measure the angles and find he center of circle
3. Practice of following supporting tools:
    - 3.1 Cast Iron, Granite, and Glass Surface Plates and their uses
    - 3.2 Straight Edge and its benefits
    - 3.3 Spirit level to level the surface
    - 3.4 Engineer’s level and its applications
    - 3.5 Engineer’s parallel types and uses
4. Practice of following gauges to take at least three readings
    - 4.1 Fixed gauges
    - 4.2 Adjustable gauges
    - 4.3 Small hole gauges
    - 4.4 Telescope gauges

5. Practice and use of following precision instruments for precise readings
    - 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
    - 6.1 Vernier caliper
    - 6.2 Vernier Height gauge
    - 6.3 Vernier depth gauge
7. Practice and use of following angle measuring tools
    - 7.1 Bevel protractor
    - 7.2 Vernier Bevel protractor
    - 7.3 Dial protractor
    - 7.4 Steel protractor
    - 7.5 Sine bar
8. Practice and use of following dial instruments
    - 8.1 Dial Caliper
    - 8.2 Dial Thickness gauge
    - 8.3 Dial Indicator
9. Practice and use of gauge blocks
10. Practice of tool maker microscope
11. Visit a production line in auto manufacturing industry and write a report on uses of profile projector
12. Visit a production line in Auto Manufacturing Industry and write a report on comparators like
    - 12.1 Mechanical comparator
    - 12.2 Electronic comparator
    - 12.3 Electrical comparator

13. Practice and use of digital instruments

    13.1 Digital Micrometer

    13.2 Digital Caliper

    13.3 Digital Indicator

    13.4 Digital Depth Gauge

    13.5 Digital Height Gauge

14. Visit a production line in Auto Manufacturing Industry and write a report on CMM for different parts

    14.1 Point to point/linear measurement

    14.2 Profile measurement (2D, 3D)

15. Visit a production line in auto manufacturing industry and check the uses of following thread and gear measurement

    15.1 Thread gauges

    15.2 Gear Tooth Caliper

    15.3 Gear Testing Machine

MMAT-261 PROCESS CONTROL

T	P	C
1	0	1

Total Contact Hour:

Theory 32

AIMS:

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

- Determine needed control loop components in specific process control applications.

COURSE CONTENTS:

1. PROCESS CONTROL 6 Hours

1.1 Systems concept

1.2 Basic systems functions and Measurements

1.3 Process Control

1.4 Process control systems

1.4.1 Open-loop

1.4.2 Closed-loop

1.4.3 Closed-loop variables

1.5 Main Systems

1.5.1 Hydraulic systems

1.5.2 Pneumatic systems

1.5.3 Static pressure systems

1.5.4 Steam pressure systems

1.5.5 Temperature systems

1.5.6 Level determination systems

1.5.7 Flow process systems

1.5.8 Analytical process systems

1.5.9 Microcomputer processing systems

1.6 Industrial processes

2. Communication 6 Hours

2.1 Binary Communications

2.2 Analog Communications

2.3 Mechanical Communication

2.3.1 Communicating with Pressure: Pneumatics

2.3.2 Communication with Voltage

2.3.3 Communication with Current

2. 4 Digital Communications

2.4.1 Smart Device Communications

2.4.2 Wireless Communications

2.5 Converting Between Signal Types

2.5.1 I/O

2.5.2 Analog to Digital

2.5.3 Digital to Analog

2.5.4 Transducers

2.6 Displaying Information

2.6.1 Mechanical Displays

2.6.2 Electronic Displays

2.6.3 Computer Displays

3. MEASURMENTS AND SENSORS 6 Hours

3.1 Data interpretation and measurement errors

3.2 Interpreting errors in measurements

3.3 Physical parameters:

3.3.1 Pressure systems

3.3.2 Thermal systems

3.3.3 Level determining systems

3.3.4 Flow process systems

3.3.5 Analytical systems

3.4 Explanation of the following:

3.4.1 Accuracy

3.4.2 Resolution

3.4.3 Repeatability

3.4.4 Sensitivity

3.4.5 Response time

3.5 Sensor:

3.5.1 Position

3.5.2 Temperature

3.5.3 Force

3.5.4 Pressure

3.5.5 Flow

3.5.6 Vibration

3.5.7 Level

3.5.8 Weighting

3.6 Calibration process

4. DATA Acquisition and Documentation 6 Hours

4.1 Data Acquisition

4.2 Key issues:

4.2.1 Measurements

4.2.2 Data

4.2.3 Users

4.3 Types of Data Acquisition equipment

4.4 Performances of Data Acquisition equipment

4.5 Types and Applications of Data Acquisition

4.6 Control System Documentation:

4.6.1 Process flow diagram

4.6.2 P&ID Drawing

4.6.3 Instrument Index and Specifications

4.6.4 Piping Diagram

4.6.5 Control Narratives

4.6.6 Loop and Logic Diagram

5. BASICS OF PROCESS CONTROL SOFTWARE 4 Hours

5.1 Purpose of Process control software

5.2 Configuration of the software environment

5.3 Generation of a Graphical user interface

5.4 Tagging process of the elements in the process

5.5 Testing and debugging of the program

5.6 Use of a PLC using a PID interface for process control

5.7 Use of a PC for process control

6. BEYOND THE BASICS OF PROCESS CONTROL 4 Hours

6.1 Advanced Regulatory Control

6.1.1 Cascade Control

6.1.2 Feed forward Control

6.1.3 Ratio Control

6.1.4 Signal Characterizers

6.1.5 Gain Scheduling and Gap Controllers

6.2 Model Predictive Control

6.3 Artificial Intelligence in Process Control

6.3.1 Fuzzy Logic Controllers

6.3.2 Neural Networks

6.4 Safety Instrumented Systems

6.5 Diagnostics and Analytics

6.5.1 Instrument and Valve Diagnostics

6.5.2 Control Loop Performance Monitoring

6.6 Alarm Management

TEXT/REFERENCE BOOKS:

1. Bryan and Bryan, Progammable Controllers Theory and Implementation, 2nd Ed.
2. Dale Patrick and Stephen Fardo, Industrial Process Control Systems
3. Maloney, Solidstate Industrial Electronics, 3rd Ed.
4. Bannister and Whithead, Instrumentation Transducers and Interfacing
5. P.W. Murill, Fundamentals of Process Control, 2nd Ed.
6. T.A. Hughes, Measurement and Control Basics, 2nd Ed
7. Hoekstra, Robotics and Industrial Automation, 2nd Ed.
8. Manuals for Process Control software
9. Manuals for National Instruments Data Acquision Board.
10. Process control basics by George Buckbee, PE

MMAT-261 PROCESS CONTROL

INSTRUCTIONAL OBJECTIVES

1. PROCESS CONTROL
    - 1.1 Define Systems concept
    - 1.2 Describe Major Basic systems functions and Measurements
    - 1.3 Understanding of Process Control
    - 1.4 Explain Main Process control systems
        - 1.4.1 Open-loop
        - 1.4.2 Closed-loop
        - 1.4.3 Closed-loop variables
    - 1.5 Describe Main Systems of following:
        - 1.5.1 Hydraulic systems
        - 1.5.2 Pneumatic systems
        - 1.5.3 Static pressure systems
        - 1.5.4 Steam pressure systems
        - 1.5.5 Temperature systems
        - 1.5.6 Level determination systems
        - 1.5.7 Flow process systems
        - 1.5.8 Analytical process systems
        - 1.5.9 Microcomputer processing systems
    - 1.6 Describe Industrial processes
2. Understanding the Communication
    - 2.1 Binary Communications
    - 2.2 Analog Communications
    - 2.3 Describe Mechanical Communication w.r.t
        - 2.3.1 Communicating with Pressure: Pneumatics
        - 2.3.2 Communication with Voltage
        - 2.3.3 Communication with Current

2.4 What is Digital Communications

2.4.1 Smart Device Communications

2.4.2 Wireless Communications

2.5 Describe Converting between Signal Types with the help of

2.5.1 I/O

2.5.2 Analog to Digital

2.5.3 Digital to Analog

2.5.4 Transducers

2.6 Define Displaying Information w.r.t

2.6.1 Mechanical Displays

2.6.2 Electronic Displays

2.6.3 Computer Displays

3. Understanding the MEASURMENTS AND SENSORS

3.1 Introduction to Data interpretation and measurement errors

3.2 Describe General Interpreting errors in measurements

3.3 Define Physical parameters w.r.t:

3.3.1 Pressure systems

3.3.2 Thermal systems

3.3.3 Level determining systems

3.3.4 Flow process systems

3.3.5 Analytical systems

3.4 Explanation of the following terms:

3.4.1 Accuracy

3.4.2 Resolution

3.4.3 Repeatability

3.4.4 Sensitivity

3.4.5 Response time

3.5 Description of Sensor w.r.t:

3.5.1 Position

3.5.2 Temperature

3.5.3 Force

3.5.4 Pressure

3.5.5 Flow

3.5.6 Vibration

3.5.7 Level

3.5.8 Weighting

3.6 Study of Calibration process

4. Understanding the DATA Acquisition and Documentation

4.1 Describe Data Acquisition

4.2 Major Key issues w.r.t:

4.2.1 Measurements

4.2.2 Data

4.2.3 Users

4.3 Main Types of Data Acquisition equipment

4.4 Performances of Data Acquisition equipment

4.5 Explain Types and Applications of Data Acquisition

4.6 Study Control System Documentation w.r.t:

4.6.1 Process flow diagram

4.6.2 P&ID Drawing

4.6.3 Instrument Index and Specifications

4.6.4 Piping Diagram

4.6.5 Control Narratives

4.6.6 Loop and Logic Diagram

5. Understanding the BASICS OF PROCESS CONTROL SOFTWARE

5.1 Define Purpose of Process control software

5.2 To study Configuration of the software environment

5.3 What is Generation of a Graphical user interface?

5.4 Define Tagging process of the elements in the process

5.5 Testing and debugging of the program

5.6 Use of a PLC using a PID interface for process control

5.7 Use of a PC for process control

6. BEYOND THE BASICS OF PROCESS CONTROL

6.1 Describe Advanced Regulatory Control w.r.t:

6.1.1 Cascade Control

6.1.2 Feed forward Control

6.1.3 Ratio Control

6.1.4 Signal Characterizers

6.1.5 Gain Scheduling and Gap Controllers

6.2 Describe Model Predictive Control

6.3 Explain Artificial Intelligence in Process Control w.r.t:

6.3.1 Fuzzy Logic Controllers

6.3.2 Neural Networks

6.4 Describe Safety Instrumented Systems

6.5 Describe Diagnostics and Analytics w.r.t:

6.5.1 Instrument and Valve Diagnostics

6.5.2 Control Loop Performance Monitoring

6.6 Define Alarm Management

MMAT 301 **Industrial Enterprise Management**

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

AIM: After going through this course, student will be able to:

I. Material management;

II. Production management;

III. Equipment management;

IV. Labor management;

V. Technical management;

VI. Marketing management;

VII. Financial management;

Course Contents:

1.	**Introduction**	**4Hrs**
2.	**Material management**	**4Hrs**
3.	**Production management**	**4Hrs**
4.	**Equipment management**	**4Hrs**
5.	**Labor Management**	**4Hrs**
6.	**Technical Management**	**6Hrs**
7.	**Marketing Management**	**2Hrs**
8.	**Financial Management**	**2Hrs**
9.	**Common Practical Writing in Enterprise Management**	**2Hrs**

Detail of Contents:

1. Introduction **4Hrs**

1.1 Enterprise Overview
1.2 Industrial enterprises
1.3 Industrial Enterprise Management

2. Material management **4Hrs**

2.1 Types of Materials for Industrial Enterprises
2.2 Material procurement and storage management
2.3 Material Warehouse Management

3. Production management **4Hrs**

3.1 Types, composition, and processes of industrial production
3.2 Organization of the production process
3.3 Production Optimization Decision
3.4 Material consumption control
3.5 Quality Management
3.6 Production site management

4. Equipment management **4Hrs**

4.1 Types of Industrial Equipment
4.2 Equipment production capacity and demand verification
4.3 Evaluation of Equipment Utilization Status
4.4 Maintenance and Repair of Equipment
4.5 Equipment updates and modifications

5. Labor Management **4Hrs**

5.1 Labor Management
5.2 Evaluation of Labor Time Utilization
5.3 Labor Quota
5.4 Labor productivity

6. Technical Management **6Hrs**

6.1 Product development
6.2 Technical Innovation and Transformation
6.3 Technology Introduction

7. Marketing Management **2Hrs**

7.1 Marketing Strategy
7.2 Sales Planning
7.3 Sales Business Management

8. Financial Management **2Hrs**

8.1 Cost and expense management
8.2 Fund raising management
8.3 Asset Management
8.4 Project Investment Management
8.5 Taxes and profits
8.6 Evaluation of Enterprise Economic Benefits

9. Common Practical Writing in Enterprise Management **2Hrs**

9.1 Writing Management Systems
9.2 Writing of Economic Contracts
9.3 Writing Business Letters
9.4 Writing of other applied documents

Recommended Textbooks:

1. The Industrial Enterprise Management (3rd Edition)by Zhang Qing (Publisher: China Machinery Industry Press, 2023)
2. The Modern Industrial Enterprise Management by Liu Xiaofeng (Publisher: China Machinery Industry Press, 2022)
3. The Engineering Economics and Industrial Enterprise Management by Liu Weiwei (Publisher: China Machinery Industry Press, 2023)

MMAT 301 Industrial Enterprise Management

Instructional Objectives:

1. **Introduction**
   - 1.1 Describe Enterprise Overview
   - 1.2 Describe Industrial enterprises
   - 1.3 Understand Industrial Enterprise Management
2. **Material management**
   - 2.1 Understand Types of Materials for Industrial Enterprises
   - 2.2 Understand Material procurement and storage management
   - 2.3 Understand Material Warehouse Management
3. **Production management**
   - 3.1 Understand Types, composition, and processes of industrial production
   - 3.2 Understand Organization of the production process
   - 3.3 Describe Production Optimization Decision
   - 3.4 Understand Material consumption control
   - 3.5 Understand Quality Management
   - 3.6 Understand Production site management
4. **Equipment management**
   - 4.1 Understand Types of Industrial Equipment
   - 4.2 Understand Equipment production capacity and demand verification
   - 4.3 Understand Evaluation of Equipment Utilization Status
   - 4.4 Understand Maintenance and Repair of Equipment
   - 4.5 Understand Equipment updates and modifications
5. **Labor Management**
   - 5.1 Understand Labor Management
   - 5.2 Understand Evaluation of Labor Time Utilization
   - 5.3 Understand Labor Quota
   - 5.4 Understand Labor productivity
6. **Technical Management**
   - 6.1 Describe Product development
   - 6.2 Describe Technical Innovation and Transformation
   - 6.3 Describe Technology Introduction
7. **Marketing Management**
   - 7.1 Understand Marketing Strategy
   - 7.2 Describe Sales Planning
   - 7.3 Understand Sales Business Management
8. **Financial Management**
   - 8.1 Understand Cost and expense management
   - 8.2 Understand Fund raising management
   - 8.3 Understand Asset Management
   - 8.4 Describe Project Investment Management
   - 8.5 Explain Taxes and profits
   - 8.6 Describe Evaluation of Enterprise Economic Benefits

9. Common Practical Writing in Enterprise Management

9.1 Understand Writing Management Systems
9.2 Understand Writing of Economic Contracts
9.3 Understand Writing Business Letters
9.4 Explain Writing of other applied documents

MMAT-312 **Hydraulic and pneumatic**

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

AIMS: After going through this course, student will be able to:

I. Introduce the basic knowledge of hydraulic and pneumatic systems;

II.Added knowledge of some new hydraulic and pneumatic components and their applications;

III.Emphasized the structural principles and typical circuits and systems of commonly used hydraulic and pneumatic components;

IV. Introduced the fault diagnosis and troubleshooting methods of the hydraulic system.

Course Contents:

1.	**Understanding of hydraulic and pneumatic transmission**	**4Hrs**
2.	**Basic knowledge of hydraulic transmission**	**4Hrs**
3.	**Hydraulic components**	**4Hrs**
4.	**Hydraulic circuit and system**	**6Hrs**
5.	**Fundamentals of Pneumatic Transmission**	**6Hrs**
6.	**Pneumatic circuit**	**6Hrs**
7.	**Fault diagnosis and troubleshooting of hydraulic system**	**2Hrs**

Detail of Contents:

1. Understanding of hydraulic and pneumatic transmission **4Hrs**

1.1 Working principle and composition of hydraulic and pneumatic transmission systems

1.2 Advantages, Disadvantages and Development of Hydraulic and Pneumatic Transmission

2. Basic knowledge of hydraulic transmission **4Hrs**

2.1 Hydraulic oil

2.2 Liquid Statics foundation

2.3 Fundamentals of Liquid Dynamics

2.4 Flow rate of liquid through small holes and gaps

3. Hydraulic components **4Hrs**

3.1 Hydraulic pump

3.2 Hydraulic motor and hydraulic cylinder

3.3 Hydraulic control valve

3.4 Hydraulic auxiliary components

4. Hydraulic circuit and system **6Hrs**

4.1 Pressure control circuit
4.2 Speed control circuit
4.3 Direction control circuit
4.4 Multi cylinder operation control circuit
4.5 Hydraulic system of power sliding table for modular machine tools
4.6 Hydraulic system of universal cylindrical grinder

5. Fundamentals of Pneumatic Transmission **6Hrs**

5.1 Pneumatic transmission working medium
5.2 Air source device and auxiliary components
5.3 Pneumatic actuator
5.4 Pneumatic control components

6. Pneumatic circuit **6Hrs**

6.1 Pneumatic basic circuit
6.2 Typical pneumatic transmission system

7. Fault diagnosis and troubleshooting of hydraulic system **2Hrs**

7.1 Fault diagnosis of hydraulic system
7.2 Fault diagnosis and troubleshooting methods for typical hydraulic components, circuits, and systems

Recommended Textbooks:

1. The Hydraulic and pneumatic by Zhou Dayong (Publisher: China Machinery Industry Press, 2022)
2. The Hydraulic and Pneumatic Technology (4th Edition) by Xu Yanxia andYao Lingfeng and Cui Peixue (Publisher: China Machinery Industry Press, 2023)
3. The Hydraulic and Pneumatic Technology (5th Edition) by Zhao Bo and Wang Hongyuan (Publisher: China Machinery Industry Press, 2020)

MMAT-312 Hydraulic and Pneumatic

Instructional Objectives:

1. **Understanding of hydraulic and pneumatic transmission**
   - 1.1 Describe Working principle and composition of hydraulic and pneumatic transmission systems
   - 1.2 Describe Advantages, Disadvantages and Development of Hydraulic and Pneumatic Transmission
2. **Basic knowledge of hydraulic transmission**
   - 2.1 Describe Hydraulic oil
   - 2.2 Understand Liquid Statics foundation
   - 2.3 Understand Fundamentals of Liquid Dynamics
   - 2.4 Understand Flow rate of liquid through small holes and gaps
3. **Hydraulic components**
   - 3.1 Understand Hydraulic pump
   - 3.2 Understand Hydraulic motor and hydraulic cylinder
   - 3.3 Understand Hydraulic control valve
   - 3.4 Understand Hydraulic auxiliary components
4. **Hydraulic circuit and system**
   - 4.1 Understand Pressure control circuit
   - 4.2 Understand Speed control circuit
   - 4.3 Understand Direction control circuit
   - 4.4 Understand Multi cylinder operation control circuit
   - 4.5 Understand Hydraulic system of power sliding table for modular machine tools
   - 4.6 Explain Hydraulic system of universal cylindrical grinder
5. **Fundamentals of Pneumatic Transmission**
   - 5.1 Understand Pneumatic transmission working medium
   - 5.2 Understand Air source device and auxiliary components
   - 5.3 Understand Pneumatic actuator
   - 5.4 Understand Pneumatic control components
6. **Pneumatic circuit**
   - 6.1 Understand Pneumatic basic circuit
   - 6.2 Understand Typical pneumatic transmission system
7. **Fault diagnosis and troubleshooting of hydraulic system**
   - 7.1 Understand Fault diagnosis of hydraulic system
   - 7.2 Explain Fault diagnosis and troubleshooting methods for typical hydraulic components, circuits, and systems

MMAT-312 Hydraulic and Pneumatic
List of Practical

1. Experiment on fluid flow resistance characteristics **12Hrs**
- 1.1 Overview
- 1.2 Experimental Purpose
- 1.3 Experimental Principles
- 1.4 Experimental setup
- 1.5 Experimental Operations
- 1.6 Data Processing and Experimental Reports
- 1.7 General precautions for fluid experimental equipment

2. Flow and pressure characteristics of hydraulic pumps and application experiments of proportional relief valves **16Hrs**
- 2.1 Overview
- 2.2 Experimental Purpose
- 2.3 Experimental Principles
- 2.4 Experimental setup
- 2.5 Experimental Operations
- 2.6 Data Processing and Experimental Reports

3. Load characteristic experiment of throttle speed control system **16Hrs**
- 3.1 Overview
- 3.2 Experimental Purpose
- 3.3 Experimental Principles
- 3.4 Experimental setup
- 3.5 Experimental Operations
- 3.6 Data Processing and Experimental Reports

4. Application experiment of electro-hydraulic proportional servo system **16Hrs**
- 4.1 Overview
- 4.2 Experimental Purpose
- 4.3 Experimental Principles
- 4.4 Experimental setup
- 4.5 Experimental Operations
- 4.6 Data Processing and Experimental Reports

5. Implementation of pneumatic automation system **12Hrs**
- 5.1 Overview
- 5.2 Experimental Purpose
- 5.3 Experimental Principles
- 5.4 Experimental setup
- 5.5 Experimental Operations
- 5.6 Data processing and experimental reports

6. Disassembly and assembly experiment of hydraulic pump **12Hrs**

6.1 Overview

6.2 Experimental Purpose

6.3 Experimental setup

6.4 Experimental Content and Principles

6.5 Common faults and troubleshooting methods of several typical hydraulic pumps

7. Disassembly and assembly experiments of hydraulic valves and cylinders **12Hrs**

7.1 Overview

7.2 Experimental Purpose

7.3 Experimental setup

7.4 Experimental Content and Principles

7.5 Precautions for Using Several Typical Hydraulic Valves

7.6 Common faults and troubleshooting methods of several typical hydraulic valves

MMAT 322 **Fault diagnosis and maintenance of CNC machine tools**

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

AIMS: After going through this course, student will be able to:

I. Understand the introduction to fault diagnosis and maintenance of CNC machine tools;

II. Master the diagnosis and maintenance of spindle electrical system faults;

III. Introduce the fault diagnosis and maintenance of the spindle electromechanical system;

IV. Describe the fault diagnosis and maintenance of the feed transmission system;

V. Describe the diagnosis of alarm faults in the CNC system.

Course Contents:

1.	**Fault diagnosis and maintenance preparation for CNC machine tools**	**4Hrs**
2.	**Debugging and Maintenance of FANUC 0i Mate-D CNC System**	**4Hrs**
3.	**Debugging and maintenance of the feed servo system**	**4Hrs**
4.	**Debugging and maintenance of the 4-axis drive system**	**6Hrs**
5.	**Debugging and Maintenance Diagnosis of FANUC PMC System**	**6Hrs**
6.	**Typical Fault Diagnosis and Maintenance of CNC Machine Tools**	**6Hrs**
7.	**Acceptance and accuracy testing of CNC machine tools**	**2Hrs**

Detail of Contents:

1. Fault diagnosis and maintenance preparation for CNC machine tools **4Hrs**

1.1 Fault diagnosis and Computerized maintenance management system of CNC machine tools

1.2 Common maintenance tools and spare parts for CNC machine tools

2. Debugging and Maintenance of FANUC 0i Mate-D CNC System **4Hrs**

2.1 Operation of FANUC 0i Mate-D CNC System

2.2 Connection of FANUC 0i Mate-D CNC System

2.3FANUC 0i Mate-D CNC System Basic Parameter Settings

2.4FANUC 0i Mate-D CNC System Alarm and Power Failure

3. Debugging and maintenance of the feed servo system **4Hrs**

3.1 FANUC β Connection of i-series servo unit

3.2 Setting of initialization parameters for the feed servo system

3.3 Adjustment and optimization settings of feed servo system

3.4 Feed servo system servo channel FSSB setting

3.5 Alarm faults and diagnosis of feed servo system
3.6 CNC machine tool return reference point fault
3.7 Daily maintenance of servo amplifiers and servo motors

4. Debugging and maintenance of the 4-axis drive system 6Hrs

4.1 Connection of simulated spindle drive and Mitsubishi FR-S500 universal frequency converter
4.2 Simulated spindle frequency converter and CNC system parameter setting
4.3 Serial spindle drive and FANUC β Connection of SVSP series servo units
4.4 Parameter Setting and Adjustment of Serial Spindle CNC System
4.5 Abnormal motor speed fault of spindle drive system

5. Debugging and Maintenance Diagnosis of FANUC PMC System 6Hrs

5.1 FANUC system PMC screen operation
5.2 FANUC PMC Address Allocation and Sequential Programming
5.3FANUC CNC system PMC parameter setting
5.4 Use of FANUC LADDER-III software

6. Typical Fault Diagnosis and Maintenance of CNC Machine Tools 6Hrs

6.1 Emergency stop, overtravel, and stored travel detection faults
6.2 Working mode selection failure
6.3 Jog feed JOG operation failure
6.4 Handwheel operation failure
6.5 Automatic operation function failure
6.6 CNC lathe automatic tool changer failure
6.7 Data transmission and backup of CNC system

7. Acceptance and accuracy testing of CNC machine tools 2Hrs

7.1 Installation, debugging and acceptance of CNC machine tools
7.2 Geometric accuracy testing of CNC machine tools
7.3 Positioning accuracy detection and pitch compensation of CNC machine tools

Recommended Textbooks:

1. The Fault diagnosis and maintenance of CNC machine tools by Jiang Yongxiang (Publisher: China Machinery Industry Press, 2019)
2. The Fault diagnosis and maintenance of CNC machine tools by Cui Yongbo(Publisher: China Machinery Industry Press, 2022)
3. The Fault diagnosis and maintenance of CNC machine tools by Luo Yongshun and Zhang Ning(Publisher: China Machinery Industry Press, 2018)

MMAT322 Fault diagnosis and maintenance of CNC machine tools

Instructional Objectives:

1. **Fault diagnosis and maintenance preparation for CNC machine tools**
   - 1.1 Describe Fault diagnosis and Computerized maintenance management system of CNC machine tools
     - 1.1.1 Understand Causes of CNC machine tool malfunctions
     - 1.1.2 Understand General methods for troubleshooting CNC machine tools
     - 1.1.3 Understand Requirements for maintenance technical data of CNC machine tools
   - 1.2 Describe Common maintenance tools and spare parts for CNC machine tools
     - 1.2.1 Understand Common CNC machine tool maintenance tools
     - 1.2.2 Understand Common CNC machine tool maintenance instruments
     - 1.2.3 Understand Common CNC machine tool maintenance instruments
     - 1.2.4 Understand Common Electrical Components of CNC Machine Tools
2. **Debugging and maintenance of FANUC 0i Mate-D CNC system**
   - 2.1 Operation of FANUC 0i Mate-D CNC System
     - 2.1.1Understand FANUC 0i Mate-D CNC System MDI Panel
     - 2.1.2 Understand Images related to CNC system and machining operations
     - 2.1.3 Understand Screens related to CNC system and machine tool maintenance operations
   - 2.2 Connection of FANUC 0i Mate-D CNC System
     - 2.2.1Understand Basic composition of FANUC 0i Mate-D CNC system
     - 2.2.2Understand FANUC 0i Mate-D CNC system overall connection
     - 2.2.3Understand FANUC 0i Mate-D control unit hardware connection
     - 2.2.4Understand FANUC 0i Mate-D control unit interface
   - 2.3 FANUC 0i Mate-D CNC System Basic Parameter Settings
     - 2.3.1 Understand Classification of CNC system parameters
     - 2.3.2Understand Display of CNC system parameters
     - 2.3.3 Understand Writing of CNC system parameters
     - 2.3.4 Understand Initial parameter setting of CNC system
   - 2.4 FANUC 0i Mate-D CNC System Alarm and Power Failure
     - 2.4.1 Understand FANUC 0i Mate-D CNC System Alarm Fault Classification
     - 2.4.2 Understand Typical System Alarm Fault Diagnosis and Maintenance
     - 2.4.3 Understand Power on and off control of CNC system
     - 2.4.4 Understand Fault manifestations and causes of CNC system power supply
3. **Debugging and maintenance of the feed servo system**
   - 3.1 FANUC β Connection of i-series servo unit
     - 3.1.1 Understand CNC machine tool feed servo system

3.1.2 Understand FANUC β Composition of i-series servo system
3.1.3 Understand FANUC β Connection of i-series servo unit
3.1.4 Understand FANUC β I series servo unit interface
3.1.5 Understand FANUC β I SVSP series servo unit interface
3.2 Setting of initialization parameters for the feed servo system
3.2.1 Understand CNC system sampling cycle servo system control process
3.2.2 Understand Parameter initialization setting of feed servo system
3.2.3 Understand Steps for initializing the parameters of the feed servo system
3.3 Adjustment and optimization settings of feed servo system
3.3.1 Understand Feed servo system parameter adjustment screen
3.3.2 Understand FANUC 0i Mate-D CNC system common servo system adjustment parameters
3.3.3 Understand FANUC 0i Mate-D CNC system and error related servo parameters
3.3.4 Understand Rapid feed bell acceleration/deceleration control of feed servo system
3.3.5 Understand Acceleration/deceleration time control for manual feeding
3.4 Feed servo system servo channel FSSB setting
3.4.1 Understand FANUC FSSB servo channel setting
3.4.2 Understand Common FSSB Setting Alarm
3.5 Alarm faults and diagnosis of feed servo system
3.5.1 Understand Automatic operation diagnosis of feed servo system
3.5.2 Understand CNC system servo system control diagnosis
3.5.3 Understand Common faults of feed servo system
3.6 CNC machine tool return reference point fault
3.6.1 Understand CNC machine tool return reference point (REF) action
3.6.2 Understand Deceleration block method return to reference point
3.6.3 Understand Signal for manually returning to the reference point
3.6.4 Understand The length of the deceleration stop and the setting of the grid fine adjustment reference point
3.6.5 Understand Return parameters related to reference points
3.6.6 Understand Fault diagnosis ideas for returning to reference points
3.6.7 Understand Common Fault Cases for Returning to Reference Points
3.7 Daily maintenance of servo amplifiers and servo motors
3.7.1 Understand Servo amplifier label
3.7.2 Understand Servo motor labels
3.7.3 Explain Encoder labels
3.7.4 Understand Daily maintenance of servo amplifiers and servo motors

4. Debugging and maintenance of spindle drive system

4.1 Connection of simulated spindle drive and Mitsubishi FR-S500 universal frequency converter

4.1.1 Understand Simulate spindle drive system

4.1.2 Understand Mitsubishi FR-S500 frequency converter power supply and strong current wiring terminals

4.1.3 Understand Mitsubishi FR-S500 frequency converter weak current control wiring terminals

4.1.4 Understand Mitsubishi FR-S500 frequency converter standard wiring diagram

4.1.5 Understand Composition of the spindle electrical circuit

4.2 Simulated spindle frequency converter and CNC system parameter setting

4.2.1 Understand Numerical control system simulation spindle parameter setting

4.2.2 Understand Mitsubishi FR-S500 frequency converter operation panel operation

4.2.3 Understand Basic parameter settings for Mitsubishi FR-S500 frequency converter

4.3 Serial spindle drive and FANUC β Connection of SVSP series servo units

4.3.1 Understand Serial Spindle Drive System

4.3.2 Understand FANUC β Spindle control interface of the SVSP series servo unit

4.4 Parameter Setting and Adjustment of Serial Spindle CNC System

4.4.1 Understand CNC system serial spindle function

4.4.2 Understand Numerical control system serial spindle system parameters and signals

4.4.3 Understand CNC system spindle setting and adjustment screen

4.5 Abnormal motor speed fault of spindle drive system

4.5.1 Understand Common faults of spindle drive system

4.5.2 Understand Common faults of spindle motor

5. Debugging and maintenance diagnosis of FANUC PMC system

5.1 FANUC system PMC screen operation

5.1.1 Understand FANUC PMC

5.1.2 Understand FANUC PMC operation screens

5.2 FANUC PMC Address Allocation and Sequential Programming

5.2.1 Understand FANUC PMC Level 2 Sequential Program

5.2.2 Understand FANUC PMC signal channel

5.2.3 Understand FANUC PMC I/O interface device type

5.2.4 Understand Connection of FANUC PMC I/O LINK module

5.3 FANUC CNC system PMC parameter setting

5.3.1 Understand PMC diagnostic screen parameter setting

5.3.2 Understand PMC ladder monitoring screen parameter setting

5.4 Use of FANUC LADDER-III software

5.4.1 Understand FANUC LADDER-III software

5.4.2 Understand Operation of FANUC LADDER-III software

5.4.3 Understand FANUC LADDER-III software online monitoring

6. Typical Fault Diagnosis and Maintenance of CNC Machine Tools

6.1 Emergency stop, overtravel, and stored travel detection faults

6.1.1 Understand CNC machine tool emergency stop function

6.1.2 Understand Emergency stop control interface circuit

6.1.3 Understand Hardware overtravel detection function of CNC machine tools

6.1.4 Understand CNC machine tool storage stroke detection 1 function

6.2 Working mode selection failure

6.2.1 Understand CNC machine tool working mode selection switch

6.2.2 Understand Relevant signals for selecting the working mode of CNC machine tools

6.2.3 Understand Working mode selection function PMC control ladder diagram

6.2.4 Understand Interface circuit for selecting the working mode of CNC machine tools

6.3 Jog feed JOG operation failure

6.3.1 Understand Jog feed JOG operation mode

6.3.2 Understand Signal related to JOG operation mode for jog feed

6.3.3 Understand Parameters related to jog feed JOG operation mode

6.3.4 Understand Jog feed JOG interface circuit

6.4 Handwheel operation failure

6.4.1 Understand Handwheel operation mode

6.4.2 Understand Signals related to handwheel operation mode

6.4.3 Understand Parameters related to handwheel operation mode

6.4.4 Understand Handwheel operation mode interface circuit

6.5 Automatic operation function failure

6.5.1 Understand Control buttons related to automatic operation mode

6.5.2 Understand Signals related to automatic operation function

6.5.3 Understand Parameters related to automatic operation function

6.5.4 Understand Automatic operation interface circuit

6.5.5 Understand Diagnostic steps for automatic operation function faults

6.6 CNC lathe automatic tool changer failure

6.6.1 Understand Action process of electric tool holder under manual operation mode

6.6.2 Understand PMC program for tool holder change under manual operation mode

6.6.3 Understand Action process of electric tool holder under automatic operation mode

6.7 Data transmission and backup of CNC system

6.7.1 Understand RS-232 serial communication cable data transmission and backup

6.7.2 Understand RS-232 serial communication data transmission and backup steps

6.7.3 Understand CF storage card data transmission and backup

7. Acceptance and accuracy testing of CNC machine tools

7.1 Installation, debugging and acceptance of CNC machine tools

7.1.1 Understand Installation of CNC machine tool body
7.1.2 Understand Connection of CNC system
7.1.3 Understand Power-on test of CNC machine tools
7.1.4 Understand Installation and adjustment of CNC machine tools
7.1.5 Understand Operation of machining center tool change device
7.1.6 Understand Trial operation of CNC machine tools
7.1.7 Understand Acceptance of CNC machine tools
7.2 Geometric accuracy testing of CNC machine tools
7.2.1 Understand Inspection of Geometric Accuracy of CNC Lathes
7.2.2 Understand Inspection of geometric accuracy of CNC milling machines
7.3 Positioning accuracy detection and pitch compensation of CNC machine tools
7.3.1 Understand Positioning accuracy and repeated positioning accuracy of CNC machine tools
7.3.2 Understand Compensation for pitch error and reverse clearance of CNC machine tools
7.3.3 Understand System parameters related to pitch error compensation

MMAT322 Fault diagnosis and maintenance of CNC machine tools

List of Practical

1. **Structure and composition of the CNC system comprehensive training platform** **12Hrs**
   - 1.1 Components of the CNC System Comprehensive Training Platform
   - 1.2 Connection of CNC system comprehensive training platform components
   - 1.3 Basic Operation of CNC System Comprehensive Training Platform
2. **Connection and debugging of CNC system** **12Hrs**
   - 2.1 Connection of CNC system
   - 2.2 Debugging of CNC system
   - 2.3 Setting of CNC system connection faults
3. **Parameter Setting and Adjustment of CNC System** **12Hrs**
   - 3.1 Backup and recovery of CNC system parameters
   - 3.2 Setting of CNC system parameters
   - 3.3 Modification and Debugging of CNC System Parameters
   - 3.4 Setting of CNC system parameter faults
4. **Debugging and use of stepper units** **12Hrs**
   - 4.1 Setting of stepper motor driver parameters
   - 4.2 Connection of stepper motor winding
   - 4.3 Measurement of characteristics of stepper motors
   - 4.4 Setting of stepper driver faults
5. **Debugging and use of AC servo system** **8Hrs**
   - 5.1 Adjustment of servo driver
   - 5.2 Setting of AC Drive Faults
   - 5.3 Implementation of a fully closed-loop CNC system
6. **Debugging and use of spindle unit** **8Hrs**
   - 6.1 Control method of frequency converter
   - 6.2 Use of intelligent terminals for frequency converters and motor characteristics
   - 6.3 Initialization and parameter settings of frequency converters
   - 6.4 Setting of frequency converter faults
7. **Detection and troubleshooting of tool change mechanism faults** **8Hrs**
   - 7.1 Common faults and diagnosis of tool holder and tool change
   - 7.2 Setting of Tool Holder Parameter Faults
8. **Detection and troubleshooting of PLC faults** **8Hrs**
   - 8.1 Content and Method of Standard PLC Debugging
   - 8.2 Modification and Debugging of Standard PLC
9. **PLC programming and debugging** **8Hrs**
   - 9.1 Compilation and Debugging of PLC Program for Huazhong CNC System
   - 9.2 Writing of Simple PLC Programs
10. **Programming of ladder diagram** **8Hrs**
    - 10.1 Use of basic components
    - 10.2 Use of functional modules

MMAT331 **Mechanical Manufacturing Technology**

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

AIMS: After going through this course, student will be able to:

I.Introduced the basic knowledge of mechanical manufacturing, machining methods and machine tools

II.Described the principles of metal cutting processing and the tools, machine tool fixtures;

III.Described the analysis and control of machining quality

Explained the formulation of mechanical processing process regulations, the foundation of machine assembly process, and the foundation of intelligent manufacturing;

IV. Introduced the relevant knowledge of intelligent manufacturing foundation.

Course Contents:

1.	**Formulation of mechanical processing process regulations**	**4Hrs**
2.	**Processing of shaft parts**	**4Hrs**
3.	**Processing of mold working parts**	**4Hrs**
4.	**Processing of box parts**	**4Hrs**
5.	**Cylindrical gear processing**	**4Hrs**
6.	**Mechanical processing accuracy**	**6Hrs**
7.	**Machined surface qualit**	**2Hrs**
8.	**Fundamentals of Mechanical Assembly Process**	**2Hrs**
9.	**Introduction to Modern Processing Technology**	**2Hrs**

Detail of Contents:

1. Formulation of mechanical processing process regulations **4Hrs**

1.1 Basic concepts

1.2 Principles, Steps, and Original Data for Formulating Process Procedures

1.3 Process Analysis of Parts

1.4 Selection of blank

1.5 Workpiece positioning and selection of positioning reference

1.6 Formulation of process route

1.7 CNC machining process design

1.8 Determination of machining allowance

1.9 Determination of process dimensions and tolerances

1.10 Selection of machine tools, process equipment, etc
1.11 Example of Process Procedure Design
1.12 Productivity and Technical Economic Analysis of Mechanical Processing

2. Processing of shaft parts **4Hrs**

2.1 Overview
2.2 Surface turning processing
2.3 Grinding of Outer Circular Surface
2.4 Precision machining of cylindrical surfaces
2.5 Spline and External Thread Processing
2.6 CNC turning process
2.7 Analysis of typical shaft parts processing technology

3. Processing of mold working parts **4Hrs**

3.1 Overview
3.2 Forming Grinding Method
3.3 Fixture and application for dressing formed grinding wheels
3.4 Common fixtures and applications for forming grinding
3.5 Analysis of Processing Technology for Mold Working Parts

4. Processing of box parts **4Hrs**

4.1 Overview
4.2 Plane processing method for box type parts
4.3 CNC milling processin
4.4 Hole System Processing of Box Parts
4.5 Analysis of machining accuracy of box hole system
4.6 Analysis of Processing Technology for Box Parts

5. Cylindrical gear processing **4Hrs**

5.1 Overview
5.2 Tooth profile machining
5.3 Analysis of cylindrical gear processing technology

6. Mechanical processing accuracy **6Hrs**

6.1 Overview
6.2 Geometric errors of the process system
6.3 Impact of force deformation on machining accuracy of process system
6.4 Impact of thermal deformation of process system on machining accuracy
6.5 The influence of internal stress in workpieces on machining accuracy
6.6 Measures to improve machining accuracy

7. Machined surface quality **2Hrs**

7.1 Overview
7.2 Factors affecting surface roughness during machining
7.3 Factors affecting the physical and mechanical properties of machined surfaces
7.4 Vibration and Control Measures in Mechanical Processing
7.5 Ways to control the surface quality of machining

8. Fundamentals of Mechanical Assembly Process 2Hrs

8.1 Overview
8.2 Assembly accuracy of mechanical products
8.3 Assembly method and selection
8.4 Assembly method and assembly of typical components
8.5 Formulation of assembly process regulations

9. Introduction to Modern Processing Technology 2Hrs

9.1 Overview
9.2 Special processing technology
9.3 micron/nanotechnology
9.4 Group technology

Recommended Textbooks:

1. The Mechanical Manufacturing Technology （2th Edition)by Zhu Huanchi (Publisher: China Machinery Industry Press, 2023)
2. The Mechanical Manufacturing Technology （4th Edition)by Wang Xiankui (Publisher: China Machinery Industry Press, 2023)
3. The Mechanical Manufacturing Technology （2th Edition)by Chen Ming (Publisher: China Machinery Industry Press, 2022)

MMAT331 Mechanical Manufacturing Technology

Instructional Objectives:

1. **Formulation of mechanical processing process regulations**
   - 1.1 Describe Basic concepts
   - 1.2 Understand Principles, Steps, and Original Data for Formulating Process Procedures
   - 1.3 Understand Process Analysis of Parts
   - 1.4 Understand Selection of blank
   - 1.5 Understand Workpiece positioning and selection of positioning reference
   - 1.6 Understand Formulation of process route
   - 1.7 Understand CNC machining process design
   - 1.8 Understand Determination of machining allowance
   - 1.9 Understand Determination of process dimensions and tolerances
   - 1.10 Understand Selection of machine tools, process equipment, etc
   - 1.11 Understand Example of Process Procedure Design
   - 1.12 Explain Productivity and Technical Economic Analysis of Mechanical Processing
2. **Processing of shaft parts**
   - 2.1 Describe Overview
   - 2.2 Understand Surface turning processing
   - 2.3 Understand Grinding of Outer Circular Surface
   - 2.4 Understand Precision machining of cylindrical surfaces
   - 2.5 Understand Spline and External Thread Processing
   - 2.6 Understand CNC turning process
   - 2.7 Understand Analysis of typical shaft parts processing technology
3. **Processing of mold working parts**
   - 3.1 Describe Overview
   - 3.2 Understand Forming Grinding Method
   - 3.3 Understand Fixture and application for dressing formed grinding wheels
   - 3.4 Understand Common fixtures and applications for forming grinding
   - 3.5 Understand Analysis of Processing Technology for Mold Working Parts
4. **Processing of box parts**
   - 4.1 Describe Overview
   - 4.2 Understand Plane processing method for box type parts
   - 4.3 Understand CNC milling processin
   - 4.4 Understand Hole System Processing of Box Parts
   - 4.5 Understand Analysis of machining accuracy of box hole system
   - 4.6 Understand Analysis of Processing Technology for Box Parts
5. **Cylindrical gear processing**
   - 5.1 Describe Overview
   - 5.2 Understand Tooth profile machining
   - 5.3 Understand Analysis of cylindrical gear processing technology

6. Mechanical processing accuracy

6.1 Describe Overview

6.2 Understand Geometric errors of the process system

6.3 Understand Impact of force deformation on machining accuracy of process system

6.4 Understand Impact of thermal deformation of process system on machining accuracy

6.5 Understand The influence of internal stress in workpieces on machining accuracy

6.6 Understand Measures to improve machining accuracy

7. Machined surface quality

7.1 Describe Overview

7.2 Understand Factors affecting surface roughness during machining

7.3 Understand Factors affecting the physical and mechanical properties of machined surfaces

7.4 Understand Vibration and Control Measures in Mechanical Processing

7.5 Understand Ways to control the surface quality of machining

8. Fundamentals of Mechanical Assembly Process

8.1 Describe Overview

8.2 Understand Assembly accuracy of mechanical products

8.3 Understand Assembly method and selection

8.4 Understand Assembly method and assembly of typical components

8.5 Explain Formulation of assembly process regulations

9. Introduction to Modern Processing Technology

9.1 Describe Overview

9.2 Understand Special processing technology

9.3 Understand micron/nanotechnology

9.4 Explain Group technology

MMAT 342 **Fundamentals of Mechanical Design**

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

AIMS: After going through this course, student will be able to:

I.Introduced the composition, working principle, and motion characteristics of various transmission mechanisms;

II.Describe the design method, application scenario, and type selection,

III. Introduced the working principle and structural characteristics of general components in general;

V.Describe usage requirements, design principles, and choices.

Course Contents:

1.	**Introduction**	**2Hrs**
2.	**Kinematic Diagram And Degrees of freedom of a planar mechanism**	**4Hrs**
3.	**Plane Linkage Mechanism**	**4Hrs**
4.	**Cam Mechanism**	**2Hrs**
5.	**Other commonly used institutions**	**2Hrs**
6.	**Gear mechanism and transmission**	**6Hrs**
7.	**Other gear mechanisms and transmissions**	**2Hrs**
8.	**Wheel Train**	**2Hrs**
9.	**Belt Drive and Chain Drive**	**2Hrs**
10.	**Connection**	**2Hrs**
11.	**Selection and Design of 11 Shafting Components**	**2Hrs**
12.	**Couplings, Clutches, and Brakes**	**2Hrs**

Detail of Contents:

1. Introduction **2Hrs**

1.1 Brief History of China's Mechanical Development
1.2 Machinery manufacturing industry in line with the times
1.3 Overview of Mechanical Design
1.4 Research objects of this course
1.5 Nature and content of this course
1.6 Characteristics and learning methods of this course

2. Kinematic diagram and degrees of freedom of a planar mechanism **4Hrs**

2.1 Motion pairs and their classification
2.2 Representation method of components and motion pairs
2.3 Schematic diagram of planar mechanism motion
2.4 Degrees of Freedom of Planar Mechanisms
2.5 Calculation of degrees of freedom for planar mechanisms
2.6 Conditions for determining motion of planar mechanisms

3. plane linkage mechanism **4Hrs**

3.1 Hinged four bar mechanism
3.2 Slider four bar mechanism
3.3 Basic characteristics of planar four bar mechanisms
3.4 Introduction to Multi bar Mechanisms
3.5 Introduction to Other Institutions

4. cam mechanism **2Hrs**

4.1 Application and Types of Cam Mechanisms
4.2 Working process of cam mechanism and motion law of follower
4.3 Graphic design of disc cam profile
4.4 Several issues in the design of cam mechanisms
4.5 Structure and Materials of Cams

5. Other commonly used institutions **2Hrs**

5.1 Working principle, type, and application of ratchet mechanism
5.2 Working principle, type, and application of groove wheel mechanism
5.3 Working Principle, Types, and Applications of Incomplete Gear Mechanisms
5.4 Spiral mechanism

6. Gear mechanism and transmission **6Hrs**

6.1 Overview
6.2 Meshing characteristics of involute tooth profiles
6.3 Basic parameters of involute standard straight cylindrical gears
6.4 Meshing transmission of involute standard straight cylindrical gears
6.5 Principle and Undercutting Phenomenon of Involute Gear Processing
6.6 Introduction to cylindrical gear accuracy
6.7 Failure Forms, Design Criteria, and Material Selection of Gear Transmission
6.8 Fatigue strength of standard straight cylindrical gear transmission
calculation
6.9 Helical cylindrical gear transmission
6.10 Structural design of cylindrical gears and maintenance of gear transmission

7. Other gear mechanisms and transmissions **2Hrs**

7.1 Bevel gear transmission
7.2 Worm drive
7.3 Structure of bevel gears, worms, and worm gears

8. Wheel Train **2Hrs**

8.1 Fixed axle gear train
8.2 Planetary gear train
8.3 Hybrid gear train
8.4 Reducer

9. Belt Drive and Chain Drive **2Hrs**

9.1 Working principle, type and characteristics of belt drive
9.2 Ordinary V-belts and V-pulleys
9.3 Analysis of Belt Drive Working Capacity
9.4 Design calculation of belt drive
9.5 Tensioning, installation and maintenance of belt drive
9.6 Chain drive
9.7 Arrangement, Tensioning, and Lubrication of Chain Drive

10. Connection **2Hrs**

10.1 Overview
10.2 Thread connection
10.3 Pin connection

11. Selection and Design of Shafting Components **2Hrs**

11.1 Classification and Application of Axles
11.2 Materials and Selection of Shafts
11.3 Rolling bearings
11.4 Hub connection
11.5 Structural Design of Shafting Components
11.6 Combination design of shaft support
11.7 Calculation of strength and stiffness of the shaft
11.8 Sliding bearings
11.9 Lubrication and Sealing of Shafting Components

12. Couplings, Clutches, and Brakes **2Hrs**

12.1 Couplings
12.2 Selection of Couplings
12.3 Clutch
12.4 Brakes

Recommended Textbooks:

1. The Fundamentals of Mechanical Design (4th Edition)by Chai Pengfei and Wan Liwen (Publisher: China Machinery Industry Press, 2023)
2. The Fundamentals of Mechanical Design (2th Edition) by Tang Changsong and Cheng Qin (Publisher: China Machinery Industry Press, 2022)
3. The Fundamentals of Mechanical Design by Guo Wei(Publisher: China Machinery Industry Press, 2022)

MMAT342 Fundamentals of Mechanical Design

Instructional Objectives:

1. **Introduction**
   - 1.1 Describe Brief History of China's Mechanical Development
   - 1.2 Describe Machinery manufacturing industry in line with the times
   - 1.3 Understand Overview of Mechanical Design
   - 1.4 Understand Research objects of this course
   - 1.5 Understand Nature and content of this course
   - 1.6 Understand Characteristics and learning methods of this course
2. **Kinematic diagram and degrees of freedom of a planar mechanism**
   - 2.1 Describe Motion pairs and their classification
   - 2.2 Understand Representation method of components and motion pairs
   - 2.3 Understand Schematic diagram of planar mechanism motion
   - 2.4 Understand Degrees of Freedom of Planar Mechanisms
   - 2.5 Understand Calculation of degrees of freedom for planar mechanisms
   - 2.6 Explain Conditions for determining motion of planar mechanisms
3. **plane linkage mechanism**
   - 3.1 Describe Hinged four bar mechanism
   - 3.2 Understand Slider four bar mechanism
   - 3.3 Understand Basic characteristics of planar four bar mechanisms
   - 3.4 Understand Introduction to Multi bar Mechanisms
   - 3.5 Describe Introduction to Other Institutions
4. **cam mechanism**
   - 4.1 Application and Types of Cam Mechanisms
   - 4.2 Describe Working process of cam mechanism and motion law of follower
   - 4.3 Explain Graphic design of disc cam profile
   - 4.4 Describe Several issues in the design of cam mechanisms
   - 4.5 Describe Structure and Materials of Cams
5. **Other commonly used institutions**
   - 5.1 Describe Working principle, type, and application of ratchet mechanism
   - 5.2 Understand Working principle, type, and application of groove wheel mechanism
   - 5.3 Understand Working Principle, Types, and Applications of Incomplete Gear Mechanisms
   - 5.4 Explain Spiral mechanism
6. **Gear mechanism and transmission**
   - 6.1 Describe Overview
   - 6.2 Understand Meshing characteristics of involute tooth profiles
   - 6.3 Understand Basic parameters of involute standard straight cylindrical gears
   - 6.4 Understand Meshing transmission of involute standard straight cylindrical gears
   - 6.5 Explain Principle and Undercutting Phenomenon of Involute Gear Processing

6.6 Describe Introduction to cylindrical gear accuracy

6.7 Understand Failure Forms, Design Criteria, and Material Selection of Gear Transmission

6.8 Understand Fatigue strength of standard straight cylindrical gear transmission
calculation

6.9 Understand Helical cylindrical gear transmission

6.10 Explain Structural design of cylindrical gears and maintenance of gear transmission

7. Other gear mechanisms and transmissions

7.1 Understand Describe Bevel gear transmission

7.2 Understand Worm drive

7.3 Describe Structure of bevel gears, worms, and worm gears

8. Wheel Train

8.1 Explain Fixed axle gear train

8.2 Describe Planetary gear train

8.3 Describe Hybrid gear train

8.4 Explain Reducer

9. Belt Drive and Chain Drive

9.1 Describe Working principle, type and characteristics of belt drive

9.2 Understand Ordinary V-belts and V-pulleys

9.3 Understand Analysis of Belt Drive Working Capacity

9.4 Understand Design calculation of belt drive

9.5 Understand Tensioning, installation and maintenance of belt drive

9.6 Understand Chain drive

9.7 Describe Arrangement, Tensioning, and Lubrication of Chain Drive

10. Connection

10.1 Describe Overview

10.2 Understand Thread connection

10.3 Explain Pin connection

11. Selection and Design of Shafting Components

11.1 Describe Classification and Application of Axles

11.2 Understand Materials and Selection of Shafts

11.3 Understand Rolling bearings

11.4 Understand Hub connection

11.5 Understand Structural Design of Shafting Components

11.6 Understand Combination design of shaft support

11.7 Understand Calculation of strength and stiffness of the shaft

11.8 Explain Sliding bearings

11.9 Explain Lubrication and Sealing of Shafting Components

12. Couplings, Clutches, and Brakes

12.1 Describe Couplings

12.2 Understand Selection of Couplings

12.3 Understand Clutch

12.4 Describe Brakes

MMAT342 Fundamentals of Mechanical Design

List of Practical

1.	**1. Mechanism motion diagram mapping experiment** 1.1 Experimental Purpose 1.2 Experimental Equipment and Tools 1.3 Experimental Principles 1.4 Experimental Content and Steps 1.5 Experimental requirements	**16Hrs**
2.	**2. Experiment on Gear Generation Principle** 2.1 Experimental Purpose 2.2 Experimental content 2.3 Experimental Equipment and Tools 2.4 Experimental Principles 2.5 Experimental Steps 2.6 Communication and Summary	**16Hrs**
3.	**3. Belt transmission experiment** 3.1 Experimental Purpose 3.2 Experimental content 3.3 Experimental equipment 3.4 Working principle 3.5 Experimental Steps 3.6 Draw slip rate curve and efficiency curve	**16Hrs**
4.	**4. Experimental design and analysis of shaft system structure** 4.1 Experimental Purpose 4.2 Preview content and preparation 4.3 Experimental equipment 4.4 Experimental content 4.5 Experimental Steps 4.6 Common Bearing Fixation and Shafting Configuration Methods	**16Hrs**
5.	**5. Disassembly and assembly experiment of reducer** 5.1 Experimental Purpose 5.2 Experimental equipment 5.3 Experimental Tools 5.4 Experimental content 5.5 Experimental Steps	**16Hrs**
6.	**6. "Wisdom Fish" Creative Combination Experiment** 6.1 Experimental Purpose 6.2 Experimental requirements 6.3 Experimental Tasks and Arrangements 6.4 Experimental Equipment and Tools 6.5 Installation and connection methods of commonly used components 6.6 Experimental Steps	**16Hrs**

MMAT352 **Tooling design**

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

AIMS: After going through this course, student will be able to:

I.Understand the importance of tooling design

II.Principles of designing jigs and fixtures with their types

III.Describe the design of commonly used inspection tools

IV.Describe various fixture designs

V.Describe common tool designs

Course Contents:

1.	**Tool design**	**12Hrs**
2.	**Machine tool fixture design**	**14Hrs**
3.	**Gauge design**	**6Hrs**

Detail of Contents:

1. Tool design **12Hrs**

1.1 Design of formed turning tools
- 1.1.1 Types and clamping methods of formed turning tools
- 1.1.2 Front and rear angles of formed turning tools
- 1.1.3 Profile design of formed turning tools
- 1.1.4 Structural dimensions of formed turning tools
- 1.1.5 Design Example of Prism Forming Turning Tools

1.2. Broach design
- 1.2.1 Types and structures of broaches
- 1.2.2 Broaching method
- 1.2.3 Design of circular hole broach

1.3 Combination Tool Design
- 1.3.1 Types and characteristics of combination tools
- 1.3.2 Design of combined cutting tools

1.4 Cutting tools for CNC machine tools
- 1.4.1 Overview
- 1.4.2 Tool system for CNC cutting tools
- 1.4.3 Section 3 Efficient CNC Tools

2. Machine tool fixture design **14Hrs**

2.1 Positioning of Workpieces
2.1.1 Basic principle of workpiece positioning
2.1.2 Positioning pair and basic requirements for positioning components
2.1.3 Workpiece positioning method and positioning components
2.1.4 Analysis and calculation of positioning error
2.1.5 Composite surface positioning
2.2 Clamping of Workpieces
2.2.1 Composition and basic requirements of clamping device
2.2.2 Determination of clamping force
2.2.3 Basic clamping mechanism
2.2.4 Linkage clamping mechanism
2.3 Design method of specialized fixtures
2.3.1 Design steps for specialized fixtures
2.3.2 Selection of tolerance fits and formulation of technical requirements
2.3.3 Example Exercises and Reflection Questions for Special Fixture Design
2.4 Typical Machine Tool Fixture Design
2.4.1 Lathe fixture
2.4.2 Milling machine fixtures
2.4.3 Drilling machine fixtures
2.4.4 Boring machine fixture
2.5 Introduction to Other Machine Tool Fixtures
2.5.1 Adjustable fixture
2.5.2 Combined fixture
2.5.3 CNC machine tool fixtures and automatic fixtures
2.6 Inspection fixture
2.6.1 Classification and design considerations for inspection fixtures
2.6.2 Example of Inspection Fixture Structure

3. Gauge design **6Hrs**

3.1 Classification and design considerations for gauges
3.2 Smooth limit gauge
3.3 Linear dimension gauge
3.4 Position gauge
3.5 Sample Gauge

Recommended Textbooks:

1. The Metal Cutting Principles and Tools (5th Edition) by Lu Jianzhong (Publisher: China Machinery Industry Press, 2022)
2. The Machine Tool Fixture Design (2nd Edition) by Xue Yuanshuan (Publisher: China Machinery Industry Press, 2022)

MMAT352 Tooling design

Instructional Objectives:

1. Tool design

- 1.1 Design of formed turning tools
  - 1.1.1 Describe Types and clamping methods of formed turning tools
  - 1.1.2 Understand Front and rear angles of formed turning tools
  - 1.1.3 Understand Profile design of formed turning tools
  - 1.1.4 Understand Structural dimensions of formed turning tools
  - 1.1.5 Understand Design Example of Prism Forming Turning Tools
- 1.2. Broach design
  - 1.2.1 Understand Types and structures of broaches
  - 1.2.2 Understand Broaching method
  - 1.2.3 Understand Design of circular hole broach
- 1.3 Combination Tool Design
  - 1.3.1 Understand Types and characteristics of combination tools
  - 1.3.2 Understand Design of combined cutting tools
- 1.4 Cutting tools for CNC machine tools
  - 1.4.1 Understand Overview
  - 1.4.2 Understand Tool system for CNC cutting tools
  - 1.4.3 Understand Efficient CNC Tools

2. Machine tool fixture design

- 2.1 Positioning of Workpieces
  - 2.1.1 Understand Basic principle of workpiece positioning
  - 2.1.2 Understand Positioning pair and basic requirements for positioning components
  - 2.1.3 Understand Workpiece positioning method and positioning components
  - 2.1.4 Understand Analysis and calculation of positioning error
  - 2.1.5 Understand surface positioning
- 2.2 Clamping of Workpieces
  - 2.2.1 Understand Composition and basic requirements of clamping device
  - 2.2.2 Understand Determination of clamping force
  - 2.2.3 Understand Basic clamping mechanism
  - 2.2.4 Understand Linkage clamping mechanism
- 2.3 Design method of specialized fixtures
  - 2.3.1 Understand Design steps for specialized fixtures
  - 2.3.2 Understand Selection of tolerance fits and formulation of technical requirements
  - 2.3.3 Understand Example Exercises and Reflection Questions for Special Fixture Design
- 2.4 Typical Machine Tool Fixture Design
  - 2.4.1 Understand Lathe fixture
  - 2.4.2 Understand Milling machine fixtures
  - 2.4.3 Understand Drilling machine fixtures
  - 2.4.4 Understand Boring machine fixture

2.5 Introduction to Other Machine Tool Fixtures

2.5.1 Understand Adjustable fixture

2.5.2 Understand Combined fixture

2.5.3 Understand CNC machine tool fixtures and automatic fixtures

2.6 Inspection fixture

2.6.1 Understand Classification and design considerations for inspection fixtures

2.6.2 Understand Example of Inspection Fixture Structure

3. Gauge design

3.1 Explain Classification and design considerations for gauges

3.2 Explain Smooth limit gauge

3.3 Explain Linear dimension gauge

3.4 Explain Position gauge

3.5 Explain Sample Gauge

MMAT352 Tooling design

List of Practical

1. Tool design **32Hrs**

1.1 Design of flat formed turning tools
1.2 Design of prismatic forming turning tools
1.3 Design of circular forming turning tools
1.4 Design of Circular Forming Turning Tool Rod
1.5 Section tolerance of formed turning tools
1.6 Design of working template for formed turning tools
1.7 Design of calibration templates for formed turning tool
1.8 Circular broach
1.9 Combination tool
1.10 Efficient CNC tools

2. Machine tool fixture design **48Hrs**

2.1 Standard parts used in fixtures, namely hexagonal, head nuts and bolts, screws and washers
2.2 Traction fixture, (a) hook type (b) latch type (c) quarter turn bolt (d) cam clamp
2.3 Positioner design
2.4 Design of template fixtures and plate fixtures
2.5 Design of swinging blade fixture
2.6 Indexing fixture design
2.7Design of milling fixtures
2.8Design of lathe fixtures for turning and boring operations

3. Gauge design **16Hrs**

3.1 Classification and design considerations for instruments
3.2 Smooth limit gauge design
3.3 Linear Dimension Gauge Design
3.4 Position gauge design
3.5 Sample Scale Design

MMAT362 **Engineering Materials and Heat Treatment**

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

AlMS: After going through this course, student will be able to:

I. Understand types and properties of commonly used engineering materials

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 nonferrous metals

Course Contents:

1.	**Process materials and their properties**	**1Hrs**
2.	**Basic knowledge of metallurgy**	**2Hrs**
3.	**Iron carbon alloy and carbon steel**	**2Hrs**
4.	**Heat treatment of steel**	**2Hrs**
5.	**Alloy steel and hard alloy**	**8Hrs**
6.	**Cast iron**	**4Hrs**
7.	**Nonferrous metals and their alloys**	**2Hrs**
8.	**Nonmetallic materials and new materials**	**2Hrs**
9.	**Selection of mechanical component materials**	**3Hrs**
10.	**Introduction to Part Blank Forming**	**6Hrs**

Detail of Contents:

1. Process materials and their properties **1Hrs**

1.1 Engineering materials and their performance indicators

1.1.1 Engineering materials and their classification

1.1.2 Common performance indicators of engineering materials

1.2 Common mechanical properties of metal materials

1.2.1 Load and common mechanical properties of metal materials

1.2.2 Strength

1.2.3 Plasticity

1.2.4 Hardness
1.2.5 Toughness
1.2.6 Fatigue strength
1.3 Physical and chemical properties of metal materials
1.3.1 Physical properties
1.3.2 Chemical properties
1.4 Explanation of Process Performance Cases of Metal Materials

2. Basic knowledge of metallurgy **2Hrs**

2.1 Crystal Structure of Pure Metals
2.1.1 Crystal and amorphous solid
2.1.2 Crystal structure
2.1.3 Types of Metal Lattices
2.1.4 Crystal structure of actual metals
2.1.5 Crystal defects in actual metals
2.2 Crystallization of Metals
2.2.1 The phenomenon and degree of undercooling of pure metals
2.2.2 Crystallization process of pure metals
2.2.3 The microstructure of alloy castings (or ingots) after crystallization
2.2.4 Grain size and its control
2.3 Crystal Structure of Alloys
2.3.1 Basic concepts of alloys
2.3.2 Phase structure of alloys
2.4 Cold plastic deformation of metals
2.4.1 Plastic deformation of metals
2.4.2 Effect of cold plastic deformation on the microstructure and properties of metals
2.4.3 Recovery and recrystallization during heating after cold plastic deformation Thermoplastic deformation of 2.5 metals
2.5.1 Difference between hot working and cold working
2.5.2 Effect of hot working on metal structure and properties

3. Iron carbon alloy and carbon steel **2Hrs**

3.1 Iron carbon alloy and its phase diagram
3.1.1 Industrial pure iron
3.1.2 Basic Structure of Iron Carbon Alloy
3.1.3 Phase diagram of iron carbon alloy
3.1.4 Classification of iron-carbon alloys
3.1.5 Crystallization process of typical iron-carbon alloys
3.1.6 Effect of carbon content on steel properties
3.1.7 Application of Iron Carbon Alloy Phase Diagram in Industry
3.2 Overview of Carbon Steel (Non Alloy Steel)
3.2.1 Effect of Common Impurity Elements on the Properties of Carbon Steel
3.2.2 Classification of carbon steel

3.2.3 Types of steel
3.3 Carbon structural steel
3.3.1 Ordinary carbon structural steel
3.3.2 High quality carbon structural steel
3.4 Carbon tool steel
3.5 Cast Carbon Steel

4. Heat treatment of steel **2Hrs**

4.1 Overview of Heat Treatment
4.2 Transformation of steel during heating
4.2.1 Solid state critical point of steel during heating and cooling
4.2.2 Structural Transformation Process of Steel During Heating
4.2.3 Grain size and control of austenite during heating
4.3 Transformation of steel during cooling
4.3.1 Isothermal transformation of undercooled austenite
4.3.2 Continuous cooling transformation of undercooled austenite
4.4 Annealing and Normalizing of Steel
4.4.1 Annealing of Steel
4.4.2 Normalizing of Steel
4.4.3 Application Selection of Annealing and Normalizing
4.5 Quenching of steel
4.5.1 Quenching process of steel
4.5.2 Quenching method
4.5.3 Hardenability and Hardenability of Steel
4.5.4 Quenching Defects and Prevention of Steel
4.6 Tempering of quenched steel
4.6.1 Purpose of Quenched Steel Tempering
4.6.2 Common tempering methods
4.6.3 Tempering brittleness
4.7 Surface Heat Treatment of Steel
4.7.1 Surface hardening of steel
4.7.2 Chemical Heat Treatment of Steel
4.8 Other heat treatment technologies
4.8.1 Timeliness treatment
4.8.2 Thermoforming treatment
4.8.3 Vacuum heat treatment
4.8.4 Controllable Atmosphere Heat Treatment
4.8.5 Surface Vapor Deposition
4.9 Heat treatment plan selection and process location arrangement
4.9.1 Selection of Common Heat Treatment Schemes
4.9.2 Heat treatment process location arrangement
4.10 Explanation of Heat Treatment Structure Process Case of Parts

5. Alloy steel and hard alloy **8Hrs**

5.1 Overview of alloy steel

5.2 Classification and grades of alloy steel
5.2.1 Classification of alloy steel
5.2.2 Grade of alloy steel
5.3 The Role of Alloy Elements in Steel
5.3.1 Effect of alloying elements on the mechanical properties of steel
5.3.2 Effect of alloy elements on the heat treatment performance of steel
5.3.3 Effect of alloy elements on the processing performance of steel
5.4 Alloy structural steel
5.4.1 Alloy steel for engineering components
5.4.2 Alloy steel for mechanical structures
5.5 Alloy tool steel
5.5.1 Alloy measuring tool steel
5.5.2 Alloy cutting tool steel
5.5.3 Impact resistant tool steel
5.5.4 Alloy mold steel
5.6 Special performance alloy steel
5.6.1 Stainless steel
5.6.2 Heat resistant steel
5.6.3 Wear resistant steel
5.6.4 Free cutting structural steel
5.7 Hard alloy
5.7.1 Application and characteristics of hard alloys
5.7.2 Common hard alloys

6. Cast iron **4Hrs**

6.1 Overview of cast iron
6.1.1 Composition and performance characteristics of cast iron
6.1.2 Classification and Application of Cast Iron
6.2 Gray cast iron
6.2.1 Composition, microstructure, and performance characteristics of gray cast iron
6.2.2 Grades and applications of gray cast iron
6.2.3 Inoculation treatment of gray cast iron
6.2.4 Heat treatment of gray cast iron
6.3 Ductile iron
6.3.1 Structure and properties of ductile iron
6.3.2 Grades and uses of ductile iron
6.3.3 Heat treatment of ductile iron
6.4 Malleable cast iron
6.4.1 Production process and composition of malleable cast iron
6.4.2 Structure and properties of malleable cast iron
6.4.3 Grades and uses of malleable cast iron
6.5 Vermicular graphite cast iron and special performance cast iron

6.5.1 Vermicular graphite cast iron
6.5.2 Special performance cast iron

7. Nonferrous metals and their alloys 2Hrs

7.1 Overview of Nonferrous Metals
7.2 Copper and copper alloys
7.2.1 Industrial pure copper
7.2.2 Copper alloy
7.3 Aluminum and aluminum alloys
7.3.1 Industrial pure aluminum
7.3.2 Aluminum alloy
7.3.3 Heat treatment of aluminum alloys
7.4 Titanium and titanium alloys
7.4.1 Industrial pure titanium
7.4.2 Titanium alloy
7.4.3 Main applications of titanium alloys
7.5 Magnesium and magnesium alloys
7.5.1 Performance characteristics of pure magnesium
7.5.2 Performance characteristics of magnesium alloys
7.5.3 Classification and Application of Magnesium Alloys
7.5.4 Development of Magnesium Alloy Applications
7.6 Sliding bearing alloy
7.6.1 Classification of bearings and bearing alloys
7.6.2 Lead based bearing alloys
7.6.3 Tin based bearing alloy
7.6.4 Aluminum based bearing alloys
7.6.5 Copper based bearing alloy

8. Nonmetallic materials and new materials 2Hrs

8.1 Overview of non-metallic materials
8.2 Polymer Materials
8.2.1 Plastic
8.2.2 Rubber
8.2.3 Fiber
8.2.4 Adhesives
8.2.5 Coatings
8.3 Ceramic Materials
8.3.1 Classification of Ceramics
8.3.2 Performance characteristics of ceramics
8.3.3 Types and Applications of Commonly Used Ceramics
8.4 Composite Materials
8.4.1 Concept of composite materials
8.4.2 Classification of composite materials
8.4.3 Performance characteristics of composite materials
8.4.4 Common composite materials
8.5 New Materials
8.5.1 High temperature materials
8.5.2 Shape memory materials

8.5.3 Superconducting materials

9. Selection of mechanical component materials 3Hrs

9.1 Failure of Mechanical Parts
- 9.1.1 Concept and characteristics of failure
- 9.1.2 Types of Failure
- 9.1.3 Causes of failure

9.2 General principles for material selection of mechanical parts
- 9.2.1 Performance considerations
- 9.2.2 Process performance considerations
- 9.2.3 Economic considerations

9.3 Typical Parts Material Selection Examples
- 9.3.1 Material selection and heat treatment of shaft parts
- 9.3.2 Material selection and process analysis of gear parts
- 9.3.3 Material selection for box type parts

10. Introduction to Part Blank Forming 6Hrs

10.1 Foundations for Casting and Forming
- 10.1.1 Overview of Casting
- 10.1.2 Sand Casting
- 10.1.3 Introduction to Special Casting

10.2 Welding Forming Foundation
- 10.2.1 Welding Overview
- 10.2.2 Welding rod arc welding
- 10.2.3 Submerged arc welding
- 10.2.4 Gas shielded welding
- 10.2.5 Resistance welding
- 10.2.6 plasma arc welding
- 10.2.7 Brazing

10.3 Foundations of Forging and Forming
- 10.3.1 Overview of Forging and Pressing
- 10.3.2 Free forging
- 10.3.3 Die forging
- 10.3.4 Sheet metal stamping
- 10.3.5 Introduction to New Forging Technology

Recommended Textbooks:

1. The Mechanical Engineering Materials and Heat Treatment (2nd Edition) by Zhang Wenzhuo (Publisher: China Machinery Industry Press, 2022)
2. The Mechanical Engineering Materials and Heat Treatment by Gu Shuqun (Publisher: China Machinery Industry Press, 2011)
3. The Mechanical Engineering Materials and Heat Treatment (2nd Edition) by Wang Yingjie (Publisher: China Higher Education Press, 2016)

MMAT362 Engineering Materials and Heat Treatment

Instructional Objectives:

1. **Engineering materials and their properties**
    - 1.1 Engineering materials and their performance indicators
        - 1.1.1 Describe Engineering materials and their classification
        - 1.1.2 Describe Common performance indicators of engineering materials
    - 1.2 Common mechanical properties of metal materials
        - 1.2.1 Explain Load and common mechanical properties of metal materials
        - 1.2.2 Explain Strength
        - 1.2.3 Explain Plasticity
        - 1.2.4 Explain Hardness
        - 1.2.5 Toughness
        - 1.2.6 Explain Fatigue strength
    - 1.3 Physical and chemical properties of metal materials
        - 1.3.1 Explain Physical properties
        - 1.3.2 Explain Chemical properties
    - 1.4 Explain Explanation of Process Performance Cases of Metal Materials
2. **Basic knowledge of metallurgy**
    - 2.1 Crystal Structure of Pure Metals
        - 2.1.1 Understand Crystal and amorphous solid
        - 2.1.2 Understand Crystal structure
        - 2.1.3 Understand Types of Metal Lattices
        - 2.1.4 Understand Crystal structure of actual metals
        - 2.1.5 Understand Crystal defects in actual metals
    - 2.2 Crystallization of Metals
        - 2.2.1 Understand The phenomenon and degree of undercooling of pure metals
        - 2.2.2 Understand Crystallization process of pure metals
        - 2.2.3 Understand The microstructure of alloy castings (or ingots) after crystallization
        - 2.2.4 Understand Grain size and its control
    - 2.3 Crystal Structure of Alloys
        - 2.3.1 Understand Basic concepts of alloys
        - 2.3.2 Understand Phase structure of alloys
    - 2.4 Cold plastic deformation of metals
        - 2.4.1 Understand Plastic deformation of metals
        - 2.4.2 Understand Effect of cold plastic deformation on the microstructure and properties of metals
        - 2.4.3 Understand Recovery and recrystallization during heating after cold plastic deformation Thermoplastic deformation of 2.5 metals
        - 2.5.1 Understand Difference between hot working and cold working
        - 2.5.2 Understand Effect of hot working on metal structure and

properties

3. Iron carbon alloy and carbon steel

3.1 Iron carbon alloy and its phase diagram

3.1.1 Understand Industrial pure iron

3.1.2 Understand Basic Structure of Iron Carbon Alloy

3.1.3 Understand Phase diagram of iron carbon alloy

3.1.4 Understand Classification of iron-carbon alloys

3.1.5 Understand Crystallization process of typical iron-carbon alloys

3.1.6 Understand Effect of carbon content on steel properties

3.1.7 Understand Application of Iron Carbon Alloy Phase Diagram in Industry

3.2 Overview of Carbon Steel (Non Alloy Steel)

3.2.1 Understand Effect of Common Impurity Elements on the Properties of Carbon Steel

3.2.2 Understand Classification of carbon steel

3.2.3 Understand Types of steel

3.3 Carbon structural steel

3.3.1 Understand Ordinary carbon structural steel

3.3.2 Understand High quality carbon structural steel

3.4 Explain Carbon tool steel

3.5 Explain Cast Carbon Steel

4. Heat treatment of steel

4.1 Explain Overview of Heat Treatment

4.2 Transformation of steel during heating

4.2.1 Understand Solid state critical point of steel during heating and cooling

4.2.2 Understand Structural Transformation Process of Steel During Heating

4.2.3 Understand Grain size and control of austenite during heating

4.3 Transformation of steel during cooling

4.3.1 Understand Isothermal transformation of undercooled austenite

4.3.2 Understand Continuous cooling transformation of undercooled austenite

4.4 Annealing and Normalizing of Steel

4.4.1 Understand Annealing of Steel

4.4.2 Understand Normalizing of Steel

4.4.3 Understand Application Selection of Annealing and Normalizing

4.5 Quenching of steel

4.5.1 Understand Quenching process of steel

4.5.2 Understand Quenching method

4.5.3 Understand Hardenability and Hardenability of Steel

4.5.4 Understand Quenching Defects and Prevention of Steel

4.6 Tempering of quenched steel

4.6.1 Understand Purpose of Quenched Steel Tempering

4.6.2 Understand Common tempering methods

4.6.3 Understand Tempering brittleness

4.7 Surface Heat Treatment of Steel

4.7.1 Understand Surface hardening of steel

4.7.2 Understand Chemical Heat Treatment of Steel

4.8 Other heat treatment technologies

4.8.1 Understand Timeliness treatment

4.8.2 Understand Thermoforming treatment

4.8.3 Understand Vacuum heat treatment

4.8.4 Understand Controllable Atmosphere Heat Treatment

4.8.5 Understand Surface Vapor Deposition

4.9 Heat treatment plan selection and process location arrangement

4.9.1 Understand Selection of Common Heat Treatment Schemes

4.9.2 Understand Heat treatment process location arrangement

4.10 Explain Explanation of Heat Treatment Structure Process Case of Parts

5. Alloy steel and hard alloy

5.1 Explain Overview of alloy steel

5.2 Classification and grades of alloy steel

5.2.1 Understand Classification of alloy steel

5.2.2 Understand Grade of alloy steel

5.3 The Role of Alloy Elements in Steel

5.3.1 Understand Effect of alloying elements on the mechanical properties of steel

5.3.2 Understand Effect of alloy elements on the heat treatment performance of steel

5.3.3 Understand Effect of alloy elements on the processing performance of steel

5.4 Alloy structural steel

5.4.1 Understand Alloy steel for engineering components

5.4.2 Understand Alloy steel for mechanical structures

5.5 Alloy tool steel

5.5.1 Understand Alloy measuring tool steel

5.5.2 Understand Alloy cutting tool steel

5.5.3 Understand Impact resistant tool steel

5.5.4 Understand Alloy mold steel

5.6 Special performance alloy steel

5.6.1 Understand Stainless steel

5.6.2 Understand Heat resistant steel

5.6.3 Understand Wear resistant steel

5.6.4 Understand Free cutting structural steel

5.7 Hard alloy

5.7.1 Understand Application and characteristics of hard alloys

5.7.2 Understand Common hard alloys

6. Cast iron

6.1 Overview of cast iron

6.1.1 Understand Composition and performance characteristics of cast iron

6.1.2 Understand Classification and Application of Cast Iron

6.2 Gray cast iron

6.2.1 Understand Composition, microstructure, and performance characteristics of gray cast iron

6.2.2 Understand Grades and applications of gray cast iron

6.2.3 Understand Inoculation treatment of gray cast iron

6.2.4 Understand Heat treatment of gray cast iron

6.3 Ductile iron

6.3.1 Understand Structure and properties of ductile iron

6.3.2 Understand Grades and uses of ductile iron

6.3.3 Understand Heat treatment of ductile iron

6.4 Malleable cast iron

6.4.1 Understand Production process and composition of malleable cast iron

6.4.2 Understand Structure and properties of malleable cast iron

6.4.3 Understand Grades and uses of malleable cast iron

6.5 Vermicular graphite cast iron and special performance cast iron

6.5.1 Understand Vermicular graphite cast iron

6.5.2 Understand Special performance cast iron

7. Nonferrous metals and their alloys

7.1 Explain Overview of Nonferrous Metals

7.2 Copper and copper alloys

7.2.1 Understand Industrial pure copper

7.2.2 Understand Copper alloy

7.3 Aluminum and aluminum alloys

7.3.1 Understand Industrial pure aluminum

7.3.2 Understand Aluminum alloy

7.3.3 Understand Heat treatment of aluminum alloys

7.4 Titanium and titanium alloys

7.4.1 Understand Industrial pure titanium

7.4.2 Understand Titanium alloy

7.4.3 Understand Main applications of titanium alloys

7.5 Magnesium and magnesium alloys

7.5.1 Understand Performance characteristics of pure magnesium

7.5.2 Understand Performance characteristics of magnesium alloys

7.5.3 Understand Classification and Application of Magnesium Alloys

7.5.4 Understand Development of Magnesium Alloy Applications

7.6 Sliding bearing alloy

7.6.1 Understand Classification of bearings and bearing alloys

7.6.2 Understand Lead based bearing alloys

7.6.3 Understand Tin based bearing alloy

7.6.4 Understand Aluminum based bearing alloys

7.6.5 Understand Copper based bearing alloy

8. Nonmetallic materials and new materials

8.1 Explain Overview of non-metallic materials

8.2 Polymer Materials
8.2.1 Understand Plastic
8.2.2 Understand Rubber
8.2.3 Understand Fiber
8.2.4 Understand Adhesives
8.2.5 Understand Coatings
8.3 Ceramic Materials
8.3.1 Understand Classification of Ceramics
8.3.2 Understand Performance characteristics of ceramics
8.3.3 Understand Types and Applications of Commonly Used Ceramics
8.4 Composite Materials
8.4.1 Understand Concept of composite materials
8.4.2 Understand Classification of composite materials
8.4.3 Understand Performance characteristics of composite materials
8.4.4 Understand Common composite materials
8.5 New Materials
8.5.1 Understand High temperature materials
8.5.2 Understand Shape memory materials
8.5.3 Understand Superconducting materials

9. Selection of mechanical component materials
9.1 Failure of Mechanical Parts
9.1.1 Understand Concept and characteristics of failure
9.1.2 Understand Types of Failure
9.1.3 Understand Causes of failure
9.2 General principles for material selection of mechanical parts
9.2.1 Understand Performance considerations
9.2.2 Understand Process performance considerations
9.2.3 Understand Economic considerations
9.3 Typical Parts Material Selection Examples
9.3.1 Understand Material selection and heat treatment of shaft parts
9.3.2 Understand Material selection and process analysis of gear parts
9.3.3 Understand Material selection for box type parts

10. Introduction to Part Blank Forming
10.1 Foundations for Casting and Forming
10.1.1 Understand Overview of Casting
10.1.2 Understand Sand Casting
10.1.3 Understand Introduction to Special Casting
10.2 Welding Forming Foundation
10.2.1 Understand Welding Overview
10.2.2 Understand Welding rod arc welding
10.2.3 Understand Submerged arc welding
10.2.4 Understand Gas shielded welding
10.2.5 Understand Resistance welding
10.2.6 Understand plasma arc welding

- 10.2.7 Understand Brazing
- 10.3 Foundations of Forging and Forming
  - 10.3.1 Understand Overview of Forging and Pressing
  - 10.3.2 Understand Free forging
  - 10.3.3 Understand Die forging
  - 10.3.4 Understand Sheet metal stamping
  - 10.3.5 Understand Introduction to New Forging Technology

MMAT362 Engineering Materials and Heat Treatment

List of Practical

1. MATERIALS TESTING 48Hrs

1. Practice for brinnell hardness test
2. Practice for Rockwell hardness test for B-scale hardness
3. Practice for Rockwell hardness test for C-scale hardness
4. Practice for lzod test on cast iron or Aluminum standard test specimens
5. Practice for tensile test on universal testing machine on standard specimen
6. Practice for Compression test on cast iron specimen.
7. Practice for bending test on universal testing machine
8. Practice for shear test on universal testing machine
9. Practice for torsion test on torsion testing machine
10. Practice for fatigue test
11. Practice for Dye Penetrant test
12. Practice for Ultrasonic test on ultrasonic testing equipment
13. Practice for Magnetic particle test

2. HEAT TREATMENT 48Hrs

14.Practice for working of metallurgical microscope
15. Practice of preparation of specimen for metallography
16. Observe micro-structure of carbon steel specimen
17. Observe micro-structure of cast iron specimen
18. Practice for hardening and observe micro structure of carbon steel
19. Practice for annealing and observe grain structure of carbon steel
20. Practice for normalizing and observe grain structure
21. Practice for pack carburizing and observe grain structure
22. Practice for stress relieving of Aluminum

MMAT375 **Work Shop Practice-III**

Total Contact Hours		T	P	C
Theory	64	2	9	5
Practical	288			

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

i) Operating CNC special machining machines such as electric machining and laser processing.

ii) Innovative product design using additive manufacturing equipment.

iii) Operation of laser welding robot.

iV) Writing project reports

Course Contents:

1.	**Overview of Special Processing**	**2Hrs**
2.	**Electrical discharge machining technology**	**8Hrs**
3.	**Wire EDM machining technology**	**12Hrs**
4.	**Electrochemical machining technology**	**12Hrs**
5.	**Rapid prototyping technology**	**12Hrs**
6.	**Laser processing technology**	**8Hrs**
7.	**Plasma processing technology**	**10Hrs**

Detail of Contents:

1. Overview of Special Processing **2Hrs**

1.1 Special processing and its development trend
1.2 Characteristics and classification of special processing
1.3 Impact of Special Processing on Material Machinability and Structural Process ability

2. Electrical discharge machining technology **8Hrs**

2.1 Principle basis of Electrical discharge machining
2.2 Electrical discharge machining equipment
2.4 Electrical discharge machining process
2.5 Electrical discharge machining operation examples
2.6 Some problems in Electrical discharge machining

3. Wire EDM machining technology **12Hrs**

3.1 Overview of Wire EDM Machining
3.2 Electric discharge wire cutting machine tool
3.3 Basic Operation of Electric Spark Wire Cutting Machine Tool
3.4 Programming for Electric Spark Wire Cutting

3.5 Process indicators and influencing factors of electric discharge wire cutting machining
3.6 Wire EDM machining process
3.7 Process Method for Wire EDM Machining
3.8 Common process problems and solutions for wire EDM machining
3.9 Operation and Example of Wire EDM Machining

4. Electrochemical machining technology **12Hrs**

4.1 Principle, characteristics and classification of Electrochemical machining
4.2 Electrochemical machining
4.3 Electrolytic grinding
4.4 Electro polishing
4.5 Electroforming, Coating, and Composite Plating Processing
4.6 Typical training examples of Electrochemical machining

5. Rapid prototyping technology **12Hrs**

5.1 Technical basis of rapid prototyping
5.2 Rapid prototyping process

6. Laser processing technology **8Hrs**

6.1 Fundamentals of Laser Processing Technology
6.2 Laser processing technology

7. Plasma processing technology **10Hrs**

7.1 Plasma arc and its generator
7.2 Characteristics and types of plasma arc machining
7.3 Plasma arc cutting
7.4 Plasma arc welding and spraying

Recommended Textbooks:

1. The Special Processing Technology(2th Edition) by Li Yuqing(Publisher:China University of Science and Technology Press,2023)
2. The Special processing (7th edition) by Bai Jicheng and Liu Jinchun and Guo Yongfeng and Yang Xiaodong(Publisher: Mechanical Industry Press, 2022)
3. The Special processing (6th edition) by Bai Jicheng (Publisher: Mechanical Industry Press, 2021)

MMAT375 Work Shop Practice-III

Instructional Objectives:

1. **Overview of Special Processing**
   - 1.1 Describe Special processing and its development trend
   - 1.2 Explain Characteristics and classification of special processing
   - 1.3 Explain Impact of Special Processing on Material Machinability and Structural Process ability
2. **Electrical discharge machining technology**
   - 2.1 Describe Principle basis of Electrical discharge machining
   - 2.2 Explain Electrical discharge machining equipment
   - 2.4 Explain Electrical discharge machining process
   - 2.5 Explain Electrical discharge machining operation examples
   - 2.6 Explain Some problems in Electrical discharge machining
3. **Wire EDM machining technology**
   - 3.1 Describe Overview of Wire EDM Machining
   - 3.2 Explain Electric discharge wire cutting machine tool
   - 3.3 Explain Basic Operation of Electric Spark Wire Cutting Machine Tool
   - 3.4 Explain Programming for Electric Spark Wire Cutting
   - 3.5 Explain Process indicators and influencing factors of electric discharge wire cutting machining
   - 3.6 Explain Wire EDM machining process
   - 3.7 Explain Process Method for Wire EDM Machining
   - 3.8 Explain Common process problems and solutions for wire EDM machining
   - 3.9 Explain Operation and Example of Wire EDM Machining
4. **Electrochemical machining technology**
   - 4.1 Describe Principle, characteristics and classification of Electrochemical machining
   - 4.2 Explain Electrochemical machining
   - 4.3 Explain Electrolytic grinding
   - 4.4 Explain Electro polishing
   - 4.5 Explain Electroforming, Coating, and Composite Plating Processing
   - 4.6 Explain Typical training examples of Electrochemical machining
5. **Rapid prototyping technology**
   - 5.1 Describe Technical basis of rapid prototyping
   - 5.2 Rapid prototyping process
6. **Laser processing technology**
   - 6.1 Describe Fundamentals of Laser Processing Technology
   - 6.2 Explain Laser processing technology
7. **Plasma processing technology**
   - 7.1 Describe Plasma arc and its generator
   - 7.2 Explain Characteristics and types of plasma arc machining
   - 7.3 Explain Plasma arc cutting
   - 7.4 Explain Plasma arc welding and spraying

MMAT375 **Work Shop Practice-III**

List of Practical

288 Hrs.

1.	**Die electrode Electrical discharge machining**	32Hrs
2.	**Wire EDM machining of stamping molds**	48Hrs
3.	**Innovative Rapid prototyping**	32Hrs
4.	**Laser marking of products**	32Hrs
5.	**Laser engraving processing of crystals**	32Hrs
6.	**Laser welding processing of Machine element**	16Hrs
7.	**Robot laser welding of parts**	32Hrs
8.	**T-joint flat fillet welding**	16Hrs
9.	**Flat fillet welding of tube plate**	16Hrs
10.	**S-shaped flat fillet welding**	16Hrs
11.	**I-shaped groove butt welding**	16Hrs

MMAT382 **CAD/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 Sketches (2D & 3D)

II Solid Modeling

III Assembly Modeling

IV CAM for Milling, Turning

V Process Planning

Course Contents:

1.	**Introduction to 2D and3D CAD**	**1Hrs**
2.	**2D Sketch**	**2Hrs**
3.	**Dimension and Constraint**	**2Hrs**
4.	**Tolerances**	**2Hrs**
5.	**Solid Modeling**	**8Hrs**
6.	**Assembly Modeling**	**4Hrs**
7.	**Drawing View**	**2Hrs**
8.	**Presentation Module**	**2Hrs**
9.	**Sheet Metal Components**	**3Hrs**
10.	**CAM**	**6Hrs**

Detail of Contents:

1. Introduction to 2D and3D CAD **1Hrs**

1.1 Modules
1.2 Toolbars
1.3 Units and Dimensions
1.4 important Terms and Definitions

2. 2D Sketch **2Hrs**

2.1 Sketch Environment
2.2 Drawing Display Tools
2.3 Sketching Entities
2.4 Pattern

2.5 Tolerance
2.6 Work Feature

3. Dimension and Constraint **2Hrs**

3.1 Dimension
3.2 Geometric Constraint
3.2.1 Perpendicular Constraint
3.2.2 Parallel Constraint
3.2.3 Tangent Constraint
3.2.4 Coincident Constraint
3.2.5 Concentric Constraint
3.2.6 Collinear Constraint
3.2.7 Horizontal Constraint
3.2.8 Vertical Constraint
3.2.9 Equal Constraint
3.2.10 Fix Constraint
3.2.11 Symmetric Constraint
3.2.12 Smooth Constraint
3.3 Measurement

4. Tolerances **2Hrs**

4.1 Parameter
4.2 3D Sketching Entities

5. Solid Modeling **8Hrs**

5.1 Modeling Tools
5.1.1 Extrude Feature
5.1.2 Revolve Feature
5.1.3 Holes Feature
5.1.4 Fillets Feature
5.1.5 Chamfers Feature
5.1.6 Ribs Feature
5.1.7 Thicken and Offset Feature
5.2 Concept of Edit Feature
5.3 Advanced Modeling Tools
5.3.1 Sweep Feature
5.3.2 Lofted Feature
5.3.3 Coil Feature
5.3.4 Thread Feature
5.3.5 Shell Feature
5.3.6 Face Draft Feature
5.3.7 Replacing Face Feature
5.3.8 Boundary Patch Feature
5.3.9 Stitching Surfaces Feature
5.3.10 Sculpt Feature

6. Assembly Modeling **4Hrs**

6.1 Types of Assembly
6.2 Assembly Component
6.2.1 Mate Constraint

6.2.2 Angle Constraint
6.2.3 Tangent Constraint
6.2.4 Insert Constraint
6.2.5 Rotation Constraint
6.2.6 Rotation-Translation Constraint
6.2.7 Transitional Constraint
6.3 Edit Assembly Constraint

7. Drawing View **2Hrs**

7.1 Types of Views
7.2 Drawing Standards
7.3 Drawing Sheets
7.4 Dimension Style
7.5 Parts Lists

8. Presentation Module **2Hrs**

8.1 Presentation View
8.2 Assembly Animation

9. Sheet Metal Components **3Hrs**

9.1 Sheet Metal Components Parameter
9.2 Sheets Metal Components
9.2.1 Fold Feature
9.2.2 Flange Feature
9.2.3 Cut Feature
9.2.4 Corner Seam Feature
9.2.5 Bend Feature
9.2.6 Corner Round Feature
9.2.7 Corner Chamfer Feature
9.2.8 Hem Feature
9.2.9 Contour Flange Feature

10. CAM **6Hrs**

10.1 Introduction of CAM10.1.1User Interface
10.1.2 Setup of materials
10.1.3 Setup of cutting tools10.1.4Strategy and cutting processes
10.1.5 Generating tool paths
10.1.6 Tool parts simulation
10.2 2D CAM
10.2.1 Holes Drilling
10.2.2 Face cutting
10.2.3 Side cutting
10.2.4 Pocket cutting
10.2.5 Slot cutting
10.3 CAM Milling
10.3.1 Rough cutting
10.3.1.1 Z-level Roughing
10.3.1.2 Parallel Roughing

10.3.1.3 Plunge Roughing
10.3.1.4 Flat Roughing
10.3.1.5 Cutting Boundaries
10.3.1.6 Step overs and leads
10.3.2 Finish cutting
10.3.2.1 Parallel Finishing
10.3.2.2 Z Level Finishing
10.3.2.3 Corner and Pencil Finishing
10.3.2.4 Iso-line Finishing
10.3.2.5 Radial and Spiral Finishing
10.3.2.6 Flowline Finishing
10,3,2.7 Between 2 curves Finishing
10.3.2.8 Swarf Finishing
10.3.2.9 Cutting Finishing
10.3.2.10 Step overs Finishing
10.4 CAM Lathe
10.4.1 Facing
10.4.2 Boring
10,4.3 Grooving
10.4.4 Threading (Inside and Outside)
10.4.5 Cut off

Recommended Textbooks:

1. The UG NX10.0 3D Modeling and Automatic Programming Project Tutorial (2nd Edition) by Xu Jiazhong and Jinying (Publisher: China Machinery Industry Press, 2021)
2. The Mechanical CAD/CAM Technology(4th Edition) by Wang Longtai(Publisher: China Machinery Industry Press, 2022)
3. CNC Milling Technology and Skills (Huazhong System)by Wang Gang (Publisher: China Machinery Industry Press, 2023)

MMAT382 CAD/CAM

Instructional Objectives:

1. **Introduction to 2D and 3D CAD**
    - 1.1 Describe Modules
    - 1.2 Describe Toolbars
    - 1.3 Describe Units and Dimensions
    - 1.4 Describe important Terms and Definitions
2. **2D Sketch**
    - 2.1 Describe Sketch Environment
    - 2.2 Explain Drawing Display Tools
    - 2.3 Explain Sketching Entities
    - 2.4 Explain Pattern
    - 2.5 Explain Tolerance
    - 2.6 Explain Work Feature
3. **Dimension and Constraint**
    - 3.1 Explain Dimension
    - 3.2 Geometric Constraint
        - 3.2.1 Understand Perpendicular Constraint
        - 3.2.2 Understand Parallel Constraint
        - 3.2.3 Understand Tangent Constraint
        - 3.2.4 Understand Coincident Constraint
        - 3.2.5 Understand Concentric Constraint
        - 3.2.6 Understand Collinear Constraint
        - 3.2.7 Understand Horizontal Constraint
        - 3.2.8 Understand Vertical Constraint
        - 3.2.9 Understand Equal Constraint
        - 3.2.10 Understand Fix Constraint
        - 3.2.11 Understand Symmetric Constraint
        - 3.2.12 Understand Smooth Constraint
    - 3.3 Explain Measurement
4. Tolerances
    - 4.1 Understand Parameter
    - 4.2 Understand 3D Sketching Entities
5. **Solid Modeling**
    - 5.1 Modeling Tools
        - 5.1.1 Understand Extrude Feature
        - 5.1.2 Understand Revolve Feature
        - 5.1.3 Understand Holes Feature
        - 5.1.4 Understand Fillets Feature
        - 5.1.5 Understand Chamfers Feature
        - 5.1.6 Understand Ribs Feature
        - 5.1.7 Understand Thicken and Offset Feature
    - 5.2 Explain Concept of Edit Feature
    - 5.3 Advanced Modeling Tools
        - 5.3.1 Understand Sweep Feature

5.3.2 Understand Lofted Feature
5.3.3 Understand Coil Feature
5.3.4 Understand Thread Feature
5.3.5 Understand Shell Feature
5.3.6 Understand Face Draft Feature
5.3.7 Understand Replacing Face Feature
5.3.8 Understand Boundary Patch Feature
5.3.9 Understand Stitching Surfaces Feature
5.3.10 Understand Sculpt Feature

6. Assembly Modeling

6.1 Describe Types of Assembly
6.2 Assembly Component
6.2.1 Understand Mate Constraint
6.2.2 Understand Angle Constraint
6.2.3 Understand Tangent Constraint
6.2.4 Understand Insert Constraint
6.2.5 Understand Rotation Constraint
6.2.6 Understand Rotation-Translation Constraint
6.2.7 Understand Transitional Constraint
6.3 Explain Edit Assembly Constraint

7. Drawing View

7.1 Explain Types of Views
7.2 Explain Drawing Standards
7.3 Explain Drawing Sheets
7.4 Explain Dimension Style
7.5 Explain Parts Lists

8. Presentation Module

8.1 Explain Presentation View
8.2 Explain Assembly Animation

9. Sheet Metal Components

9.1 Explain Sheet Metal Components Parameter
9.2 Sheets Metal Components
9.2.1 Understand Fold Feature
9.2.2 Understand Flange Feature
9.2.3 Understand Cut Feature
9.2.4 Understand Corner Seam Feature
9.2.5 Understand Bend Feature
9.2.6 Understand Corner Round Feature
9.2.7 Understand Corner Chamfer Feature
9.2.8 Understand Hem Feature
9.2.9 Understand Contour Flange Feature

10. CAM

10.1 Introduction of CAM
10.1.1 Understand User Interface
10.1.2 Understand Setup of materials

10.1.3 Understand Setup of cutting tools10.1.4Strategy and cutting processes

10.1.5 Understand Generating tool paths

10.1.6 Understand Tool parts simulation

10.2 2D CAM

10.2.1 Describe Holes Drilling

10.2.2 Describe Face cutting

10.2.3 Describe Side cutting

10.2.4 Describe Pocket cutting

10.2.5 Describe Slot cutting

10.3 CAM Milling

10.3.1 Rough cutting

10.3.1.1 Describe Z level Roughing

10.3.1.2 Describe Parallel Roughing

10.3.1.3 Describe Plunge Roughing

10.3.1.4 Describe Flat Roughing

10.3.1.5 Describe Cutting Boundaries

10.3.1.6 Describe Step overs and leads

10.3.2 Finish cutting

10.3.2.1 Describe Parallel Finishing

10.3.2.2 Describe Z Level Finishing

10.3.2.3 Describe Corner and Pencil Finishing

10.3.2.4 Describe Isoline Finishing

10.3.2.5 Describe Radial and Spiral Finishing

10.3.2.6 Describe Flowline Finishing

10,3,2.7 Describe Between 2 curves Finishing

10.3.2.8 Describe Swarf Finishing

10.3.2.9 Describe Cutting Finishing

10.3.2.10 Describe Step overs Finishing

10.4 CAM Lathe

10.4.1 Explain Facing

10.4.2 Explain Boring

10,4.3 Explain Grooving

10.4.4 Explain Threading (Inside and Outside)

10.4.5 Explain Cut off

MMAT382 CAD/CAM

List of Practical

1. Practice Sketch and Constrain 10Hrs

1.1 Draw Line
1.2 Draw Circle
1.3 Draw Ellipse
1.4 Draw Arc
1.5 Draw Rectangle
1.6 Draw Polygon
1.7 Place Points/Center Point
1.8 Create Fillet
1.9 Create Chamfer
1.10 Draw Spline
1.11 Create 3D Intersection Curve
1.12 Draw Helical curve
1.13 Add Perpendicular Constraint
1.14 Add Parallel Constraint
1.15 Add Tangent Constraint
1.16 Add Coincident Constraint
1.17 Add Concentric Constraint
1.18 Add Collinear Constraint
1.19 Add Horizontal Constraint
1.20 Add Vertical Constraint
1.21 Add Equal Constraint
1.22 Add Fix Constraint
1.23 Add Symmetric Constraint
1.24 Add Smooth Constraint

2. Practice Solid Modeling 20Hrs

2.1 Create Extrude
2.2 Create Revolve
2.3 Create Hole
2.4 Create Fillet
2.5 Create Chamfer
2.6 Create Rib
2.7 Create Thicken/Offset
2.8 Create Emboss
2.9 Create Decal
2.10 Create Sweep
2.11 Create Loft
2.12 Create Coil
2.13 Create Thread
2.14 Create Shell
2.15 Create Face Draft

2.16 Create Split
2.17 Create Boundary Patch
2.18 Create Trim and Extend Surface
2.19 Create Stitch Surface
2.20 Create Replace Face
2.21 Create Sculpt

3. Practice Assembly Modeling **10Hrs**

3.1 Practice Top Down Assembly
3.2 Practice Bottom Up Assembly
3.3 Practice Assemble parts with Mate Constraint
3.4 Practice Assemble parts with Angle Constraint
3.5 Practice Assemble parts with Tangent Constraint
3.6 Practice Assemble parts with Insert Constraint
3.7 Practice Assemble parts with Rotation Constraint
3.8 Practice Assemble parts with Rotation-Translation Constraint
3.9 Practice Assemble parts with Transitional Constraint

4. Practice Sheet Metal **14Hrs**

4.1 Create Fold
4.2 Create Flange
4.3 Create Cut
4.4 Create Corner Seam
4.5 Create Bend
4.6 Create Corner Round
4.7 Create Corner Chamfer
4.8 Create Hem
4.9 Create Contour Flange

5. Practice Welds **8Hrs**

5.1 Create Fillet Weld
5.2 Create Cosmetic Weld
5.3 Create Groove Weld

6. Practice 2.5D CAM **10Hrs**

6.1 Create Toolpath for Drilling
6.2 Create Toolpath for Side Cutting
6.3Create Toolpath for Face Cutting
6.4 Create Toolpath for Pocket

7. Practice CAM Milling **14Hrs**

7.1 Create Toolpath for Z-Level Rough Cutting
7.2 Create Toolpath for Parallel Rough Cutting
7.3 Create Toolpath for Z-Level Finish Cutting
7.4 Create Toolpath for Parallel Finish Cutting
7.5 Create Toolpath for 3D Spiral Cutting
7.6 Create Toolpath for Corner Re-machining
7.7 Create Toolpath for Pencil Cutting
7.8 Create Toolpath for Horizon + Vertical Cutting

8. CAM Turn/Milling **20Hrs**

8.1 Create Toolpath for External / Internal Turning

8.2 Create Toolpath for External/Internal Threading
8.3 Create Toolpath for Engraving on Side Face
8.4 Create Toolpath for Drilling/Slotting on Side Face
8.5 Create Toolpath for Drilling/Slotting on External Face
8.6 Create Milling Tool path on Side Face and External Face (Turn/Mill)
8.7 Create Tool path for 4-Axies Rotary Milling

MMAT 392 **NC machine tool technology**

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) Understand G code, M code and several types of CNC Tooling System.

ii) Operating CNC milling machine and machining center.

iii) Operating CNC lathes and turning centers.

Course Contents:

1.	**Introduction**	**1Hrs**
2.	**CNC Processing Technology**	**2Hrs**
3.	**Programming of CNC Machining**	**16Hrs**
4.	**Contour Control Principles of CNC Machine Tools**	**3Hrs**
5.	**Computer Numerical Control Equipment**	**2Hrs**
6.	**Position Detection Device**	**3Hrs**
7.	**Servo System of CNC Machine Tools**	**3Hrs**
8.	**Mechanical Structure of CNC Machine Tools**	**2Hrs**

Detail of Contents:

1. Introduction **1Hrs**
- 1.1 Overview
- 1.2 Characteristics and classification of CNC machine tools
- 1.3 Development history, current situation and trend of CNC machine tools

2. CNC Processing Technology **2Hrs**
- 2.1 Characteristics of CNC machining technology
- 2.2 Design of CNC machining process procedures
- 2.3 Cutting tools for CNC machine tools

3. Programming of CNC Machining **16Hrs**
- 3.1 Overview
- 3.2 Fundamentals of CNC Programming
- 3.3 Instructions for CNC system
- 3.4 Programming of CNC lathes
- 3.5 Programming of CNC milling machines
- 3.6 Programming of machining centers

3.7 Introduction to Automatic Programming
3.8 Tool setting method for CNC machine tools

4. Contour Control Principles of CNC Machine Tools **3Hrs**

4.1 Overview
4.2 Pulse incremental interpolation
4.3 Data sampling method
4.4 Speed control during processing
4.5 Principle of tool radius compensation

5. Computer Numerical Control Equipment **2Hrs**

5.1 Overview
5.2 Hardware structure of computer numerical control device
5.3 Software structure of computer numerical control devices

6. Position Detection Device **3Hrs**

6.1 Overview
6.2 Rotating Transformer
6.3 Inductosyn
6.4 Photo encoder
6.5 Grating

7. Servo System of CNC Machine Tools **3Hrs**

7.1 Overview
7.2 Stepping motor and open-loop feed servo system
7.3 DC servo motor and speed control
7.4 AC servo motor and speed control
7.5 Linear Motor and Its Application in CNC Machine Tools
7.6 Position control of servo system
7.7 Spindle servo system

8. **Mechanical Structure of CNC Machine Tools** **2Hrs**

8.1 Overview
8.2 Main transmission device of CNC machine tools
8.3 Feed transmission device of CNC machine tools
8.4 Guideway and rotary table of CNC machine tools
8.5 Automatic tool change device for CNC machine tools
8.6 Auxiliary devices for CNC machine tools

Recommended Textbooks:

1. The Machine Tool CNC Technology by Xu Dezhang and Liu Youyu's(Publisher:China University of Science and Technology Press,2011)
2. The Programming and Operation of CNC Turning by Hao Yonggang(Publisher: Mechanical Industry Press, 2021)
3. CNC Milling Technology and Skills (Huazhong System)by Wang Gang (Publisher: China Machinery Industry Press, 2023)

MMAT392 NC machine tool technology

Instructional Objectives:

1. **Introduction**
   - 1.1 Describe Overview
   - 1.2 Describe Classification of CNC machine tools
   - 1.3 Describe Characteristics of CNC machine tools
   - 1.4 Describe Development history, current situation, and trends of CNC machine tools
2. **CNC Processing Technology**
   - 2.1 Describe Characteristics of CNC machining technology
   - 2.2 Explain CNC machining process specification design
   - 2.3 Explain cutting tools for CNC machine tools
3. **Programming of CNC Machining**
   - 3.1 Describe Overview
   - 3.2 Explain Fundamentals of CNC Programming
   - 3.3 Explain Instructions for CNC system
   - 3.4 Explain Programming of CNC lathes
   - 3.5 Explain Programming of CNC milling machines
   - 3.6 Explain Programming of machining centers
   - 3.7 Explain Introduction to Automatic Programming
   - 3.8 Explain Tool setting method for CNC machine tools
4. **Contour Control Principles of CNC Machine Tools**
   - 4.1 Describe Overview
   - 4.2 Explain Pulse incremental interpolation
   - 4.3 Explain Data sampling method
   - 4.4 Explain Speed control during processing
   - 4.5 Explain Principle of tool radius compensation
5. **Computer Numerical Control Equipment**
   - 5.1 Describe Overview
   - 5.2 Explain Hardware structure of computer numerical control device
   - 5.3 Explain Software structure of computer numerical control devices
6. **Position Detection Device**
   - 6.1 Describe Overview
   - 6.2 Explain Rotating Transformer
   - 6.3 Explain Inductosyn
   - 6.4 Explain Photo encoder
   - 6.5 Explain Grating
7. **Servo System of CNC Machine Tools**
   - 7.1 Describe Overview
   - 7.2 Explain Stepping motor and open-loop feed servo system
   - 7.3 Explain DC servo motor and speed control
   - 7.4 Explain AC servo motor and speed control
   - 7.5 Explain Linear Motor and Its Application in CNC Machine Tools
   - 7.6 Explain Position control of servo system
   - 7.7 Spindle servo system

8. **Mechanical Structure of CNC Machine Tools**
   8.1 Describe Overview
   8.2 Explain Main transmission device of CNC machine tools
   8.3 Explain Feed transmission device of CNC machine tools
   8.4 Explain Guideway and rotary table of CNC machine tools
   8.5 Explain Automatic tool change device for CNC machine tools
   8.6 Explain Auxiliary devices for CNC machine tools

MMAT392 NC machine tool technology

List of Practical 96 Hrs.

1. Observe Safety Precautions of CNC Machines 2Hrs

1.1 General Safety Precaution for Machining Center, Turning Center

1.2 Machine Tool Safety Precautions for Machining Center, Turning Center

1.3 Warning and Marking Sign for Machining Center, Turning

2. Observe Outline of Machine 4Hrs

2.1 Conception of Machines

2.2 Profile Diagram and Main Part Name of Machining Center, Turning Center

2.3 Machine Specification of Machining Center, Turning Center

2.4 Tool Specification

2.5 Controller Specification

2.6 Hydraulic and Pneumatic System (Coolant, Air)

3. Operate Different Functions of Machines 16Hrs

3.1 Operational Panel Introduction of Machining Center, Turning Center

3.2 Operation Step of Machining Center, Turning Center

- 3.2.1 Switch On, Switch Off
- 3.2.2 Work Piece Setting
- 3.2.3 Adjusting and Zero Setting
- 3.2.4 Setting Tools and Tool Holders
- 3.2.5 Running Machines

4. Operate NC Program on Machining and Turning Center 8Hrs

4.1Main Program and Sub Program

4.2Interpolation Functions

4.3 Feed Functions

4.4 Coordinate and Local Coordinate System

4.5 Miscellaneous Functions(M Code)

46 Cycle Functions

4.7 Compensation Functions

4.8 automatic programming

5. Maintenance and Troubleshooting 6Hrs

5.1Regular inspection

- 5.1.1 Inspection before Starting, After Starting and End of Daily Operation
- 5.1.2 Weekly, Monthly, Seasonal and Annual Inspection

5.2 Lubrication Method

5.3 Cleaning and Replacement Method

- 5.3.1 Cleaning of the Lubrication Oil Reservoir
- 5.3.2 Air Filter
- 5.3.3 Coolant Tank
- 5.3.4 Cleaning and Replacement of hydraulic Tank

5.3.5 Replacement of Spin-Oil Filter
5.3.6 Assembly Precautions after Cleaning or Replacement
5.3.7 Oil Cooler for Spindle Cooling
5.3.8 Replacement Method for Spindle Cooling and Gear Box Lubricant
5.4 Environmental protection treatment of wastewater, oil, and waste
5.5 Steel Belt Chip Conveyor
5.6 Trouble Shooting for Circuit Control Parts
5.7 Trouble Shooting for Pipin

6. Operate Different CNC Machines 60Hrs

6.1 Operate Machining Center for following operations
6.1.1 Drilling
6.1.2 Tapping
6.1.3 Reaming
6.1.4 Shoulder Cutting
6.1.5 Face Cutting
6.1.6 Slot Milling
6.1.7 Spot Milling
6.1.8 Pocket Milling
6.1.9 Open Pocket and island Milling
6.1.10 Core Milling
6.1.11 Project and its inspection
6.2 Operate Turning Center for following operations
6.2.1 External/Internal Turning
6.2.2 External/Internal Grooving
6.2.3 External/Internal Threading
6.2.4 Cut-Off
6.2.5 Drilling/Slotting on Side Face
6.2.6 Drilling/Slotting on External Face
6.2.7 Milling on Side Face and External Face (Turn/Mill)

TECHNOLOGY BRIEF WITH JOB OFFERING COMPANIES

Mechanical manufacturing and automation technology refers to the use of machinery, tools, and advanced systems to design, produce, and assemble products in an efficient and automated manner. This field plays a crucial role in various industries, including automotive, aerospace, electronics, consumer goods, and more. Automation technology enhances productivity, reduces labor costs, improves product quality, and increases overall efficiency in manufacturing processes Mechanical manufacturing and automation technology are continuously evolving, driven by advancements in robotics, AI, materials science, and connectivity. These trends are shaping the future of manufacturing, leading to more efficient, flexible, and sustainable production processes.

Mechanical manufacturing is an ever changing field. Therefore, it is a complex technology discipline that deals with the design manufacturing, operation/control and production process of all kind of industrial machinery/equipment and electro-mechanical products. Mechanical automation engineers are mainly focused on machine designs.

Workforce is increasing which can only be managed through setting relevant competency standards in collaboration with the leading industries.

This course carries much value and recognized in the private, semi government and government sector as well as abroad for **Occupations / jobs** as:-

- Process and control engineer
- Automation engineer
- Quality control manager
- Machine design engineer
- Quality control and auditor
- Manufacturing automation engineer

Companies/Organizations Offering Jobs in the Mechanical Engineering and Automation Technology

International Companies:-

- BAE Systems
- Yokogawa electric
- Siemens

- Honeywell
- Apple
- Toyota international
- Honda
- Mitsubishi and many more…

Besides overseas employment, the following Pakistani companies/firms/Organizations are also offering jobs:

- NLC Engineers
- NLC Polymers
- Sky Electric
- Atlas Honda, Lahore
- United Automobiles
- Infinity engineering LTD.
- Qadri industries
- HMC Taxila

Proposed Minimum Qualification of Teacher/ Instructor

- **MS/ Master in Mechanical Engineering/Automation Eng./Mechatronics/Robotics with 2-Years' relevant experience in teaching/ industry**

  OR

- **BS in Industrial Engineering/Automation Eng./Mechatronics/Robotics with 2-Years' relevant experience in teaching/ industry**

OR

- **BS in Electrical/ Electronics/Mechatronics and Industrial Engg. with 2-Years' relevant experience in teaching/ industry**

OR

- **DAE in Mechanical Engineering/Automation /Mechatronics/Robotics with 5-Years' relevant experience in teaching/ industry**

Curriculum Development Committee

Sr. No	Name & Designation	Status
1.	Professor Zhang Li Tie	president
2.	Professor Shao Yonglu	Professional leader
3.	Guan Xingju	Professor
4.	Yang Yunlong	Professor
5.	Sun Jing	Associate Professor
6.	Wang Xiaoxu	Associate Professor
7.	Luo Jie	Lecturer
8.	Engineer Zhang Zongren	Dean
9.	Engr. Amjad Ali	Manager Training & Coord.
10.	Engr. Kamran Abbas	Chief Instructor
11.	Engr. Muhammad Majid	Instructor