REVISED CURRICULUM

OF

DIPLOMA OF ASSOCIATE ENGINEER

IN

MECHANICAL TECHNOLOGY

(SECOND YEAR)

Revised Scheme of Studies D.A.E. 2ND Year Mechanical

Code		Subject	T	P	C
Gen	211	Islamiat and Pak Studies	1	0	1
Phy	212	Applied Mechanics	1	3	2
Math	212	Applied Mathematics-II	2	0	2
MGM	211	Business Communication	1	0	1
MGM	221	Business Management and Industrial Economics	1	0	1
REVISED SUBJECTS					
Elect.	202	Applied Electricity and Electronics	1	3	2
Mech.	223	Engineering Drawings-II (A) Machine Drawing 0 3 (B) 2D & 3D CAD 0 3 **Theory 1 0**	1	6	3
Mech.	236	Workshop Practice-II (A) Basic Machine Shop-II 0 6 (B) Foundry and Pattern Making 0 3 (C) Adv. Welding 0 3 Theory 2 0	2	12	6
Mech.	242	Metallurgy	2	0	2
Mech.	252	Metrology	1	3	2
TOTAL			**13**	**27**	**22**

Gen-211

ISLAMIAT AND PAKSTUDY

اسلامیات/مطالعہ پاکستان

نصاب (سال دوم)

حصہ اول	اسلامیات	Gen 211	ٹی	پی	سی
			1	0	1

حصہ دوم مطالعہ پاکستان

کل وقت:20 گھنٹے

موضوعات

1۔ سورہ المومنوں ایک تا گیارہ آیات معہ ترجمہ

2۔ دس منتخب احادیث معہ ترجمہ وتشریح

- خیر کم من تعلم القران و علمه
- لاایمان لمن لا امانة له و لادین لمن عهدله
- ایاکم والظن ان الظن اکذب الحدیث
- من احدث فی امرنا هذا ما لیس منه فهورد
- من حمل علینا السلاح فلیس منا
- اناو کا فل الیتیم فی الجنة هکذا
- لا یومن احد کم حتی اکون احب الیه من والده و ولده و الناس اجمعین
- من بنی لله مسجد ابنی الله له بیتاً فی الجنة
- لاضرر ولا ضرار فی الاسلام
- کلکم راع و کلکم مسئول عن رعیته

3۔ سیرت طیبہ

- مکی زندگی، ولادت، بعثت، ہجرت

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

خطبہ حجۃ الوداع

4۔ حضور ﷺ بحیثیت:

معلم کامل۔ سربراہ خاندان

5۔ اسلامی معاشرہ

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

جہاد، کسب حلال، مسجد (اہمیت وفضیلت)

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

سال دوم　　اسلامیات

تدریسی مقاصد

قرآن مجید　　منتخب آیات قرآنی

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

خصوصی مقاصد

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

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

خصوصی مقاصد

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

سیرت طیبہ

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

خصوصی مقاصد

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

اسلامی معاشرہ

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

خصوصی مقاصد

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

اسلامی ریاست

عمومی مقاصد ،اسلامی ریاست کی خصوصیات بیان کر سکے۔

خصوصی مقاصد

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

نصاب اخلاقیات (غیر مسلم طلباء کیلئے)

ٹی	پی	سی
1	0	1

سال دوم

کل وقت 20 گھنٹے

موضوعات

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

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

نصاب اخلاقیات

سال دوم

تدریسی مقاصد

عمومی مقاصد طالب علم

اخلاقیات کی اہمیت وضرورت سے آگاہ ہو سکے اور بیان کر سکے۔

خصوصی مقاصد طالب علم اس قابل ہو۔

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

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

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

نصاب مطالعہ پاکستان

ٹی	پی	سی
1	0	1

سال دوم

کل وقت 12 گھنٹے

حصہ دوم

موضوعات

- دوقومی نظریہ
- تحریک پاکستان
- انڈین کانگرس
- مسلم لیگ
- تقسیم بنگال
- میثاق لکھنو
- تحریک خلافت
- سندھی تحریک
- تجاویز دھلی
- نہرو رپورٹ
- قائداعظم کے چودہ نکات
- خطبہ الہٰ آباد
- انتخابات 1938 اور انتقال اقتدار
- قرارداد پاکستان

حصہ دوم

مطالعہ پاکستان

تدریسی مقاصد

تحریک پاکستان

عمومی مقصد قیام پاکستان کے اسباب ومحرکات کو بیان کر سکے۔

خصوصی مقاصد

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

Phy-212
APPLIED MECHANICS

Phy-212 APPLIED MECHANICS

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

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

COURSE CONTENTS

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

2. EQUILIBRIUM OF CON-CURRENT FORCES **4 Hours**
- 2.1 Concurrent forces
- 2.2 Addition and Resolution of Vectors
- 2.3 Toggle Joint, Hanging Chains
- 2.4 Roof Trusses, Cranes.
- 2.5 Framed structures

3. MOMENTS AND COUPLES: **3 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 Hours**
- 4.1 Non-concurrent forces
- 4.2 Free body diagram
- 4.3 Varignon's theorem
- 4.4 Conditions of total Equilibrium (Review)
- 4.5 Ladders

5. MOMENT OF INERTIA: **4 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: 4 Hours

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

7. WORK, ENERGY AND POWER 3 Hours

7.1 Work-Energy relationship
7.2 Work done by variable .
7.3 Power
7.4 I.H.P, B.H.P and Efficiency
7.5 Dynamometer.

8. **TRANSMISSION OF POWER**

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

9. MACHINES: 3 Hours

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

10. VIBRATORY MOTION: 2 Hours

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

11. ELASTICITY: 3 Hours

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

12. Simple Mechanism

12.1 Introduction
12.2 Kinematic link or element
12.3 Kinematic pair and types

12.4 Kinematic chains and types

13. Velocity in mechanism

13.1 Introduction

13.2 Instantaneous center

13.3 Instantaneous velocity

13.4 Velocity of a link by Instantaneous center method

13.5 Relative velocity of two bodies in straight line

13.6 Velocity of a link by relative velocity method

Phy. 212 APPLIED MECHANICS

INSTRUCTIONAL OBJECTIVES

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

1.1 Explain Dimensional 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 Use the concepts to solve problems on power and work-energy

8. Understand transmission of power through ropes and belts

8.1 Describe the need for transmission of power

8.2 Describe the method of transmission of power

8.3Understand 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 rotary motion to simple vibratory motion.

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

10.5 Derive formulae for position, velocity and acceleration of a body executing S.H.M.

10.6 Use the concept of S.H.M to helical springs.

10.7 Use the concept S.H.M to solve problems on pendulum.

11. UNDERSTAND BENDING MOMENTS AND SHEARING FORCES.

11.1 Define three types of stresses and 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 EXPERIMENTS

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

31. Find the coefficient of Rigidity of a rectangular bar using Deflection of Beam Apparatus
32. Determine S.F. and B.M. in a loaded cantilever (Point Loads)
33. Determine S.F. and B.M. in a simply supported Beam (Point Loads)
34. Determine S.F. and B.M. in a simply supported Beam (Point loads and uniformly distributed load)
35. Determine S.F. and B.M. in a simply supported Beam (Point loads and uniformly distributed)
36. Study working and function of link mechanism of different types

BOOKS RECOMMENDED:

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

Math-212

Applied Mathematics-II

MATH-212 **Applied Mathematics-II**

	T	P	C
Total Contact Hours:	2	0	2

Theory: 64 Hours.

Aims & Objectives:

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

COURSE CONTENTS:

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

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

2. DIFFERENTIATION. **4 Hours**

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

3. DIFFERENTIATION OF ALGEBRIC FUNCTION.

4 Hours

3.1 Explicit function
3.2 Implicit function
3.3 Parametric forms
3.4 Problems

4. DIFFERENTATION OF TRIGNOMETRIC FUNCTION.

4 Hours

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

5. DIFFERENTIATION OF LOGARITHIMIC & EXPONENTIAL FUNCTION. 4 Hours

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

6. RATE OF CHANGE OF VARIABLE. 4 Hours

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

7. INTEGRATION. 8 Hours

7.1 Concept
7.2 Fundamental Formulas
7.3 Important Rules
7.4 Problems.

8. METHOD FOR INTEGRATION. 6 Hours

8.1 Integration by substitution
8.2 Integration by parts
8.3 Problems.

9. DEFINITE INTEGRALS. 6 Hours

9.1 Properties
9.2 Application to Area
9.3 Problems

10. PLANE ANALYTIC GEOMETRY & STRAIGHT LINE. 6 Hours

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

11. EQUATION OF STRAIGHT LINE. 6 Hours

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

12. THE EQUATION OF THE CIRCLE. 8 Hours

12.1 Standard form of equation
12.2 Central form of equation

12.3 General form of equation
12.4 Radius & coordinate of the Centre
12.5 Problems

REFREFNCE BOOKS

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

MATH -212 **APPLIED MATHEMATICS –II**

INSTRUCTIONAL OBJECTIVES

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

1.1 Define a function

1.2 List all types of function

1.3 Explain the concept of limit and limit of a function

1.4 Explain fundamental theorem on limits

1.5 Derive some important limits

1.6 Solve simple problems on limits

2. UNDERSTAND THE CONCEPT OF DIFFERENTIAL COEFFICIENT

2.1 Derive mathematics expression for a differential coefficient.

2.2 Explain geometrical interpretation of differential coefficient.

2.3 Differentiate a content, constant associated with a variable and the sum of finite number of function.

2.4 Solved related problems.

3. USE RULES OF DIFFERENTIAL TO SOLVE PROBLEMS OF ALGEBRIC FUNCTIONS.

3.1 Differentiate ab-initio Xn and (ax+b)n

3.2 Derive product, quotient and chain rules.

3.3 Find derivative of implicit function & explicit function.

3.4 Differentiate parametric forms; function w.r.t another function and by Rationalization.

3.5 Solve problems using these formulas.

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

4.1 Differentiate from first principle sin x ,cosx,tang x.

4.2 Derive formula for derivation of sec x, cosec x, cot x.

4.3 Find differential coefficient of inverse trigonometric functions.

5. USE RULES OF DIFFERENTIATION TO LOGARITHMIC AND EXPONENTIAL FUNCTIONS.

5.1 Derive formulas for differential coefficient of logarithmic and exponential functions.

5.2 Solve problems using these formulas.

6. UNDERSTAND RATE OF CHANGE OF ONE VARRIABLE WITH RESPECT TO ANOTHER.

6.1 Write expression for velocity, acceleration, and slope of a line.

6.2 Define an increasing and decreasing function, maxima and minima values, of inflection.

6.3 Explain criteria for maxima and minima values of a function.

6.4 Solve problems involving rate of change of variables.

7. APPLY CONCEPT OF INTEGRATION IN SOLVING TECHNOLOGICALPROBLEMS

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

8. UNDERSTAND DIFFERENT METHODS OF INTEGRATION.

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

9. UNDERSTAND THE METHOD OF SOLVING DEFENITE INTEGRALS.

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

10. UNDERSTAND THE CONCEPT OF PLANE ANALYTIC GEOMETRY.

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

11. USE EQUATIONS OF STRAIGHT LINE IN SOLVING PROBLEMS.

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

12. SOLVE TECHNOLOGICAL PROBLEMS USING EQUATION OF CIRCLE.

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

Mgm-211

BUSINESS COMMUNICATION

Mgm-211 BUSINESS COMMUNICATION

T	P	C
1	0	1

Total contact hours

Theory 32 Hrs

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

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

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

COURSE CONTENTS

1. COMMUNICATION PROCESS. 6 Hours

- 1.1 Purposes of communication
- 1.2 Communication process
- 1.3 Distortions in communication
- 1.4 Consolidation of communiqué
- 1.5 Communication flow
- 1.6 Communication for self-development

2. ORAL COMMUNICATION SKILLS. 6 Hours

- 2.1 Significance of speaking.
- 2.2 Verbal and non-verbal messages.
- 2.3 Strategic steps of speaking.
- 2.4 Characteristics of effective oral messages.
- 2.5 Communication Trafficking.
- 2.6 Oral presentation.

3. QUESTIONING SKILLS. 3 Hours

- 3.1 Nature of question.
- 3.2 Types of questions.
- 3.3 Characteristics of a good question.
- 3.4 Questioning strategy

4. LISTENING SKILLS. 5 Hours

- 4.1 Principles of active listening.
- 4.2 Skills of active listening.
- 4.3 Barriers to listening.
- 4.4 Reasons of poor listening.
- 4.5 Giving Feedback.

5. INTERVIEWING SKILLS. 3 Hours

- 5.1 Significance of interviews.
- 5.2 Characteristics of interviews.
- 5.3 Activities in an interviewing situation
- 5.4 Types of interviews.

5.5 Interviewing strategy.

6. REPORT WRITING. 3 Hours

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

7. READING COMPREHENSION. 2 Hours

7.1 Reading problems.
7.2 Four Reading skills.

8. GROUP COMMUNICATION. 4 Hours

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

RECOMMENDED BOOKS

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

Mgm-211 **BUSINESS COMMUNICATION**

INSTRUCTIONAL OBJECTIVES

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

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

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

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

5. Determine the appropriate interview type for the specific work-related situation and conduct a work-related interview.
   - 5.1 State the significance of interviews.
   - 5.2 State the characteristics of interviews.
   - 5.3 Explain the activities in an interviewing situation.
   - 5.4 Describe the types of interviews.
   - 5.5 Explain the interviewing strategy.
   - 5.6 Prepare instrument for a structured interview.

6. PREPARE A REPORT OUT-LINE, BASED ON SUBJECT MATTER AND AUDIENCE.
   - 6.1 Identify the different types of reports.
   - 6.2 Determine when to use an informal or formal report presentation.
   - 6.3 Identify the stages of planning a report.

6.4 Identify the parts of a report and choose the parts appropriate for each type of report.

6.5 Draft a report outline.

7. DEMONSTRATE READING COMPREHENSION.

7.1 Identify major reading problems.

7.2 Identify basic reading skills.

7.3 State methods of previewing written material.

7.4 Identify methods of concentration when reading.

7.5 Demonstrate reading comprehension.

8. UNDERSTAND THE PRINCIPLES OF GROUP COMMUNICATIONS.

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

8.2 Explain responsibilities of a meeting/committee.

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

8.4 Distinguish between content and process at meetings.

8.5 Explain the key characteristics of a good group facilitator.

Mgm-221 BUSINESS MANAGEMENT AND INDUSTRIAL ECONOMICS

Total Contact Hours

Theory	32	T	P	C
Practical	0	1	0	1

AIMS The students will be able to develop management skills, get acquainted the learner with the principles of management and economic relations and develop commercial / economic approach to solve the problems in the industrial set-up.

COURSE CONTENTS

1. ECONOMICS **2 Hours**

1.1 Definition: Adam Smith, Alfred Marshall, Prof. Robins.
1.2 Nature and scope
1.3 Importance for technicians.

2. BASIC CONCEPTS OF ECONOMICS **1 Hour**

2.1 Utility
2.2 Income
2.3 Wealth
2.4 Saving
2.5 Investment
2.6 Value.

3. DEMAND AND SUPPLY. **2 Hours**

3.1 Definition of demand.
3.2 Law of demand.
3.3 Definition of supply.
3.4 Law of supply.

4. FACTORS OF PRODUCTION. **2 Hours**

4.1 Land
4.2 Labour
4.3 Capital
4.4 Organization.

5. BUSINESS ORGANIZATION. **3 Hours**

5.1 Sole proprietorship
5.2 Partnership
5.3 Joint stock company

6. ENTERPRENEURIAL SKILLS **4 Hours**

6.1 Preparing, planning, establishing, managing, operating and evaluating relevant resources in small business.
6.2 Business opportunities, goal setting.
6.3 Organizing, evaluating and analyzing opportunity and risk tasks.

7. SCALE OF PRODUCTION. 2 Hours

7.1 Meaning and its determination.
7.2 Large scale production.
7.3 Small scale production.

8. ECONOMIC SYSTEM 3 Hours

8.1 Free economic system.
8.2 Centrally planned economy.
8.3 Mixed economic system.

9. MONEY. 1 Hour

9.1 Barter system and its inconveniences.
9.2 Definition of money and its functions.

10. BANK. 1 Hour

10.1 Definition
10.2 Functions of a commercial bank.
10.3 Central bank and its functions.

11. CHEQUE 1 Hour

11.1 Definition
11.2 Characteristics and kinds of cheque.
11.3 Dishonor of cheque.

12. FINANCIAL INSTITUTIONS 2 Hours

12.1 IMF
12.2 IDBP
12.3 PIDC

13. TRADE UNION 2 Hours

13.1 Introduction and brief history.
13.2 Objectives, merits and demerits.
13.3 Problems of industrial labor.

14. INTERNATIONAL TRADE. 2 Hours

14.1 Introduction
14.2 Advantages and disadvantages.

15. MANAGEMENT 1 Hour

15.1 Meaning
15.2 Functions

16. ADVERTISEMENT 2 Hours

16.1 The concept, benefits and draw-backs.
16.2 Principal media used in business world.

17. ECONOMY OF PAKISTAN 1 Hour

17.1 Introduction
17.2 Economic problems and remedies.

BOOKS RECOMMENDED

1. Nisar-ud-Din, Business Organization, Aziz Publisher, Lahore
2. M. Saeed Nasir, Introduction to Business, Ilmi Kitab Khana, Lahore.
3. S.M. Akhtar, An Introduction to Modern Economics, United Limited, Lahore.

Mgm-221 BUSINESS MANAGEMENT AND INDUSTRIAL ECONOMICS

INSTRUCTIONAL OBJECTIVES

1. UNDERSTAND THE IMPORTANCE OF ECONOMICS.

1.1 State definition of economics given by Adam Smith, Alfred Marshall and Professor Robins.
1.2 Explain nature and scope of economics.
1.3 Describe importance of study of economics for technicians.

2. UNDERSTAND BASIC TERMS USED IN ECONOMICS.

2.1 Define basic terms, utility, income, wealth, saving, investment and value.
2.2 Explain the basic terms with examples

3. UNDERSTAND LAW OF DEMAND AND LAW OF SUPPLY.

3.1 Define Demand.
3.2 Explain law of demand with the help of schedule and diagram.
3.3 State assumptions and limitation of law of demand.
3.4 Define Supply.
3.5 Explain law of Supply with the help of schedule and diagram.
3.6 State assumptions and limitation of law of supply.

4. UNDERSTAND THE FACTORS OF PRODUCTION

4.1 Define the four factors of production.
4.2 Explain labor and its features.
4.3 Describe capital and its peculiarities.

5. UNDERSTAND FORMS OF BUSINESS ORGANIZATION.

5.1 Describe sole proprietorship, its merits and demerits.
5.2 Explain partnership, its advantages and disadvantages.
5.3 Describe joint stock company, its merits and demerits.
5.4 Distinguish public limited company and private limited company.

6. UNDERSTAND ENTERPRENEURIAL SKILLS

6.1 Explain preparing, planning, establishing and managing small business set up
6.2 Explain evaluating all relevant resources
6.3 Describe organizing analyzing and innovation of risk of task

7. UNDERSTAND SCALE OF PRODUCTION.

7.1 Explain scale of production and its determination.
7.2 Describe large scale production and it merits.
7.3 Explain small scale of production and its advantages and disadvantages.

8. UNDERSTAND DIFFERENT ECONOMIC SYSTEMS.

8.1 Describe free economic system and its characteristics.
8.2 Explain centrally planned economic system, its merits and demerits.
8.3 State mixed economic system and its features.

9. UNDERSTAND WHAT IS MONEY

9.1 Define money
9.2 Explain barter system and its inconveniences.

9.3 Explain functions of money.

10. UNDERSTAND BANK AND ITS FUNCTIONS.

10.1 Define bank.
10.2 Describe commercial bank and its functions.
10.3 State central bank and its functions.

11. UNDERSTAND CHEQUE AND DISHONOR OF CHEQUE.

11.1 Define cheque.
11.2 Enlist the characteristics of cheque.
11.3 Identify the kinds of cheque.
11.4 Describe the causes of dishonor of a cheque.

12. UNDERSTAND FINANCIAL INSTITUTIONS.

12.1 Explain IMF and its objectives.
12.2 Explain organizational set up and objectives of IDBP.
12.3 Explain organizational set up and objectives of PIDC.

13. UNDERSTAND TRADE UNION, ITS BACKGROUND AND FUNCTIONS.

13.1 Describe brief history of trade union.
13.2 State functions of trade union.
13.3 Explain objectives, merits and demerits of trade unions.
13.4 Enlist problems of industrial labor.

14. UNDERSTAND INTERNATIONAL TRADE.

14.1 Explain international trade.
14.2 Enlist its merits and demerits.

15. UNDERSTAND MANAGEMENT

15.1 Explain meaning of management.
15.2 Describe functions of management.
15.3 Identify the problems of business management.

16. UNDERSTAND ADVERTISEMENT.

16.1 Explain the concept of advertisement.
16.2 Enlist benefits and drawbacks of advertisement.
16.3 Describe principal media of advertisement used in business world.

17. UNDERSTAND THE ECONOMIC PROBLEMS OF PAKISTAN.

17.1 Describe economy of Pakistan.
17.2 Explain economic problems of Pakistan
17.3 Explain remedial measures for economic problems of Pakistan.

Elect-202

APPLIED ELECTRICITY AND ELECTRONICS

Elect-202 APPLIED ELECTRICITY AND ELECTRONICS

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

Pre-requisites: Applied Physics (1st year)

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

Course Contents:

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

Detail of Contents:

1. FUNDAMENTALS OF ELECTRICITY 3Hrs

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

2. PROTECTION DEVICES AND ELECTRICAL SAFETY 5 Hrs

2.1 Fuse and their types
2.2 Circuit breaker and their types
2.3 Relay and their types
2.4 Starter and their types
2.5 Switches and types
2.6 timers

3. MOTORS, GENERATORS AND TRANSFORMERS **5 Hrs**

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

4. (A) MEASURING INSTRUMENTS **4 Hrs**

4.1 Types of instruments
4.2 Secondary type
4.3 Types of meter, potentiometer, bridge circuit
4.4 Calibration of meters

(B) DOMESTIC WIRING

4.5 Wiring and their types
4.6 Estimate of wiring

5. FUNDAMENTALS OF ELECTRONICS **3 Hrs**

5.1 Semi conductor theory, doping, P & N type materials
5.2 PN Junction diode, potential barrier, forward and reverse bias
5.3 Use of PN Diode as rectifier
5.4 Half-wave, full-wave and bridge rectifiers
5.5 Filtering, invertors and stabilizers
5.6 Power supply

6. TRANSISTORS/AND SPECIAL DIODES **4 Hours**

6.1 PNP & NPN transistors, biasing, working
6.2 Use of transistors as amplifiers, gains in CE, CB and CC amplifiers
6.3 Zener diode
6.4 Photo diode, Diac, Triac as a regulator, photovoltaic cells, LED

7. PROGRAM LOGIC CONTROLER (PLC) and Logic Gates **5 Hrs**

7.1 PLC advantage and disadvantages and its types
7.2 Basic PLC programming
7.3 Gate and types, Relay logic
7.4 k. maps, binary system
7.5 Design a control circuit

8. THYRISTORS **3 Hrs**

8.1 SCR, working, uses as control devices
8.2 Phase control of SCR's
8.3 Speed control of AC and DC motors

Recommended Textbooks:

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

Elect-202 APPLIED ELECTRICITY AND ELECTRONICS

Instructional Objectives:

1. UNDERSTAND BASIC CONCEPTS AND LAWS OF ELECTRICITY

1.1 Define units of current, voltage and resistance with respect to supply of single phase and three phase
1.2 Explain Ohm's Law with simple calculations
1.3 Solves simple problems on laws of resistance
1.4 Substitute two of the three variables to find the third unknown in equation V=I x R
  1.4.1 Calculate the equivalent resistances for resistors joined in series, parallel and combination
  1.4.2 Calculate the total capacitance in series and parallel
1.5 Calculate electrical and mechanical power and the inter relation between the two systems
1.6 Heating effect of current, Jowls Law
1.7 Calculate the electrical energy consumption in an installation and prepare the energy bill
1.8 Define the inductors and its uses
1.9 Define RLC circuit and its uses
1.10 Define the batteries and battery cell
  1.10.1 Define primary and secondary battery
  1.10.2 State the types of primary and secondary batteries

2. UNDERSTAND PROTECTION DEVICES AND ELECTRICAL SAFETY

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

3. UNDERSTAND WORKING OF ELECTRIC MOTORS, AND GENERATORS AND TRANSFORMERS

3.1 Explain Faraday's law
3.2 State the construction of alternator and D.C. generator with its parts and working
3.3 Explain the working principal of transformers and emf equation
3.4 State various parts of a welding transformer and setting
3.5 Explain the working of single phase, three phase, and servo motors
3.6 Explain the working of stepper motors

4. INSTRUMENTS AND WIRING

4.1 Define primary and secondary types of instruments, calibration of instruments
4.2 Define secondary analog digital and working effect
4.3 Explain types of meters, there uses and connection in a circuit (Watt Meter, Volt Meter, Ampere Meter, Energy meter maximum indicator oscilloscope) and methods of calibration
4.4 Define wiring and describe batten wiring, conduit PVC, casing capping wiring and there uses
  4.4.1 Describe advantages and disadvantages of each
4.5 Prepare the estimate sheet for wiring(Take of Sheet)

5. UNDERSTAND THE FUNDAMENTALS OF ELECTRONICS

5.1 State the Semi conductor theory

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

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

5.3 Describe the use of PN junction diode as rectifier

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

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

5.6 Explain Power supply

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

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

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

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

6.3 State the biasing working of zenor diodes

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

7. PROGRAM LOGIC CONTROLER (PLC) AND GATES

7.1 Define PLC, working, advantages and disadvantages

7.2 Describe Basic PLC programming

7.3 Explain Gate and Types

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

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

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

8. UNDERSTAND THE APPLICATION OF THYRISTORS IN CONTROL CIRCUITS

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

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

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

Elect-202 APPLIED ELECTRICITY AND ELECTRONICS

List of Practical:

1. FUNDAMENTALS OF ELECTRICITY

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

2. PROTECTION DEVICES AND ELECTRICAL SAFETY

2.1 Application of various fuses in wiring
2.2 Study of connection circuit breaker 2 pole, 3 pole with time setting

3. MOTORS, GENERATORS AND TRANSFORMERS

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

4. INSTRUMENTS AND WIRING

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

5. FUNDAMENTALS OF ELECTRONICS

5.1 Study and connections of PN diodes as rectifiers
5.2 Connecting PN Diode as half-wave and full-wave rectifier
5.3 Connecting PN Diode as bridge Rectifiers with filter
5.4 Study of Power Supply

6. TRANSISTORS AND SPECIAL DIODES

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

7. PROGRAM LOGIC CONTROLER (PLC) AND GATES

7.1 Study of PLC system
7.2 Study and connection of gate AND, OR, NOT, NAND, NOR, XOR, NXOR
7.3 Study how to execute PLC
    7.3.1 Basic commands and how to design control circuit
    7.3.2 working of relays

8. THYRISTORS

8.1 Study and connections of SCR as a power switches

Elect-202 APPLIED ELECTRICITY AND ELECTRONICS

Practical Objectives:

1. FUNDAMENTALS OF ELECTRICITY

1.1 Study of electrical measuring instruments, handling precautions, methods of connection
- 1.1.1 Develop the skill Scale reading
- 1.1.2 Connection in parallel and series
- 1.1.3 Identification linear and square law scale
- 1.1.4 Understand of Parallax errors in instruments
- 1.1.5 Adjustment of pointer
- 1.1.6 Develop the skill of identification of AC & DC

1.2 Verification of Ohm's law
- 1.2.1 Students will be able to verify the Relation b/w voltage and current
- 1.2.2 Verify the relation b/w current and resistance
- 1.2.3 Draw the relation b/w current, voltage and resistance

1.3 Verification of laws of combination; of resistance
- 1.3.1 Develop the skill to connect the load in series
- 1.3.2 Understand the current equal at all loads
- 1.3.3 To calculate the voltage drop at every resistance
- 1.3.4 To calculate the total resistance in series and parallel load
- 1.3.5 To calculate the total capacitance charge and voltage in series and parallel

1.4 Measurement of power by Volt-ammeter and wattmeter
- 1.4.1 Develop the skill to connect the load with voltmeter
- 1.4.2 Students will be able to verify the power with voltmeter and ampere meter
- 1.4.3 Understand the internal connection of watt meter

1.5 Measurement of energy
- 1.5.1 Develop the skill to connect the energy meter with load
- 1.5.2 To calculate the energy bill taking the unit consumed

1.6 Batteries
- 1.6.1 Develop the skill identification of primary and secondary cell
- 1.6.2 Understand the types of Batteries w.r.t primary and secondary

2. PROTECTION DEVICESAND ELECTRICAL SAFETY

2.1 Use a fuse in wiring
- 2.1.1 Students will be able to connect the fuse with proper phase
- 2.1.2 Calculate the fusing factor
- 2.1.3 Understand the material of fuse material

2.2 Study of connection circuit breaker 2 pole, 3 pole with time setting.
- 2.2.1 Develop the skill of connection of circuit breaker 2 pole, 3 poles, with setting
- 2.2.2 Choose the proper circuit breaker
- 2.2.3 Understand the function of breaker

2.3 Connection of start delta starter
- 2.3.1 Develop the skill of connection
- 2.3.2 Start motor
- 2.3.3 Develop the skill of personal safety

2.4 Develop the skill to select the switches according to their rating

2.5 Develop the skill to understand the connection of timer according to the circuit

3. MOTORS, GENERATORS AND TRANSFORMERS

3.1 Verification of faraday's laws of electro-magnetic induction
- 3.1.1 Students will be able to understand the working principal of generator
- 3.1.2 To understand the EMF induced
- 3.1.3 Understand the induce AC and DC

3.2 Study of AC and DC generators
- 3.2.1 Develop the skill to identify the AC and DC generator
- 3.2.2 Able to understand the parts of generator
- 3.2.3 Able to understand the function of each part

3.3 Study of welding transformers
- 3.3.1 Develop the skill of current setting
- 3.3.2 According to the welding materials
- 3.3.3 Connection and precautions

3.4 Starting single-phase induction motors, reversal
- 3.4.1 Develop the skill of connection with starting and running coil
- 3.4.2 Making reverse and forward speed of motor
- 3.4.3 Other method to start the motor

3.5 Starting 3-phase induction motors, reversal
- 3.5.1 Develop the skill to understand the method starting 3 phase motor
- 3.5.2 Connection with star delta starter with magnetic contactors
- 3.5.3 Connection with reverse forward switch

3.6 Connections of magnetic starters with motors
- 3.6.1 Draw the circuit diagram with magnetic contactors of three phase motor
- 3.6.2 Develop the skill to use magnetic contactor for safety purpose

4. INSTRUMENTS AND WIRING

4.1 Measurement size of cable
- 4.1.1 Develop the skill of Choice of cable
- 4.1.2 To measure the gauge of wire
- 4.1.3 To understand the core of cable

4.2 Wiring, PVC, casing Capping and Batten
- 4.2.1 Able to identify the wiring
- 4.2.2 Develop the skill of wiring
- 4.2.3 Wiring according to cable
- 4.2.4 Estimate the wiring

4.3 Study of oscilloscope
- 4.3.1 Develop the skill to use the function of oscilloscope and use it
- 4.3.2 Adjustment
- 4.3.3 Reading of CRT graph

4.4 Study of calibration of instruments
- 4.5.1 Develop the skill of comparison with absolute instruments
- 4.5.2 Understand the errors
- 4.5.3 adjustment accuracy and remove error
- 4.5.4 Develop the skill, calibrate the instruments with using bridge and slandered instruments

4.6 Study using of AVO meter and meggar
- 4.6.1 Develop the skill to use of multi meter
- 4.6.2 Measure current voltage and resistance
- 4.6.3 Check emitter base collector
- 4.6.4 Understand cathode anode diode

5. FUNDAMENTALS OF ELECTRONICS

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

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

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

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

6. TRANSISTORS AND SPECIAL DIODES

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

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

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

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

7. PROGRAM LOGIC CONTROLER (PLC) AND GATES

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

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

7.3 Study how to execute PLC
- 7.3.1 Develop the skill understand the mode
- 7.3.2 Use function
- 7.3.3 Identify the step of execution
- 7.3.4 Method of execution

7.4 Basic commands and how to design control circuit
- 7.4.1 Develop the skill to understand the commands
- 7.4.2 Identify the basic commands
- 7.4.3 How to design a control
- 7.4.4 Develop the skill control the logic delay using truth table

8. THYRISTORS

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

Elect-202 APPLIED ELECTRICITY AND ELECTRONICS

List of Equipment:

A) Electrical Equipments

1.	Basic Electricity Trainer	10-set
2.	Volt Meter DC/AC	10-set
3.	Clamp On / Tongue Tester	10-set
4.	Watt Meter DC/AC	05-set
5.	Energy Meter (Single phase)	10-set
6.	Energy Meter (Three phase)	10-set
7.	Magnetic Contactor (Single Phase)	10-set
8.	Magnetic Contactor (Three Phase)	10-set
9.	Induction Motor (Single Phase)	10-set
10.	Induction Motor (Three Phase)	10-set
11.	3pt & 4pt Starter	10-set
12.	Lead Acid Batteries(12v 40Ah)	10-set
13.	Relay Coil (12V DC)	10-set
14.	Relay Coil (220V AC)	20-set
15.	Phase Sequence Meter	10-set
16.	Star Delta Starter	10-set
17.	Transformer (10 KVA)	10-set
18.	Meggar Tester (1000Ω)	05-set
19.	Calibrated Meter Box	04-set
20.	Multi- Meter (1-1000 V)	10-set
21.	Tool kit complete	10-set

B) Electronics Equipments

1.	Semi Conductor Trainer	10-set
2.	Industrial Electronics Trainer	10-set
3.	PLC Trainer	10-set
4.	Analogue Multi Meter	10-set
5.	Curve Tracer	5-set
6.	Digital Multimeter	10-set
7.	Regulator Power supply 0-30 Volts, 5A	10-set
8.	Dual Channel Oscilloscope 20 MHZ	10-set
9.	Function Generator	10-set

Mech-252
METROLOGY

Mech-252 METROLOGY

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

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

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

Course Contents:

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

Detail of Contents:

1. INTRODUCTION TO MEASUREMENT AND QUALITY CONTROL 4Hrs

1.1 History of measurements
1.1 Importance and purpose of measurements
1.2 Quality control and its Importance in metrology
1.3 S.I Units
1.4 ISO Standards
1.5 Fits, Tolerance & Allowance
1.6 Geometric Tolerance

2. LINEAR MEASUREMENTS SUPPORTING TOOLS **2Hrs**

- 2.1 Cast iron surface plate
- 2.2 Granite Surface plate
- 2.3 Glass surface plate
- 2.4 Straight edges
- 2.5 Spirit levels
- 2.6 Engineer's parallels
- 2.7 Universal Surface gauge

3. GAUGES **2 Hrs**

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

4. ADJUSTABLE MEASURING TOOLS **3 Hrs**

- 4.1 Vernier Caliper
- 4.2 Micrometer
- 4.3 Dial indicator

5. ANGLE MEASURING TOOLS **3 Hrs**

- 5.1 Fixed angle measuring tool
- 5.2 Angle gauges
- 5.3 Adjustable angle measuring tools
  - 5.3.1 Without graduations
  - 5.3.2 With graduations

6. PRECISION MEASURING INSTRUMENTS **3 Hrs**

- 6.1 Vernier height gauge
- 6.2 Vernier depth gauge
- 6.3 Inside Micrometer
- 6.4 Depth Micrometer
- 6.5 Thread Micrometer
- 6.6 Hot gauge Micrometer
- 6.7 Vernier Micrometer

7. ACCURACY IN MEASUREMENTS **2 Hrs**

- 7.1 Elements of Metrology
- 7.2 Classification of Errors
  - 7.2.1 Controllable errors
  - 7.2.2 Random errors
- 7.3 Calibration
- 7.4 Repeatability

8. DIAL INSTRUMENTS **2 Hrs**

- 8.1 Dial Caliper
- 8.2 Dial thickness gauge
- 8.3 Dial bore gauge

9. TAPER MEASUREMENTS **1 Hr**

- 9.1. Gauge Block
- 9.2. Sine Bar

10. OPTICAL MEASUREMENT **2 Hrs**

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

11. COMPARATORS **2 Hrs**

11.1 Mechanical Comparator
11.2 Electrical Comparator
11.3 Electronic Comparator

12. DIGITAL INSTRUMENTS **1 Hr**

12.1 Digital Micrometer
12.2 Digital Caliper
12.3 Digital Indicator
12.4 Digital Depth Gauge
12.5 Digital Height Gauge
12.6 Digital Read Out (DRO)

13. COORDINATE MEASURING MACHINE **3Hrs**

13.1 Working principle of CMM and its coordinates
13.2 Part and Accessories
13.3 Use of CMM
13.4 Digital 3D Scanner

14. GEAR MEASUREMENT **2 Hrs**

14.1 Gear Testing machine
14.2 Backlash Measurement

Recommended Textbooks:

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

Mech-252 METROLOGY

Instructional Objectives:

1. INTRODUCTION TO MEASUREMENTS

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

2. UNDERSTAND LINEAR MEASUREMENT SUPPORTING TOOL

- 2.1 Describe Cast-iron Surface plate
- 2.2 Describe Granite Surface plate
- 2.3 Describe Glass Surface plate
- 2.4 Describe Straight edges
- 2.5 Describe Spirit levels
- 2.6 Describe Engineers parallels
- 2.7 Explain Universal Surface gauge

3. KNOW ABOUT GAUGES

- 3.1 Describe the ring gauge and its uses
- 3.2 Describe the plug gauge and its uses
- 3.3 Describe the snap gauge and its uses
- 3.4 Describe the radius gauge and its uses
- 3.5 Describe the angle gauge and its uses
- 3.6 Describe screw pitch gauge
- 3.7 Describe the use of standard wire gauge
- 3.8 Describe the use of feeler gauge

4. UNDERSTAND ADJUSTABLE MEASURING TOOLS

- 4.1 Explain the construction and use of vernier Caliper
- 4.2 Explain the construction and use of Micrometer
- 4.3 Explain the construction and use of Dial Indicator

5. UNDERSTAND ANGLE MEASURING TOOLS

- 5.1 Describe the use of following fixed angle Measuring Tools
  - 5.1.1 Centre Square
  - 5.1.2 Combination square
  - 5.1.3 Try Square
  - 5.1.4 Double Square
  - 5.1.5 Die maker Square
  - 5.1.6 Engineer Square
- 5.2 Describe the use of following angle gauges
  - 5.2.1 Thread gauges
  - 5.2.2 Grinding gauges
  - 5.2.3 Tool angle gauge
  - 5.2.4 Drill gauges
  - 5.2.5 Drill point gauge
- 5.3 Discuss adjustable angle measuring tools

5.3.1 Without graduations
- 5.3.1.1 Sine bar
- 5.3.1.2 Universal bevel
- 5.3.1.3 Combination bevel

5.3.2 With Graduations
- 5.3.2.1 Bevel protractor
- 5.3.2.2 Vernier bevel protractor
- 5.3.2.3 Steel protractor
- 5.3.2.4 Dial protractor

6. EXPLAIN FOLLOWING PRECISION MEASURING INSTRUMENTS

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

7. ACCURACY IN MEASUREMENT

7.1 State five basis Metrology Elements
7.2 Explain classification of Errors
- 7.2.1 Controllable Errors
- 7.2.2 Random Errors

7.3 Explain Calibration and its need
7.4 Explain Repeatability

8. UNDERSTAND THE DIAL INSTRUMENTS

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

9. TAPER MEASUREMENTS

9.1 Describe the use of Gauge Blocks
9.2 Describe the use of Sine Bar

10. OPTICAL MEASUREMENTS

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

11. DESCRIBE THE USE OF FOLLOWING COMPARATORS

11.1 Mechanical comparator
11.2 Electronic comparator
11.3 Electrical comparator

12. DESCRIBE THE USE OF FOLLOWING DIGITAL INSTRUMENTS

12.1 Digital Micrometer
12.2 Digital Caliper
12.3 Digital indicator
12.4 Digital Depth gauge
12.5 Digital height gauge
12.6 Digital Readout

13. COORDINATE MEASURING MACHINE

13.1 Describe the coordinates of CMM
13.2 Describe the accessories of CMM

13.3 Describe the use of CMM

13.4 Describe the use of 3-D scanner

14. GEAR MEASUREMENT

14.1 Describe about gear testing machine

14.2 Describe about backlash measurement

Mech-252 METROLOGY

List of Practical:

1. PRACTICE OF FOLLOWING GRADUATED TOOLS 3Hrs

1.1 Steel Rule
1.2 Hook Rule
1.3 Folding Rule
1.4 Trammels

2. PRACTICE OF COMBINATION SET 3Hrs

3. PRACTICE OF FOLLOWING SUPPORTING TOOLS 3Hrs

3.1 Cast Iron, Granite, and Glass Surface Plates
3.2 Straight Edge
3.3 Spirit level
3.4 Engineer's level
3.5 Engineer's parallel

4. PRACTICE OF FOLLOWING GAUGES 6 Hrs

5.1 Fixed gauges
5.2 Adjustable gauges
5.3 Small hole gauges
5.4 Telescope gauges

5. PRACTICE AND USE OF FOLLOWING PRECISION INSTRUMENTS 12 Hrs

5.1 Outside Micrometer
5.2 Inside Micrometer
5.3 Depth Micrometer
5.4 Thread Micrometer
5.5 Vernier Micrometer

6. PRACTICE AND USE OF VERNIER TOOLS 9Hrs

6.1 Vernier caliper
6.2 Vernier Height gauge
6.3 Vernier depth gauge

7. PRACTICE AND USE OF FOLLOWING ANGLE MEASURING TOOLS 6 Hrs

7.1 Bevel protractor
7.2 Vernier Bevel protractor
7.3 Dial protractor
7.4 Steel protractor
7.5 Sine bar

8. CALCULATION RELATING TO TOLERANCE AND ALLOWANCE 3 Hrs

9. PRACTICE AND USE OF FOLLOWING DIAL INSTRUMENTS 3 Hrs

9.1 Dial Caliper
9.2 Dial Thickness gauge
9.3 Dial Indicator

10. PRACTICE AND USE OF GAUGE BLOCKS 6 Hrs

11. PRACTICE OF TOOL MAKERS MICROSCOPE 6 Hrs

12. PRACTICE OF PROFILE PROJECTOR 3 Hrs

13. PRACTICE AND USE OF FOLLOWING COMPARATORS 9Hrs

13.1 Mechanical comparator
13.2 Electronic comparator
13.3 Electrical comparator

14. PRACTICE AND USE OF DIGITAL INSTRUMENTS 6 Hrs

14.1 Digital Micrometer
14.2 Digital Caliper
14.3 Digital Indicator
14.4 Digital Depth Gauge
14.5 Digital Height Gauge

15. PRACTICE OF MEASUREMENT ON CMM 9 Hrs

15.1 Point to point/linear measurement
15.2 Profile measurement (2D, 3D)

16. PRACTICE OF THREAD AND GEAR MEASUREMENT 9 Hrs

16.1 Thread gauges
16.2 Gear Tooth Caliper
16.3 Gear Testing Machine

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

Mech-252 METROLOGY

Practical Objectives:

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

1. PRACTICE OF FOLLOWING GRADUATED TOOLS

1.1 PRACTICE OF STEEL RULE
- 1.1.1 Read steel rule correctly
- 1.1.2 Measure linear lines with steel rule

1.2 PRACTICE OF HOOK RULE
- 1.2.1 Set hook rule with work piece correctly
- 1.2.2 Measure the size using hook rule

1.3 PRACTICE OF FOLDING RULE
- 1.3.1 Unfold the folding rule correctly
- 1.3.2 Measure the job size accurately

1.4 PRACTICE OF TRAMMELS
- 1.4.1 Mount the trammels with beam
- 1.4.2 Set the points with work piece accurately
- 1.4.3 Measure the size with steel rule

2. PRACTICE OF COMBINATION SET

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

3. PRACTICE OF FOLLOWING SUPPORTING TOOLS

3.1 PRACTICE OF SURFACE PLATES (Cast Iron, Granite, and Glass)
- 3.1.1 Know about the use of surface plates
- 3.1.2 Know about the selection of surface plates as per work
- 3.1.3 Know about the care of surface plates

3.2 PRACTICE OF STRAIGHT EDGE
- 3.2.1 Know about the care of straight edge
- 3.2.2 Use straight edge in different exercises

3.3 PRACTICE OF SPIRIT LEVEL
- 3.3.1 Know about setting of spirit level on work-piece
- 3.3.2 Use to check horizontal and vertical surfaces job properly
- 3.3.3 Know about the use and care of spirit level

3.4 ENGINEERS LEVEL
- 3.4.1 Know about bubble setting of level
- 3.4.2 Check level of worktable of any machine tool

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

4. PRACTICE OF FOLLOWING GAUGES

4.1 PRACTICE OF FIX GAUGES
- 4.1.1 Measure the job for upper and lower limit
- 4.1.2 Calculate maximum and minimum size
- 4.1.3 Calculate tolerance and allowance
- 4.1.4 Understand representation of tolerance

4.2 PRACTICE OF ADJUSTABLE GAUGES
- 4.2.1 Know about setting of adjustable gauges
- 4.2.2 Use adjustable gauges properly

4.3 PRACTICE OF SMALL HOLE GAUGES
- 4.3.1 Select proper size small hole gauge
- 4.3.2 Use the small hole gauge properly
- 4.3.3 Read the size on micrometer

4.4 PRACTICE OF TELESCOPE GAUGES
- 4.4.1 Select proper size telescope gauge
- 4.4.2 Set the gauge in work piece
- 4.4.3 Read the size on micrometer

5. PRACTICE AND USE OF FOLLOWING PRECISION INSTRUMENTS

5.1 PRACTICE OF OUTSIDE MICROMETER
- 5.1.1 Calculate least count
- 5.1.2 Remove zero error
- 5.1.3 Measure the size of job accurately

5.2 PRACTICE OF INSIDE MICROMETER
- 5.2.1 Remove zero error
- 5.2.2 Set the instruments on work piece
- 5.2.3 Read the size correctly

5.3 PRACTICE OF DEPTH MICROMETER
- 5.3.1 Remove the zero error
- 5.3.2 Set the instruments on work pieces properly
- 5.3.3 Read the size accurately

5.4 PRACTICE OF THREAD MICROMETER
- 5.4.1 Set the thread micrometer on work piece
- 5.4.2 Read the scale properly
- 5.4.3 Measure the size accurately

5.5 PRACTICE OF VERNIER MICROMETER
- 5.5.1 Remove zero error
- 5.5.2 Set the instruments on work piece
- 5.5.3 Read the vernier scale
- 5.5.4 Measure the size accurately

6. PRACTICE AND USE OF VERNIER TOOLS

6.1 PRACTICE OF VERNIER CALIPER
- 6.1.1 Check weather zero error exits or not
- 6.1.2 Read the vernier scale correctly
- 6.1.3 Measure different sizes accurately

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

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

7. PRACTICE AND USE OF FOLLOWING ANGLE MEASURING TOOLS

7.1 PRACTICE OF BEVEL PROTRACTOR
- 7.1.1 Set the blade in protractor properly
- 7.1.2 Set the protractor on work piece accurately
- 7.1.3 Read the angle correctly

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

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

7.4 PRACTICE OF STEEL PROTRACTOR
- 7.4.1 Set the protractor on work piece
- 7.4.2 Measure the angle

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

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

9. PRACTICE AND USE OF FOLLOWING DIAL INSTRUMENTS
9.1 PRACTICE OF DIAL CALIPER
- 9.1.1 Set the pointer on zero properly
- 9.1.2 Set the work piece correctly
- 9.1.3 Read the dial scale accurately

9.2 PRACTICE OF DIAL THICKNESS GAUGE
- 9.2.1 Remove zero error
- 9.2.2 Set the work piece properly
- 9.2.3 Measure the size accurately

9.3 Practice of Dial Indicator
- 9.3.1 Set the Indicator on magnetic stand
- 9.3.2 Set the pointer on zero
- 9.3.3 Set the pointer on work piece
- 9.3.4 Read the dial scale

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

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

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

13. PRACTICE AND USE OF FOLLOWING COMPARATORS
13.1 PRACTICE OF MECHANICAL COMPARATOR

13.1.1 Make complete setup for mechanical comparator
13.1.2 Set the dial at zero
13.1.3 Compare the size of job with standard

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

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

14. PRACTICE OF DIGITAL INSTRUMENTS

14.1 Use of digital instruments
14.2 Explain the care of digital instruments

15. PRACTICE ON COORDINATE MEASURING MACHINE

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

16. PRACTICE OF THREAD AND GEAR MEASUREMENT

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

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

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

Mech-252 **METROLOGY**

List of Equipment:

1.	Steel Rule (Metric scale)	44Nos.
2.	Hook Rule	22 Nos.
3.	Folding Rule	22 Nos.
4.	Trammels	22 Nos.
5.	Measuring Tapes	22 Nos.
6.	Cast-Iron Surface Plate	10 Nos.
7.	Granite Surface Plate	5 Nos.
8.	Glass Surface Plate	5 Nos.
9.	Straight Edge	10 Nos.
10.	Spirit level	10 Nos.
11.	Engineers Level	10 Nos.
12.	Engineers Parallel	10 Nos.
13.	Outside Micrometer	44 Nos.
14.	Inside Micrometer (Rod Type)	10 Nos.
15.	Inside Micrometer (Caliper Type)	10 Nos.
16.	Hole Gauge/3 point Micrometer	2 Nos.
17.	Depth Micrometer (Fix)	10 Nos.
18.	Depth Micrometer (Adjustable)	10 Nos.
19.	Thread Micrometer	10 Nos.
20.	Hot Gauge Micrometer	10 Nos.
21.	Vernier Micrometer with Metric scale	10 Nos.
22.	Dial Indicator with stand	10 Nos.
23.	Vernier Caliper (only Metric Scale)	44 Nos.
24.	Vernier Height Gauge(only Metric Scale)	10 Nos.
25.	Vernier Depth Gauge (Hook Type)	10 Nos.
26.	Dial Caliper	10 Nos.
27.	Dial Thickness Gauge	10 Nos.
28.	Dial Bore-Gauge	10 Nos.
29.	Bevel Protractor	10 Nos.
30.	Universal Bevel Protractor	10 Nos.
31.	Dial Protractor	10 Nos.
32.	Steel Protractor	22 Nos.
33.	Sine Bar	5- Nos.
34.	Fix Gauges (Ring-Plug-Snap-Radius)	5-set
35.	Adjustable Gauges	5-set
36.	Thread Gauges	5-set
37.	Standard wire gauge	10 Nos.
38.	Small Hole Gauges	5-set
39.	Telescope Gauges	5-set
40.	Digital Micrometer	10 Nos.
41.	Digital Caliper	10 Nos.
42.	Digital Depth Micrometer	10 Nos.
43.	Digital Depth Caliper	10 Nos.
44.	Digital Height Gauge	10 Nos.
45.	Digital Height Master	5 Nos.

46.	**Digital Indicator with stand**	**10 Nos.**
47.	**Gear Tooth Caliper Metric scale**	**10 Nos.**
48.	**Mechanical Comparator**	**10 Nos.**
49.	**Electrical Comparator**	**10 Nos.**
50.	**Electronics Comparator**	**2 Nos.**
51.	**Gauge Block Set (mm)**	**2 Nos.**
52.	**Tool Makers Microscope**	**1No.**
53.	**Coordinate Measuring M/c (2D, 3D)**	**1No.**
54.	**Digital 3D Scanner**	**1No.**
55.	**Profile Projector/Shadow Graph**	**1No.**
56.	**Gear Testing machine**	**1No.**
57.	**Optical Flats**	**10 Nos.**

Mech-223

ENGINEERING DRAWING AND CAD-II

Mech-223 ENGINEERING DRAWING AND CAD-II

Total Contact Hours	**T**	**P**	**C**
Theory: 32Hrs	**1**	**6**	**2**
Practical: 192Hrs			

Pre-requisites: BASIC ENGINEERING DRAWING AND CAD-I

AIMS: At the end of this course students will be able to understand the use of engineering drawings in various fields of industry specially related with Mechanical Technology. They will understand the various symbols, development and intersections, machine parts, sectioning, fasteners, keys & cotters, coupling, riveted joints and detail and the assembly drawings of their respective parts. More over they can draw the above said parts communicating their manufacturing details in each aspect. In part B students will be able to apply the Auto-Cad Commands and can draw respective 2D & 3D drawings with their applications.

Course Contents:

1.	**SYMBOLIC REPRESENTATIONS**	**3 Hrs**
2.	**DEVELOPMENTS OF SOLIDS**	**3 Hrs**
3.	**INTERSECTION OF DUCTS/PIPES & SOLIDS**	**3 Hrs**
4.	**SECTIONING**	**2Hrs**
5.	**FASTENERS DESCRIPTION**	**3 Hrs**
6.	**RIVET AND RIVETED JOINTS**	**3 Hrs**
7.	**KEYS & COTTERS**	**2 Hrs**
8.	**BEARINGS**	**3Hrs**
9.	**SHAFT COUPLINGS**	**3 Hrs**
10.	**PRODUCTION DRAWINGS**	**4 Hrs**
11.	**APPLICATION OF TOLERANCES, ALLOWANCES, AND FITS**	**3 Hrs**

Detail of Contents:

1. SYMBOLIC REPRESENTATIONS **3 Hrs**

- 1.1 Machining Symbols
- 1.2 Welding symbols
- 1.3 Material Symbols
- 1.4 Thread Symbols
- 1.5 Conventional Breaks

2. DEVELOPMENT OF SOLIDS **3Hrs**

- 2.1 Solids and its types
- 2.2 Methods of finding developments

2.3 Procedure of developing Prism, Pyramid, Cone & Cylinder (Right & Oblique)
2.4 Frustum and truncation

3. INTERSECTION OF DUCTS/PIPES AND SOLIDS **3 Hrs**

3.1 Intersection of plane surfaces
3.2 Intersection of curved surfaces
3.3 Cylinder with Cylinder
3.4 Cylinder with Cone

4. SECTIONING

2Hrs

4.1 Sectioning and its purposes
4.2 Cutting Plane, C.P. Line, Section Lines
4.3 Type of sectional views
4.4 Parts not sectioned

5. FASTENERS DESCRIPTION

3Hrs

5.1 Fasteners
5.2 Threads & nomenclature
5.3 Screw Threads, their types
5.4 Nuts, Bolts and studs
5.5 Lock nut & devices

6. RIVET AND RIVETED JOINTS **3 Hrs**

6.1 Rivet, Rivet heads
6.2 Riveted joints
6.3 Plates and cover plates
6.4 Riveting process
6.5 Caulking and fullering
6.6 Empirical proportions
6.7 Technical terms

7. KEYS & COTTERS **2 Hrs**

7.1 Key and its nomenclature
7.2 Types of keys
7.3 Use of key
7.4 Cotters and its types
7.5 Comparison between keys and cotters

8. BEARINGS **3Hrs**

8.1 Bearing and its importance
8.2 Types of Bearing
8.3 Parts of Bearing

9. SHAFT COUPLING **3 Hrs**

9.1 Shaft and Coupling
9.2 Types of Coupling
9.3 Parts and Proportions
9.4 Uses of Coupling

10. PRODUCTION DRAWINGS **4 Hrs**

10.1 Working / production drawing

10.2 Types of production drawings
10.3 Importance of detail and assembly drawings
10.4 Title blocks
10.5 Essentials Requirements for making detail and assembly drawings

11. APPLICATION OF TOLERANCE, ALLOWANCE AND FITS 3 Hrs

11.1 Introduction
11.2 Tolerance
11.3 Allowance
11.4 Difference between Tolerance and Allowance
11.5 Fits and its types
11.6 Applications

Recommended Textbooks:

1. **Engineering Drawing by French Verick.**
2. **Fundamentals of Engineering Drawing by Luzzader.**
3. **AutoCAD 2010 Tutorial First Level: 2D Fundamentals by Randy H. Shih**
4. **AutoCAD 2010 Tutorial Second Level: 3D Modeling by Randy H. Shih**

Mech-223 ENGINEERING DRAWING AND CAD-II

Contents:

PART-B: AUTO CAD MECHANICAL – II **96 Hrs**

1. INTRODUCTION TO AUTOCAD FOR MECHANICAL TECHNOLOGY **12Hrs**
- 1.1. Auto CAD Mechanical Design Concepts
- 1.2. User Interface
- 1.3. Mechanical Structure

2. TOOLS FOR CREATING AND MANIPULATING **27 Hrs**
- 2.1. Drawing Tools
- 2.2. Editing Tools

3. MECHANICAL PARTS GENERATORS **21Hrs**
- 3.1. Standard Parts
- 3.2. Springs
- 3.3. Chains / Belts
- 3.4. Shafts

4. DIMENSION AND DRAWING SHEETS **12 Hrs**
- 4.1. Dimension
- 4.2. Annotation and Symbols
- 4.3. Drawing Sheets

5. BILL OF MATERIALS, PARTS LISTS **9 Hrs**
- 5.1. Bill of Materials
- 5.2. Parts Lists
- 5.3. Ballooning Parts

6. 3D SURFACE MODELING **6 Hrs**
- 6.1 Plan Surface, Ruled Surface
- 6.2 Extrude Surface, Revolve Surface
- 6.3 Sweep Surface, Loft Surface
- 6.4 Surface Trim & Extend

7. SOLID MODELING **9 Hrs**
- 7.1 Extrude Solid, Revolve Solid
- 7.2 Sweep Solid, Loft Solid
- 7.3 Boolean Operations

Mech-223 ENGINEERING DRAWING AND CAD-II

Instructional Objectives:

After completion of this Course students will be able to;

1. SYMBOLIC REPRESENTATIONS

1.1 State different material symbols used in production
1.2 Apply to draw the different symbols on various production drawings
1.3 Describe Machining, Plumbing, Piping & welding Symbols
1.4 Explain and draw Thread symbols and conventional breaks

2. DEVELOPMENTS OF SOLIDS

2.1 State the geometrical solids
2.2 Explain right and oblique prism and pyramid
2.3 Differentiate cone and cylinder, (Right and Oblique)
2.4 Distinguish frustum and truncation
2.5 Describe the methods use to develop the solids

3. INTERSECTION OF DUCTS/PIPES

3.1 Define plane and curved surfaces
3.2 Define line of intersection
3.3 Explain the procedure to determine the line of intersection of plane and curve surfaces
3.4 Define curve of intersection/penetration

4. SECTIONING

4.1 Define the sectioning and its purposes
4.2 State cutting plane, C.P. line and section lines
4.3 Explain different sectional views
4.4 Describe the parts which are not sectioned

5. FASTENERS DESCRIPTION

5.1 Define the term Fastener
    5.1.1. Describe threaded and unthreaded Fastener
    5.1.2. State internal and external threads
5.2 Explain threads and its nomenclature/terms
5.3 Explain different forms of thread and their uses
5.4 Describe the function of nut and bolts and their types
5.5 Explain locking devices

6. RIVET AND RIVETED JOINTS

6.1 Define Rivet, different Rivet heads
6.2 Explain Riveted Joints , Define Lap and Butt Joints (Single and Double Riveted types)
6.3 Differentiate plate, strap and cover plates
6.4 Explain Riveting and their processes
6.5 Distinguish caulking & **fullering** process
6.6 Calculate the empirical proportions' by un-wins formula
6.7 Explain technical terms used in Riveted Joints

7. KEYS & COTTERS

7.1 Define key and cotter
7.2 Describe its nomenclature
7.3 Explain the types of key
7.4 Describe the use of key
7.5 State material of key and cotter

7.6 Compare key and cotter

8. BEARINGS

8.1 Define Bearing
8.2 Explain the importance of Bearing
8.3 Describe the types of bearing
8.4 Explain parts of Bearing

9. SHAFT COUPLINGS

9.1 Define shaft and shaft coupling
9.2 Explain the types of coupling
9.3 State parts and proportions of coupling
9.4 Explain the uses of protective and non protective coupling

10. PRODUCTION DRAWINGS

10.1 Define production drawing
10.2 Explain the types of production drawing
10.3 Describe importance of Detail and Assembly drawings
10.4 State the detail of Title block
10.5 Explain the essentials requirements for making Detail and Assembly drawings

11. APPLICATION OF TOLERANCE, ALLOWANCE AND FITS

11.1 Introduction of Tolerance and Allowance
11.2 Define Tolerance and explain its types
11.3 Explain Allowance
11.4 Differentiate the Tolerance and Allowance
11.5 Define Fits and its types
11.6 Apply the Tolerance, Allowance and Fits **for drawings**

Mech-223 ENGINEERING DRAWING AND CAD-II

List of Practical:

(PART-A: MANUAL DRAWING 96Hrs)

1. SYMBOLS **9 Hrs**
- 1.1 Plumbing and Piping Symbols
- 1.2 Welding Symbols, Threads Symbols
- 1.3 Material Symbols and Conventional Breaks

2. DEVELOPMENTS **15 Hrs**
- 2.1 Development of right and oblique Prism (Truncated)
- 2.2 Development of right and oblique Pyramid (Frustum & Truncated)
- 2.3 Development of right and oblique Cone (Frustum & Truncated)
- 2.4 Development of right and oblique Cylinder (Truncated)

3. INTERSECTION **6 Hrs**
- 3.1 Line of intersection of Plane surfaces
- 3.2 Line of intersection of curved surfaces

4. FASTENERS **6 Hrs**
- 4.1 Nut & Bolt (Hex. & Square Type)
- 4.2 Threads forms and multiple threads
- 4.3 Locking devices

5. RIVET AND RIVETED JOINTS **9 Hrs**
- 5.1 Rivets Heads
- 5.2 Lap Joints (Single & Double Riveted) Chain and Zigzag type
- 5.3 Butt Joints (Single & Double Riveted) Chain and Zigzag type

6. KEYS & COTTERS **3 Hrs**
- 6.1 Sketching of **different** keys and cotters

7. BEARINGS **9 Hrs**
- 7.1 Bushed Bearing (Half Section)
- 7.2 Ball Bearing (Full Section)
- 7.3 Plummer Block (Detail)(Full Section)
- 7.4 Plummer Block (Assembly)

8. SHAFT COUPLINGS **15 Hrs**
- 8.1 Split Muff Coupling
- 8.2 Flanged Coupling (Protective and non-protective type)
- 8.3 Oldham Coupling
- 8.4 Hook's Coupling
- 8.5 Knuckle Joints

9. PRODUCTION DRAWINGS **15 Hrs**
- 9.1 Boiler Stop Valve (Assembly)
- 9.2 Connecting Rod (Detail & Assembly)
- 9.3 Screw Jack (Detail & Assembly)
- 9.4 Tail Stock (Detail)
- 9.5 Tail Stock (Assembly)

10. APPLICATION OF TOLERANCE, ALLOWANCE AND FITS **9 Hrs**
- 10.1 Bearing housing assembly
- 10.2 Detail and assembly of Shaft seal unit

Mech-223 ENGINEERING DRAWING AND CAD-II

Practical Objectives:

(PART-A: MANUAL DRAWING 96 Hrs)

1. SYMBOLS

1.1 Draw the border line and title block
1.2 Draw the plumbing and piping symbols
1.3 Draw the welding and thread symbols
1.4 Draw the material symbols and conventional breaks
1.5 Identify and apply the above said symbols in various drawing

2. DEVELOPMENTS

2.1 Draw the development of right and oblique prism with its truncation (Square , Rectangle and Hexagonal type)
2.2 Draw the development of right and oblique pyramid with truncation and frustum (Square and Hexagonal type)
2.3 Draw the development of right and oblique cone with its frustum and truncation
2.4 Draw the development of right and oblique cylinder with its truncation

3. INTERSECTION

3.1 Draw the intersection of plane surfaces
3.2 Draw the development of curve surfaces like cylinder and cone
3.3 Draw the intersection of curved surfaces

4. FASTENERS

4.1 Draw the three views of Hexagonal and Square nuts
4.2 Draw the three views of Hexagonal and Square bolts
4.3 Draw the different forms of thread
4.4 Develop skills to draw the Vee and square multiple threads

5. RIVET AND RIVETED JOINTS

5.1 Identify and draw the Rivet Heads with their proportions
5.2 Draw the views of single Riveted and double Riveted Lap Joint (Chain and Zigzag type)
5.3 Draw the views of Butt Joint in single and double Riveted shape (Chain and Zigzag type)

6. KEYS & COTTERS

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

7. BEARINGS

7.1 Draw the Half sectional, Front, Side and Top view of Bushed Bearing assembly
7.2 Identify the parts and their material
7.3 Develop the skill to draw full sectional views of Ball Bearing
7.4 Know the various parts of Plummer Block
7.5 Draw the detail of Plummer Block
7.6 Draw the assembly of Plummer Block in full sections

8. SHAFT COUPLINGS

8.1 Draw the views of Split Muff Coupling
8.2 Draw the views of Flanged Coupling (Protective and non-protective type)
8.3 Develop the skill to draw the detail and assembly of Old Ham Coupling
8.4 Draw the detail views of Hooks Coupling parts
8.5 Draw the assembly drawing of Hooks Coupling
8.6 Identify the parts and material of Hooks Coupling
8.7 Develop the skill to draw assembly of Knuckle Joint

9. PRODUCTION DRAWINGS

9.1 Draw the assembly drawing of Boiler Stop Valve
9.2 Identify the parts and material of Boiler Stop Valve
9.3 Draw the views of Connecting Rod in detail and assembly drawing
9.4 Know and draw the parts detail of Screw Jack
9.5 Draw the assembly drawing of Screw Jack
9.6 Develop the skill to draw the views of Tail Stock parts
9.7 Identify the material of various parts of Tail Stock
9.8 Draw the assembly of Tail Stock in full section showing its parts

10. APPLICATION OF TOLERANCE, ALLOWANCE AND FITS

10.1 Know the method of placing Tolerance
10.2 Identify the type of Tolerance
10.3 Identify the Allowance
10.4 Identify the terms used in Allowance
10.5 Apply the above information on the drawings

Mech-223 ENGINEERING DRAWING AND CAD-II

Practical Objectives:

(PART-B: AUTOCAD MECHANICAL 96 Hrs)

1. **Understand AutoCAD 2010 working Environment**
2. **Practice View Commands**
3. **Understand Drawing Lines and types of lines command**
4. **Understand Toolbars and Profiles**
5. **2-D drawings and commands**
6. **Practice Draw Commands**
7. **Practice Modify Commands**
8. **Understand Selecting Objects**
9. **Understand Object Properties**
10. **Understand Drafting Settings and Object Snaps**
11. **Practice Dimensions**
12. **Practice Text Tools**
13. **Understand Title blocks and Templates**
14. **Understand Viewports and Layouts**
15. **Understand User Coordinate System (UCS)and the Z-axis**
16. **Practice 3D Wireframe Modeling and mesh**
17. **Understand UCS, Viewports and Wireframe Modeling**
18. **Practice 3D Surface Modeling**
19. **Practice Solid Modeling - Constructive Solid Geometry**
20. **Understand Regions, Extrude and Solid Modeling**
21. **Creating region by p-edit command**
22. **Practice Multi-view Drawings from 3D Models**
23. **Practice Symmetrical Features in Designs**
24. **Practice Advanced Modeling Tools and Techniques**
25. **Conceptual Design Tools and Techniques**
26. **Exercise Practical Drawings**

Mech-223 **ENGINEERING DRAWING AND CAD-II**

List of Machinery:

1.	Drafting Table	50-set
2.	Instruments Box	01-set
3.	Tee Square	03-set
4.	Set Square	03-set
5.	Templates	12-set
6.	French Curves	03-set
7.	Clutch Pencil	12-set
8.	Lead Pencil	60-set
9.	Eraser	12-set
10.	Erasing Machine (Manual)	06-set
11.	Portable Drawing Board	04-set
12.	Computer	50-set
13.	Printer	01-set
14.	Scanner	01-set
15.	Computer Table	50-No.
16.	Computer Chairs	50-No.
17.	Multimedia Projector	01-set
18.	Plotter	
19.	UPS	

Mech-236

WORKSHOP PRACTICE-II

Mech-236 WORKSHOP PRACTICE-II

Total Contact Hours	**T**	**P**	**C**
Theory: 64 Hrs	**2**	**12**	**6**
Practical: 384 Hrs			

Pre-requisites: WORKSHOP PRACTICE-I

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

A) Machine Shop:

1) Operate lathe, drill 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) Welding Inspection and Testing

Mech-236 WORKSHOP PRACTICE-II

A) Machine Shop:

Course Contents:

1.	**TYPES OF LATHE AND USES**	**3Hrs**
2.	**LATHE CUTTING TOOL GEOMETRY**	**1Hr**
3.	**MACHINING TIME**	**2Hrs**
4.	**LATHE OPERATIONS**	**5Hrs**
5.	**DRILL MACHINES AND OPERATIONS**	**6Hrs**
6.	**TOOL GRINDERS AND OPERATIONS**	**2Hrs**
7.	**GRINDING WHEELS**	**4Hrs**
8.	**SHAPER MACHINES**	**4Hrs**
9.	**PLANNER MACHINES**	**5Hrs**

Detail of Contents:

1. LATHE MACHINES **3 Hrs**

1.1 TYPES OF LATHE AND THEIR USES
- 1.1.1 Centre lathe
- 1.1.2 Bench lathe
- 1.1.3 Capstan lathe
- 1.1.4 Turret lathe
- 1.1.5 Tool room lathe
- 1.1.6 Special purpose lathe
- 1.1.7 CNC lathe

1.2 LATHE ATTACHMENTS AND WORK HOLDING DEVICES
- 1.2.1 Taper turning attachment
- 1.2.2 Cylindrical grinding attachment
- 1.2.3 Milling attachment
- 1.2.4 Tool and job holding devices on lath machine

2. LATHE CUTTING TOOL GEOMETRY **1 Hr**

2.1 Single point cutting tool terms

2.2 Tool angles
- 2.2.1 Front clearance angle
- 2.2.2 Side clearance angle
- 2.2.3 Top rake angle
- 2.2.4 Side rake angle
- 2.2.5 End relief angle
- 2.2.6 Side relief angle

3. MACHINING TIME **2 Hrs**

3.1 Machining time (turning and facing)

3.2 Total machining time
3.3 Factors involved in total machining time
3.4 Formulae for calculation of machining and total machining time
3.5 Coolants and Lubricants
3.5.1 Types of coolants and lubricants
3.5.2 Applications and uses of each

4. LATHE OPERATIONS **5Hrs**

4.1 Drilling for reaming
4.1.1 Drill calculation for reaming
4.1.2 Reaming
4.1.3 Purpose and importance of reaming
4.2 Boring
4.2.1 Straight Boring
4.2.2 Counter Boring
4.2.3 Taper Boring
4.3 Methods of Taper Turning
4.3.1 Tail stock offset method
4.3.2 Taper turning attachment method
4.4 Threading Operations
4.4.1 External threading
4.4.2 Internal threading
4.4.3 Procedure of cutting threads (external & internal)
4.4.4 Thread rolling

5. DRILL MACHINES **6 Hrs**

5.1 Parts of drill machines
5.1.1 Major parts and their functions
5.2 Types of drill machines
5.2.1 Sensitive drill machine and uses
5.2.2 Bench drill machine and uses
5.2.3 Gang drill machine and uses
5.2.4 Multi-spindle drill machine & uses
5.2.5 Radial drill machine & uses
5.3 Drill Machine Operations
5.3.1 Drill and drill types
5.3.2 Drilling
5.3.3 Counter sinking
5.3.4 Counter boring
5.3.5 Reaming
5.3.6 Spot facing
5.3.7 Tapping
5.4 Tool and Job holding devices used on drill machines
5.5 Procedure of drills grinding
5.6 Safety precautions during drilling operation and drill grinding

6. TOOL GRINDER **2 Hrs**

6.1 Types of tool grinder
6.1.1 Pedestal grinder
6.1.2 Bench grinder
6.1.3 Wet grinder

7. GRINDING WHEELS AND STANDARD MARKING SYSTEM **4 Hrs**

7.1 Grinding wheel elements
7.1.1 Abrasive

7.1.2 Grain
7.1.3 Grade
7.1.4 Bond
7.1.5 Structure
7.1.6 Selection of grinding wheel

7.2 Grinding Wheels
7.2.1 Standard wheels shapes and their applications
7.2.2 Loading and glazing of grinding wheels
7.2.3 Truing and dressing method of grinding wheels
7.2.4 Inspection of grinding wheels
7.2.5 Safety precautions for tool grinding

8. SHAPER **4 Hrs**

8.1 Types of Shaper & Description.
8.2 Shaper stroke adjustment
8.2.1 Length of stroke
8.2.2 Position of stroke
8.2.3 No. of strokes per minute
8.3 Forward and backward Stroke of Shaper
8.4 Lubrication of shaper
8.5 Shaper Operations
8.5.1 Vertical shaping
8.5.2 Horizontal shaping
8.5.3 Angular shaping
8.5.4 Oblique profile shaping

9. PLANNER MACHINE **5Hrs**

9.1 Parts of planner and functions
9.2 Forward and backward stroke
9.3 Lubrication
9.4 Difference between shaper and planner
9.5 Planner operations
9.5.1 Plain flat surface
9.5.2 Cutting dove-tail slides
9.5.3 Cutting simple slots
9.5.4 Cutting T –slots
9.5.5 Cutting tools used on the planner

Recommended Textbooks:

1. **Technology of Machine Tools by Steve F. Krar, Albert F. Check**
2. **Shop Theory by James Anderson, Earil E. Tatro**
3. **Production Machine Shop by John E. Neely**
4. **Machine Tool Technology by Willard J. McCarthy, Dr. Victor E. Reff**
5. **Machine Tool Metal Working by John L. Feirer**
6. **Workshop Technology by R.K. Jain**

Mech-236 WORKSHOP PRACTICE-II

A) Machine Shop:

Instructional Objectives:

1. LATHE MACHINE

1.1 Understand the types of Lathe machine and their uses
- 1.1.1 Describe center lathe with its uses
- 1.1.2 Describe bench lathe with its uses
- 1.1.3 Describe capstan lathe with its uses
- 1.1.4 Describe turret lathe with its uses
- 1.1.5 Describe tool room lathe with its uses
- 1.1.6 Describe special purpose lathes with its uses
- 1.1.7 Describe CNC lathe with its uses

1.2 Understand the types of Lathe attachments
- 1.2.1 Explain taper turning attachment
- 1.2.2 Explain cylindrical grinding attachment
- 1.2.3 Explain milling attachment
- 1.2.4 **Explain Tool and work holding devices of Lathe Machine**

2. LATHE CUTTING TOOL ANGLES

2.1 Describe single point cutting tool terms

2.2 Understand the lathe tool angles
- 2.2.1 Describe the front clearance angle
- 2.2.2 Describe side clearance angle
- 2.2.3 Describe top rake angle
- 2.2.4 Describe side/back rake angle
- 2.2.5 Describe end relief angle
- 2.2.6 Describe side relief angle

3. MACHINING TIME

3.1 Understand machining and total machining time
- 3.1.1 Explain machining time i.e. setup time, actual time
- 3.1.2 Explain total machining time
- 3.1.3 Describe the factors involved in total machining time, i.e. setup time, actual machining time, auxiliary time and delay time
- 3.1.4 Explain the formulae for calculating machining and total machining time

3.2 Understand coolants and lubricants
- 3.2.1 List types of coolants and lubricants
- 3.2.2 Describe the applications and uses of each

4. LATHE OPERATIONS

4.1 Understand drilling for reaming
- 4.1.1 Explain drill size calculation for reaming
- 4.1.2 Define reaming
- 4.1.3 Describe purpose and importance of reaming
- 4.1.4 Enlist types of reamers

4.2 Understand Boring
- 4.2.1 Describe straight boring
- 4.2.2 Describe counter boring
- 4.2.3 Describe taper boring
- 4.2.4 State types of boring tools

4.3 Understand methods of taper turning

4.3.1 List the methods of taper turning i.e. tail stock offset method and taper turning attachment method
4.3.2 Explain each method
4.3.3 Explain merits and demerits of each method

4.4 Understand threads and use of threads
4.4.1 **Types of threads**
4.4.2 Methods of thread cutting
4.4.3 Describe the procedure of cutting external and internal threads on lath machine
4.4.4 Describe thread rolling

5. DRILL MACHINES

5.1 Understand parts of drill machine
5.1.1 Explain major parts and their functions

5.2 Understand types of drill machine
5.2.1 Describe sensitive drill machine and its uses
5.2.2 Describe bench drill machine and its uses
5.2.3 Describe gang drill machine and its uses
5.2.4 Describe multi-spindle drill machine and its uses
5.2.5 Describe radial drill machine and its uses

5.3 Understand drill machine operations
5.3.1 Drill types and drill parts
5.3.2 Explain drilling
5.3.3 Explain counter sinking
5.3.4 Explain counter boring
5.3.5 Explain reaming
5.3.6 Explain spot facing
5.3.7 Explain tapping

5.4 Understand tool and job holding devices used on drill machine
5.4.1 Describe tool and job holding devices

5.5 Describe procedure for drill grinding

5.6 Describe safety precautions adopted during drilling operation.

6. TOOL GRINDER

6.1 Understand types of tool grinders
6.1.1 Describe pedestal grinder
6.1.2 Describe bench grinder
6.1.3 Describe wet grinder

7. ELEMENTS OF GRINDING WHEEL AND STANDARD MARKING SYSTEM

7.1. Understand grinding wheel elements
7.1.1. Explain abrasive materials used for grinding wheels
7.1.2. Explain grain size
7.1.3. Explain grade of grinding wheel
7.1.4. Explain bonding material used for grinding wheel
7.1.5. Explain structure of grinding wheel
7.1.6. Describe selection of grinding wheel
7.1.7. Describe standard marking system for grinding wheel

7.2. Understand grinding wheels
7.2.1. Describe standard wheel shapes and their applications
7.2.2. Describe loading and glazing of grinding wheel
7.2.3. Describe **truing** and dressing methods of grinding wheel
7.2.4. Describe inspection of grinding wheel
7.2.5. Describe safety precautions to be observed during tool grinding

8. SHAPER

- 8.1 Understand shaper types
  - 8.1.1 List types of shaper
  - 8.1.2 Explain each
- 8.2 Understand shaper stroke adjustment
  - 8.2.1 Explain the procedure for setting length of stroke
  - 8.2.2 Explain the procedure for setting position of stroke
  - 8.2.3 Explain No. of strokes per minute and its calculations
- 8.3 Explain forward and backward stroke of shaper
- 8.4 Explain lubrication of shaper
- 8.5 Understand shaper operations
  - 8.5.1 Explain Vertical shaping
  - 8.5.2 Explain Horizontal shaping
  - 8.5.3 Explain angular shaping
  - 8.5.4 Explain oblique profile shaping

9 PLANNER MACHINE

- 9.1 Understand planner parts and functions
  - 9.1.1 Explain major parts of Planner and their functions
- 9.2 Explain forward and backward stroke
- 9.3 Explain lubrication of planner
- 9.4 Explain the difference between shaper and planner
- 9.5 Understand planner operations
  - 9.5.1 Describe the procedure for planning flat surfaces on planner
  - 9.5.2 Describe the procedure for cutting dovetail slides on planner
  - 9.5.3 Describe the procedure for cutting simple slots on planner
  - 9.5.4 Describe the procedure for cutting T-slots on planner
  - 9.5.5 Enlist cutting tools used on planner

Mech-236 **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**	**12 Hours**
3.	**Taper turning by taper turning attachment**	**12 Hours**
4.	**Eccentric turning practice**	**18 Hours**
5.	**Practice of reaming**	**6 Hours**
6.	**Practice of taper boring**	**6 Hours**
7.	**Practice of grinding tool for thread cutting**	**6 Hours**
8.	**Practice of cutting metric v-thread**	**9 Hours**
9.	**Practice of cutting square thread**	**12 Hours**
10.	**Practice of cutting acme thread**	**12 Hours**
11.	**Practice of cutting multi-start v-thread**	**12 Hours**
12.	**Practice of cutting internal metric v-thread**	**12 Hours**
13.	**Practice of preparing milling arbor**	**12 Hours**
14.	**Practice of preparing plain mandrel**	**9 Hours**
15.	**Practice of drill grinding**	**12 Hours**
16.	**Practice of shaping V-Block**	**36 Hours**

Mech-236 WORKSHOP PRACTICE-II

A) Machine Shop:

Practical Objectives:

1. CENTERING THE JOB BY DIAL INDICATOR METHOD

The student will be able to:-

1.1. Use the 4-jaw independent chuck for centering
1.2. Use the rings given on the face of chuck for centering w/p
1.3. Hold dial indicator using magnetic stand on bed ways or at any suitable place
1.4. Use the dial indicator for centering
1.5. Center the work pieces by dial indicator

2. TAPER TURNING BY TAIL STOCK OFF-SET METHOD

The student will be able to:-

2.1 Calculate the amount of tail stock off-set
2.2 Off-set the tail stock to the required amount
2.3 Set up the cutting tool as for parallel turning
2.4 Hold job between centers along with drive plate and lathe dog
2.5 Take light cuts controlling the feed by carriage hand wheel
2.6 Measure the small end of taper

3. TAPER TURNING BY TAPPER TURNING ATTACHMENT

The student will be able to:-

3.1 Calculate the amount of guide bar set-over
3.2 Disconnect cross slide feed screw
3.3 Loosen lock screw of guide bar and off-set the guide bar end for required amount
3.4 Set the compound rest at 90 degree
3.5 Lock the anchor bracket to the lathe bed
3.6 Set the depth of cut and turn the taper

4. ECCENTRIC TURNING PRACTICE

The student will be able to:-

4.1 Face the ends of job to get the required length
4.2 Turn the required diameter
4.3 Mount four jaw chuck on machine spindle
4.4 Mark center line on the job end
4.5 Punch the center of eccentric position
4.6 Hold job between 4-jaw chuck and revolving center supporting it from eccentric center drill hole
4.7 Parallel the job at its both ends
4.8 Take light cuts to determine the portion of job for eccentric turning
4.9 Perform eccentric turning operation

5. PRACTICE OF REAMING

The student will be able to:-

5.1 Checking the drill hole
5.2 Select the reamer of correct size
5.3 Use the reamer
5.4 Checking with plug gauge
5.5 List safety factors

6. PRACTICE OF TAPER BORING

The student will be able to:-

6.1 Select proper boring tool

6.2 Clamp the boring tool in proper position
6.3 Set tapper angle
6.4 Perform taper boring operation
6.5 List safety factors

7. PRACTICE OF GRINDING TOOL FOR THREAD CUTTING

The student will be able to:-

7.1 Grind required angle of threading tool
7.2 Check tool angle of threading tool with tool angle/Center gauge
7.3 List safety factors

8. PRACTICE OF CUTTING METRIC V-THREAD

The student will be able to:-

8.1 Clamp the threading tool properly
8.2 Set gear tumbler and lever according to thread pitch
8.3 Take trial cut to check the pitch
8.4 Control depth of cut from cross slide dial
8.5 Measure thread pitch by using thread pitch gauge
8.6 Cut the metric V-threads

9. PRACTICE OF CUTTING SQUARE THREAD

The student will be able to:-

9.1 Hold job and turning tool properly
9.2 Turn job by using right hand tool
9.3 Hold threading tool at 90 degree angle
9.4 Set change gear for getting correct pitch
9.5 Take trial cut to check the pitch
9.6 Measure thread pitch by suing thread pitch gauge
9.7 Cut the square threads

10. PRACTICE OF CUTTING ACME THREAD

The student will be able to:-

10.1 Hold job and turning tool properly
10.2 Turn job by using right hand tool
10.3 Hold threading tool at 29 degree angle
10.4 Set change gear for getting correct pitch
10.5 Take trail cut to check the pitch
10.6 Measure thread pitch by using thread pitch gauge
10.7 Cut the acme threads

11. PRACTICE OF CUTTING MULTI-START V-THREAD

The student will be able to:-

11.1 Hold job and turning tool properly
11.2 Turn job by using right hand tool according to required diameter
11.3 Hold threading tool properly
11.4 Set change gear for getting correct pitch for multi-start thread
11.5 Take trail cut (first start) to check the pitch
11.6 Control depth of cut from cross slide knob
11.7 Move the compound slide and set the threading tool for second start
11.8 Measure thread pitch and Cut multiple V-Threads

12. PRACTICE OF CUTTING INTERNAL V-THREAD

The student will be able to:-

12.1 Hold job and turning tool properly
12.2 Drill/bore by using drill/boring tool
12.3 Hold internal v-threading tool properly
12.4 Set change gear for getting correct pitch

12.5 Take trail cut to check the pitch
12.6 Measure thread pitch by using thread ring gauge
12.7 Cut internal V-treads

13. PRACTICE OF PREPARING MILLING ARBOR

The student will be able to:-

13.1 Turn work to correct length by facing the both ends
13.2 Drill center hole on one end of job
13.3 Remove chuck and replace it by drive plate
13.4 Mount live center in head stock spindle
13.5 Mount revolving center in tail stock spindle
13.6 Clamp the work between the centers using dog carrier
13.7 Cut left hand thread on right end
13.8 Mount end mill in the chuck
13.9 Mount milling attachment on the top of the carriage
13.10 Hold the work in milling attachment crosswise
13.11 Mill the Key seat/way feeding the job against revolving end mill

14. PRACTICE OF PREPARING PLAIN MANDREL

The student will be able to:-

14.1 Turn work piece to correct length by facing the both ends
14.2 Drill center hole on both end of the job
14.3 Remove chuck and replace it by drive plate
14.4 Mount live center in head stock spindle
14.5 Mount revolving center in tail stock spindle
14.6 Clamp the job between the centers using dog carrier and turn it
14.7 Turn the diameter for gear blank bore following the tolerance
14.8 Turn the shoulder square
14.9 Turn groove of required size
14.10 Cut threads according to required size

15. PRACTICE OF DRILL GRINDING

The student will be able to:-

15.1 Stand in front of the wheel but slightly to the left
15.2 Dress grinding wheel
15.3 Hold the drill between the thumb and first finger of the right hand
15.4 Hold shank of twist drill between the thumb and finger of left hand
15.5 Set twist drill with wheel face at 59 degree angle
15.6 Twist the drill until its one cutting edge is horizontal and parallel to wheel face
15.7 Swing the shank of drill slight downward and to the left while other hand is supported by the tool rest
15.8 Apply slight forward motion to this hand
15.9 Repeat necessary steps to grind other lip of drill
15.10 Measure the length of lips and their angle i.e. 118 degree using drill point gauge

16. PRACTICE OF SHAPING V-BLOCK

The student will be able to:-

16.1 Clamp the cutting tool in tool post
16.2 Check alignment of shaper vice
16.3 Clamp and level the work piece
16.4 Set the length of stroke
16.5 Set the suitable number of strokes per minute
16.6 Adjust suitable depth of cut
16.7 Control both the manual and automatic feeds
16.8 Shape horizontal, vertical surfaces at right angle to each other.
16.9 Set the tool head at an angle

16.10 Shape the angular surfaces
16.11 Cut slots on shaper

Mech-236 **WORKSHOP PRACTICE-II**

A) Machine Shop:

List of Machinery:

1.	Center Lathe	**20Nos.**
2.	Shaper Machine	**2 Nos.**
3.	Pillar Type Drill Machine	**3 Nos.**
4.	Pedestal Grinder	**2 Nos.**
5.	Power Hack Saw	**1No.**

Mech-236 **WORKSHOP PRACTICE-II**

B) Foundry and Pattern Making:

Course Contents:

(Part A: Foundry)

1.	**MOLDING AND MOLDING TECHNIQUES**	**2Hrs**
2.	**CORE AND CORE MAKING**	**2Hr**
3.	**CUPOLA OPERATION**	**4Hrs**
4.	**CASTING DEFECTS**	**2Hrs**

(Part B: Pattern Making)

5.	**PATTERN MAKING**	**4Hrs**
6.	**PATTERN ALLOWANCES**	**2Hrs**

Detail of Contents:

(Part A: Foundry)

1. Molding and molding techniques **2Hrs**
- 1.1 Bedding in molding
- 1.2 Use of two parting surfaces
- 1.3 Molding of loose piece pattern
- 1.4 Use of draw back
- 1.5 Molding with three piece molding box

2. Core and Core making **2Hrs**
- 2.1 Cores and its type
- 2.2 Core sand and its properties
- 2.3 Core baking
- 2.4 Solid and hollow core

3. Cupola Operation **4Hrs**
- 3.1 Cupola's charge and its Properties
- 3.2 Charging of cupola
- 3.3 Tapping and botting
- 3.4 Melting and pouring

4. Casting Defects **2Hrs**
- 4.1 Blow holes, its causes and remedies
- 4.2 Shrinkage cavity or crack its causes and remedies
- 4.3 Miss-run, its causes and remedies
- 4.4 Mismatch, its causes and remedies
- 4.5 Fins, its causes and remedies

(Part B:Pattern Making)

5. PATTERN MAKING **4Hrs**

- 5.1 Principle of pattern making
- 5.2 Selection of pattern material with respect to their properties
- 5.3 Pattern Construction and its techniques
- 5.4 Preparation of pattern layout
- 5.5 Preservation and storage of pattern
- 5.6 Master Pattern
- 5.7 Modern Trends in Pattern Making
  - 5.7.1 Using CNC router
  - 5.7.2 Using Rapid Prototyping Machine
    - 5.7.2.1 Stereo lithography (SLA) Machine
    - 5.7.2.2 Selective Laser Sintering (SLS) Machine

6. PATTERN ALLOWANCES **2Hrs**

- 6.1 Shrinkage allowance
- 6.2 Machining allowance
- 6.3 Draft allowance
- 6.4 Rapping allowance
- 6.5 Distortion allowance

Recommended Textbooks:

1. **Foundry practice By William H Salmon**
2. **Foundry Technology By K.P.Sinha & D.B.Goel**
3. **Foundry Technology By Dr. Fazal Kareem**
4. **Exploring Pattern making and foundry By Harvey D. Minar and John G.Millar**

Mech-236 WORKSHOP PRACTICE-II

C) Foundry and Pattern Making:

Instructional Objectives:

(Part A: Foundry)

1. **Explain Molding and molding techniques**
   - 1.1 Explain bedding in molding techniques
   - 1.2 Explain use of two parting surfaces
   - 1.3 Describe molding of loose piece pattern
   - 1.4 Describe use of draw back
   - 1.5 Describe molding with three piece molding box (Cope drag & Cheek)
2. **Explain core and core making**
   - 2.1 Explain core and its type
   - 2.2 Explain different core sand composition and its properties
     - 2.2.1. Green sand core
     - 2.2.2. Dry sand core
   - 2.3 Describe core baking
   - 2.4 Describe solid and hollow core
3. **Explain cupola operations**
   - 3.1 Explain cupola charge and its properties
   - 3.2 Explain charging process of cupola
   - 3.3 Explain tapping and botting of cupola furnace
     - 3.3.1 Tapping bar
     - 3.3.2 Bott stick
     - 3.3.3 Botting clay
     - 3.3.4 Slag hole tapping
     - 3.3.5 Melting zones
   - 3.4 Explain melting and pouring process
4. **Explain Casting Defects**
   - 4.1 Explain blow holes, its causes and remedies
   - 4.2 Explain shrinkage cavity and crack, its causes and remedies
   - 4.3 Describe miss run, its causes and remedies
   - 4.4 Describe mismatch, its causes and remedies
   - 4.5 Describe fins, its causes and remedies

(Part B: Pattern Making)

5. **Explain pattern making**
   - 5.1 Introduction to pattern making and its importance
   - 5.2 Explain principles of pattern making
   - 5.3 Explain selection of pattern material with respects to material properties
   - 5.4 Explain techniques of pattern constructions
     - 5.4.1 Explain preparation of pattern layout
     - 5.4.2 Explain construction of pattern
   - 5.5 Describe preservation and storage of pattern
   - 5.6 Describe master pattern
   - 5.7 Explain Modern Trends in Pattern Making
     - 5.7.1 Describe working and operation of CNC router
     - 5.7.2 Describe working and operation of Rapid Prototyping Machine

5.7.2.1 Stereo lithography (SLA) Machine
5.7.2.2 Selective Laser Sintering (SLS) Machine

6. Explain pattern allowances

6.1 Explain shrinkage allowance
6.2 Explain machining allowance
6.3 Explain draft allowance
6.4 Describe rapping allowance
6.5 Explain distortion allowance

Mech-236 WORKSHOP PRACTICE-II

B) Foundry and Pattern Making:

Practical List:

(Part A: Foundry)

1. MOLDING **12 Hrs**

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 **9 Hrs**

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 **12 Hrs**

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

5. SAND TESTING **15 Hrs**

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 **6 Hrs**

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 **6 Hrs**

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**	**6 Hrs**
10.	**Practice of making two piece patterns (step pully) along with core prints**	**3 Hrs**
11.	**Application of CNC Router for complex shaped pattern**	**3 Hrs**
12.	**Preparation of a pattern of Bell or Vase on Rapid Prototyping Machine**	**6 Hrs**
13.	**Preparation of a pattern of Mobile Case on Rapid Prototyping Machine**	**6 Hrs**

Mech-236 WORKSHOP PRACTICE-II

B) Foundry and Pattern Making:

Practical Objectives:

(Part A: Foundry)

1. MOLDING

AFTER PERFORMING THE MOLDING PRACTICE THE STUDENT WILL BE ABLE TO:-

1.1 Do the molding with two piece pattern
1.2 Perform molding with two piece pattern
1.3 Perform molding with three piece pattern
1.4 Able to use three piece molding box i.e. cope drag and cheek

2. CORE MAKING

AFTER PERFORMING THE CORE MAKING THE STUDENT WILL BE ABLE TO:-

2.1 Make the core of round shape with two piece core box
2.2 Make the half core with single piece core box
2.3 Assemble the two halves of the core
2.4 Bake the core for proper strength

3. CASTING

AFTER PERFORMING THE CASTING PRACTICE THE STUDENT WILL BE ABLE TO:-

3.1 Use the pyrometer for determine the temperature of furnace
3.2 Observe the construction and feature of cupola furnace
3.3 Operate the cupola furnace
3.4 Do the tapping operation
3.5 Perform the pouring molten metal in the mold

4. CLEANING AND FINISHING OF CASTING

AFTER PERFORMING THE CLEANING AND FINISHING PRACTICE THE STUDENT WILL BE ABLE TO:-

4.1 Clean the casting with hammer and chisel
4.2 Remove the sand with wire brush
4.3 Cut the gate and riser by Hack saw
4.4 Remove the entrapped sand by sand blasting machine and to polis the casting with tumbling barrel machine

5. SAND TESTING

AFTER PERFORMING THE SAND TESTING PRACTICE THE STUDENT WILL BE ABLE TO:-

5.1 Determine the moisture contents in the foundry sand
5.2 Check the clay contents in the foundry sand
5.3 Find out the permeability No. of foundry sand
5.4 Determine the green compressive strength of molding sand
5.5 Check the grain size of foundry sand

6. TESTING OF CASTING

AFTER PERFORMING THE TESTING OF CASTING PRACTICE THE STUDENT WILL BE ABLE TO:-

6.1 Detect the blow holes in the casting
6.2 Find the Mismatch in the casting
6.3 Find the Miss run and its remedies in the casting
6.4 Detect the Fins and its remedies

(Part B: Pattern Making)

7. AFTER PERFORMING THIS PRACTICAL THE STUDENT WILL BE ABLE TO:-

7.1 Prepare a pattern on wood turning for casting hollow parts
7.2 Produce core prints on the pattern
7.3 Add allowance on the pattern

8. AFTER PERFORMING THIS PRACTICAL THE STUDENT WILL BE ABLE TO:-

8.1 Prepare a single piece pattern with projected ribs
8.2 Layout a pattern properly as per design and requirements
8.3 Provide draft, Shrinkage, machining and distortion allowance
8.4 Operate CNC router machine

9. AFTER PERFORMING THIS PRACTICAL THE STUDENT WILL BE ABLE TO:-

9.1 Produce a single piece pattern manually
9.2 Layout a wood plate for pattern making
9.3 Provide draft and machining allowance on the pattern

10. AFTER PERFORMING THIS PRACTICAL THE STUDENT WILL BE ABLE TO:-

10.1 Calculate shrinkage , machining and draft allowances
10.2 Turn (step pulley) pattern on lathe
10.3 Provide core prints
10.4 Cut the pattern into two pieces
10.5 Insert dowel pins

11. AFTER PERFORMING THIS PRACTICAL THE STUDENT WILL BE ABLE TO:-

11.1 Draw the layout of pattern on the computer of CNC router
11.2 Transfer data from computer to CNC router
11.3 Prepare an accurate pattern on CNC router machine

12. AFTER PERFORMING THIS PRACTICAL THE STUDENT WILL BE ABLE TO:-

12.1 Make 3D drawing of required pattern/model on Rapid Prototyping machine
12.2 Transfer data from computer to Rapid Prototyping machine
12.3 Prepare an accurate model pattern on Rapid Prototyping machine

13. AFTER PERFORMING THIS PRACTICAL THE STUDENT WILL BE ABLE TO:-

13.1 Make 3D drawing of required pattern/model on Rapid Prototyping machine
13.2 Transfer data from computer to Rapid Prototyping machine
13.3 Prepare an accurate model pattern on Rapid Prototyping machine

Mech-236 **WORKSHOP PRACTICE-II**

B) Foundry and Pattern Making:

List of Machinery and Equipment:

1.	Core Baking Oven	1-set
2.	Pyrometer	2-set
3.	Cupola Furnace (500Kg)	1-set
4.	Gas fired tilting crucible furnaces	1-set
5.	Sand Blasting Machine	1-set
6.	Hand Grinder	5-set
7.	Tumbling Barrel Machine	1-set
8.	Moisture Test Apparatus	2-set
9.	Clay Contents Test Apparatus	2-set
10.	Permeability Test Apparatus	2-set
11.	Sand Strength Testing Machine	1-set
12.	Sand Finess Testing Equipment	1-set
13.	Jig Saw Machine	1-set
14.	Band Saw Machine	1-set
15.	Wood Thickenesser and Planner Machine	1-set
16.	Rapid prototyping machine	1-set
17.	CNC router	1-set
18.	Sand Mixer	1-set
19.	CO2 Molding Apparatus containing CO2 gas cylinder	1-set

Mech-236 **WORKSHOP PRACTICE-II**

C) Advanced Welding:

Course Contents:

1.	**TYPES OF WELDING JOINTS**	**1Hrs**
2.	**WELDING SYMBOLS / AMERICAN WELDING SOCIETY**	**1Hr**
3.	**WELDING POSITIONS**	**1 Hrs**
4.	**WELDING TESTS**	**2Hrs**
5.	**OXY ACETYLENE GAS WELDING TECHNIQUES**	**1Hrs**
6.	**ALUMINUM WELDING**	**1Hr**
7.	**COPPER WELDING**	**1 Hrs**
8.	**CAST IRON WELDING**	**1Hrs**
9.	**OXY ACETYLENE GAS CUTTING**	**1Hr**
10.	**TIG WELDING (TUNGSTEN INERT GAS WELDING/ARGON WELDING)**	**2Hrs**
11.	**MIG WELDING (METAL INERT GAS WELDING/CO2 WELDING)**	**2 Hrs**
12.	**PLASMA ARC CUTTING**	**1Hr**
13.	**SAFETY PRACTICE AND PROCEDURE**	**1 Hrs**

Detail of Contents:

1. TYPES OF WELDING JOINTS **1Hr**

- 1.1 Butt Joint
- 1.2 Lap Joint
- 1.3 Corner Joint
- 1.4 T - Joint

2. WELDING SYMBOLS / AMERICAN WELDING SOCIETY **1Hr**

- 2.1 Methods to specify welding information
- 2.2 Size of Arrow, near side and fore side
- 2.3 Weld size
- 2.4 Welding Process/Specifications

3. WELDING POSITIONS **1Hr**

- 3.1 Four positions of welding(Flat, Horizontal, vertical &over head)
- 3.2 Current Adjustment for each position
- 3.3 Welding techniques for each position

4. WELDING TESTS **2 Hrs**

- 4.1 Visual examination
- 4.2 Non-Destructive Test (NDT)and its types
- 4.3 Destructive Test (DT)and its types

5. ARC AND OXY ACETYLENE GAS WELDING TECHNIQUES **1Hr**

- 5.1 Fore Hand welding Techniques (Right to Left)

5.2 Back Hand welding Technique (Left to Right)
5.3 Preheating of base metal

6. CARBON STEEL WELDING **1Hr**

6.1 Preparation of base metal (cutting, straightening, and cleaning)
6.2 Preheating of base metal
6.3 Application of Flux
6.4 Proper plane for **carbon steel** welding
6.5 Welding Technique for **carbon steel**

7. ALUMINIUM AND COPPER WELDING **1Hr**

7.1 Weld ability of **Aluminum and Copper**
7.2 Preparation of the base metal
7.3 Preheating of base metal
7.4 Filler material
7.5 Welding technique for Aluminum and Copper

8. CAST IRON WELDING **2Hrs**

8.1 Weld ability of cast iron
8.2 Difficulties during welding of cast iron
8.3 Preparation of base metal
8.4 Preheating of base metal
8.5 Application of Flux
8.6 Welding techniques of cast iron

9. OXY ACETYLENE GAS CUTTING **1Hr**

9.1 Gas cutting blow pipes
9.2 Function of the gas cutting torch
9.3 Flame use for gas cutting
9.4 Oxidation process

10. TIG WELDING (TUNGSTUN INERT GAS WELDING/ARGON WELDING) **2Hrs**

10.1 Introduction of TIG welding Machine
10.2 Function of argon Gas
10.3 Arc of Tungsten Electrode
10.4 Current Adjustment for welding process
10.5 Function of the Tungsten Electrode

11. MIG WELDING (METAL INERT GAS WELDING/CO_2 WELDING) **2 Hrs**

11.1 Introduction of MIG welding Machine
11.2 ARC of MIG welding
11.3 Filler metal of MIG welding
11.4 Current adjustment according to size of filler metal
11.5 Function of CO_2 gas

12. PLASMA CUTTING **1 Hr**

13.1 Introduction of Plasma Cutting
13.2 Cut-ability of metals
13.3 Operation of laser cutting techniques

13. SAFETY PRACTICE AND PROCEDURE **1 Hr**

13.1 Electric Arc Welding
13.2 Gas Welding
13.3 Flashback and backfire

Recommended Textbooks:

1. **Arc Welding (Basic Fundamentals) by Johan R. Walkar**
2. **Welding Technology by O. P. Khanna**
3. **Oxyacetylene Welding (Basic Fundamentals) by R. B. Gupta, Ronald J. Barid**
4. **Pipe Welding Techniques by I. Wan H. Edward**
5. **Fundamentals of Welding Skills by Peter F. Woo**

Mech-236 WORKSHOP PRACTICE-II

C) Advanced Welding:

Instructional Objectives:

After study this topic learner will be able to:

1. TYPES OF WELDING JOINTS 1Hr

1.1 Describe the types of joint (Butt, Lap, Corner & Tee Joint)
- 1.1.1 Open Square Butt Joint
- 1.1.2 "V" Groove Butt Joint
- 1.1.3 Half "V" Groove Butt Joint
- 1.1.4 Double "V" Groove Butt Joint
- 1.1.5 "U" Groove Butt Joint
- 1.1.6 "J" Groove Butt Joint
- 1.1.7 Double "J" Groove Butt Joint

1.2 Describe the position of Lap Joint

1.3 State the position of corner Joint
- 1.3.1 Inside Corner Joint
- 1.3.2 Outside Corner Joint/Square Corner Joint

1.4 Define the position "T" Joint for inside / Outside fillet Joint

2. WELDING SYMBOLS / AMERICAN WELDING SOCIETY 1Hr

2.1 Explain the methods specify the welding information
- 2.1.1 Type of Weld
- 2.1.2 Size of Weld
- 2.1.3 Place of Weld

2.2 Explain Basic Welding Symbols
- 2.2.1 Open Square Butt Joint
- 2.2.2 "V" Groove Butt Joint
- 2.2.3 Half "V" Groove Butt Joint
- 2.2.4 Double "V" Groove Butt Joint
- 2.2.5 "U" Groove Butt Joint
- 2.2.6 "J" Groove Butt Joint
- 2.2.7 Double "J" Groove Butt Joint

2.3 Describe location of Arrow

2.4 Explain Welding Process and their specification

3. WELDING POSITIONS 1Hr

3.1 Explain four positions for welding
- 3.1.1 Flat Position
- 3.1.2 Over Head position
- 3.1.3 Vertical Position (Down to up & Up to Down)
- 3.1.4 Horizontal Position

3.2 State the current adjustment for above each position

3.3 Describe the welding technique for different position

4. WELDING TESTS 2 Hrs

4.1 Describe the types of test and visual examination

4.2 Describe the non-destructive Test (NDT)
- 4.2.1 X-rays Test

4.2.2 Gama rays Test
4.2.3 Magna Flux Test
4.2.4 Dye Penetrant Test

4.3 **Describe** Destructive Test
4.3.1 Tensile Test
4.3.2 Fatigue Test
4.3.3 Shear Test

5. ARC AND OXY ACETYLENE GAS WELDING TECHNIQUES 1Hr

5.1 Describe the Fore hand welding techniques (Right to Left hand)
5.2 Describe Back hand welding techniques (Right to Left hand)
5.3 State the preheating and post weld heat treatment of following base metals
5.3.1 Aluminum
5.3.2 Copper
5.3.3 Cast Iron
5.4 Preheating of welding electrode

6. CARBON STEEL WELDING 1Hr

6.1 Describe preparation of Base Metal
6.1.1 Straightening of Base Metal pieces
6.1.2 Cleaning of the Base Metal with sand paper
6.2 Describe preheating of base metal
6.3 Describe application of fluxes
6.4 Describe proper plane for carbon steel welding
6.5 Describe welding techniques for carbon steel welding

7. ALUMINIUM AND COPPER WELDING 1Hr

7.1 Describe weld ability of Aluminum and Copper
7.2 State preparation of base metal
7.3 State pre heating of base metal
7.4 Describe filler materials
7.5 Describe different welding technique for Aluminum and Copper
7.6 Describe use of flux

8. CAST IRON WELDING 2Hrs

8.1 Describe weld ability of C.I
8.2 Explain the difficulties of welding process raised due to heavy quantity of carbon
8.3 State preheating of base metal
8.4 Describe the applications of flux
8.5 State the welding technique used for casting iron welding

9. OXY ACETYLENE GAS CUTTING 1Hr

9.1 Explain the construction of gas cutting torch
9.2 State the types of flame
9.2.1 Neutral Flame
9.2.2 Oxidizing Flame
9.3 Explain the process of oxidation of metal / cutting process

10. TIG WELDING (TUNGSTEN INERT GAS WELDING/ORGAN WELDING) 2 Hrs

10.1 Describe construction/operation of TIG welding machine
10.2 Describe the Arc of Tungsten Electrode
10.3 State the function of organ gas
10.4 Describe the current adjustment
10.5 State the function of Tungsten electrode

11. MIG WELDING (METAL INERT GAS WELDING/CO_2 WELDING) 2 Hrs

11.1 Describe the construction and operation of the MIG welding machine

11.2 Describe the Arc of MIG welding machine
11.3 Describe the filler metal use for MIG welding
11.4 State the current adjustment
11.5 Explain the function of CO_2 gas

12. PLASMA CUTTING **1Hr**

12.1 Describe the introduction of Plasma cutting
12.2 Describe the function of plasma cutting machine
12.3 Describe the cut-ability of different metals, like aluminum, mild steel, stainless steel
12.4 Explain the operations of plasma cutting techniques

13. UNDERSTAND SAFETY PRACTICE AND PROCEDURE **1 Hr**

13.1 Observe Safety Practice and Procedures in Electric Arc Welding Shop
13.2Observe Safety Practice and Procedures in Oxy Acetylene Gas Welding Shop

Mech-236 **WORKSHOP PRACTICE-II**

C) Advanced Welding:

List of Practical:

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

Mech-236 WORKSHOP PRACTICE-II

C) Advanced Welding:

Practical Objectives:

1. **Double "V" Butt Joint by Arc welding**
   - 1.1 Make "V" grove for preparation of Arc welding joint
   - 1.2 Cleaning of base metal
   - 1.3 Tacking of base metal and complete bead
2. **Fillet joint inside corner by Arc welding**
   - 2.1 Cleaning of base metal
   - 1.1 Tacking of base metal at 90˚
   - 1.2 Complete bead
3. **"T" Fillet joint**
   - 3.1 Cleaning of base metal
   - 3.2 Tacking of base metal at 90˚
   - 3.3 Complete bead
4. **Pipe welding having Nominal size ǿ 3**
   - 4.1 Make "V" groove by grinding the edges of pipe
   - 4.2 Tacking of both pieces of pipe
   - 4.3 Fix the pipe on welding table
   - 4.4 Completion of head in same position
5. **Visual examination of pipe welded joint**
   - 5.1 Identify the welding defects of Under Cut
   - 5.2 Identify the welding defects of Porosity
   - 5.3 Identify the welding defects of Blow holes
   - 5.4 Identify the welding defects of Slag inclusion
   - 5.5 Identify the welding defects of Cracks
   - 5.6 Identify the welding defects of Lack of Penetration (Root, Side, End)
6. **Aluminum Butt joint oxyacetylene gas welding**
   - 6.1 Cleaning of the base metal edges
   - 6.2 Make the oxidizing flame
   - 6.3 Preheating of base metal up to red hot condition
   - 6.4 Flux application
   - 6.5 Tacking of base metal
   - 6.6 Apply back hand welding technique
   - 6.7 Complete bead one pass
7. **Cast Iron Butt Joint by (Oxyacetylene gas welding)**
   - 7.1 Cleaning of the base metal edges
   - 7.2 Make the oxidizing flame
   - 7.3 Preheating of base metal up to red hot condition
   - 7.4 Flux application
   - 7.5 Tacking of base metal
   - 7.6 Apply back hand welding technique
   - 7.7 Complete bead in one pass

8. Oxy-acetylene Gas cutting of mild steel

8.1 Preparation of base metal to be cut
8.2 Mark the starting and end point of base metal
8.3 Make Neutral flame of oxyacetylene
8.4 Red hot the starting point of base metal
8.5 Open the Oxygen jet
8.6 Complete the cutting process accordingly

9. TIG Welding

9.1 Introduction and function of TIG welding machine
9.2 Switch on the machine and open the organ gas
9.3 Adjust the pressure of argon Gas from pressure regulator
9.4 Switch on welding nozzle and make Arc by using proper current
9.5 Tacking of base metal with the help of filler rod
9.6 Complete the joining process accordingly

10. MIG Welding

10.1 Introduction and function of MIG welding machine
10.2 Switch on the machine and open CO_2 gas
10.3 Adjust the pressure of CO_2 gas from pressure regulator
10.4 Check the wire spool movement
10.5 Tack the base metal and complete the bead accordingly

11. PLASMA CUTTING

11.1 Cut the Aluminum
11.2 Cut the Stainless steel
11.3 Cut the mild steel

Mech-236 **WORKSHOP PRACTICE-II**

D) Advanced Welding:

List of Machinery:

1.	Welding Transformer	5-set
2.	Welding Rectifier	5-set
3.	Welding Generator	2-set
4.	TIG Welding machine	2-set
5.	MIG Welding Machine	2-set
6.	Oxy-acetylene Welding Set	4-set
7.	Power Shear	1-set
8.	Pedestal Grinder	1-set
9.	Hand Grinder (Electric)	3-set
10.	Plasma Cutting Machine	1-set
11.	Air Compressor	1-set

Mech-242

METALLURGY

Mech-242 METALLURGY

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

Pre-requisites: None

AIMS: This subject deals with the Metallurgy concepts that influence Mechanical and physical properties of Metals and Alloys. The student acquire knowledge of ores and the methods of dressing them which enhances his knowledge regarding different operations carried out in the recovery of ferrous and non-ferrous metals from their ores. The students gains also knowledge of different steel making processes. The student will also acquire knowledge of various shaping, farming, rolling methods. It will also enhance the knowledge Die-casting process of metals and powder metallurgy.

Course Contents:

1.	**INTRODUCTION TO METALLURGY**	**2 Hrs**
2.	**ORES**	**2 Hrs**
3.	**PRODUCTION PROCESS**	**2 Hrs**
4.	**REFRACTORY MATERIALS**	**4 Hrs**
5.	**TREATMENT OF IRON ORES**	**3 Hrs**
6.	**PRE-SMELTING TREATMENT OF ORES**	**4 Hrs**
7.	**BLAST FURNACE**	**5 Hrs**
8.	**MANUFACTURING OF WROUGHT IRON**	**4 Hrs**
9.	**STEEL MANUFACTURING PROCESSES**	**9 Hrs**
10.	**TYPES OF STEEL**	**4 Hrs**
11.	**NON FERROUS METALS**	**5 Hrs**
12.	**INDUSTRIAL SHAPING OF METALS**	**10 Hrs**
13.	**DIE-CASTING**	**4 Hrs**
14.	**POWDER METALLURGY**	**6 Hrs**

Detail of Contents:

1. INTRODUCTION TO METALLURGY **2 Hrs**

1.1 Definition and Classification
1.2 Scope of Metallurgy

2. ORES **2 Hrs**

2.1 Definition of ore
2.2 Iron ores and its occurrence in nature
2.3 Natural resources of iron ores in Pakistan
2.4 Classification and evaluation of iron ores

3. PRODUCTION PROCESS **2 Hrs**

- 3.1 Reduction and oxidation
- 3.2 Acid and Base in Metallurgical terminology

4. REFRACTORY MATERIALS **4 Hrs**

- 4.1 Definition and classification
- 4.2 Acid refractory materials
- 4.3 Basic refractory materials
- 4.4 Neutral refractory materials

5. TREATMENT OF IRON ORES **3 Hrs**

- 5.1 Hand picking
- 5.2 Magnetic separation
- 5.3 Gravity separation
- 5.4 Roasting and calcinations
- 5.5 Froth floatation

6. PRE-SMELTING TREATMENT OF ORES **4 Hrs**

- 6.1 Concentration
- 6.2 Agglomeration
  - 6.2.1 Sintering
  - 6.2.2 Pelletizing
  - 6.2.3 Nodulizing

7. BLAST FURNACE **5 Hrs**

- 7.1 Construction of blast furnace
- 7.2 Composition of the charge
- 7.3 Charging and working operations of the Blast Furnace
- 7.4 Chemical Reaction
- 7.5 Zones of Blast Furnace
- 7.6 Taping of molten metal
- 7.7 Preheating plant for Blast Furnace
- 7.8 Pig iron properties and uses

8. MANUFACTURING OF WROUGHT IRON **4 Hrs**

- 8.1 Classification of Puddling furnace
- 8.2 Charge of Puddling furnace
- 8.3 Simple operation of Puddling furnace
- 8.4 Construction of Puddling furnace
- 8.5 Uses of wrought iron

9. STEEL MANUFACTURING PROCESSES **9 Hrs**

- 9.1 Chemistry of steel refining
  - 9.1.1 Raw Material
  - 9.1.2 Constituents of each raw material
  - 9.1.3 Chemical Reactions
- 9.2 Open Hearth Furnace.
  - 9.2.1 Construction and working of an Open Hearth Furnace
  - 9.2.2 Acid process
  - 9.2.3 Basic Process
- 9.3 Bessemer Convertor
  - 9.3.1 Construction of convertor
  - 9.3.2 Charge of the convertor
  - 9.3.3 Operation of Bessemer convertor
- 9.4 Electric Arc Furnace
  - 9.4.1 Types of Electric Furnaces
  - 9.4.2 Construction of Electric Furnaces

9.4.3 Charging of Electric Arc Furnaces
9.4.4 Operation of Electric Arc Furnaces
9.4.5 Oxidation period
9.4.6 Addition of alloying elements and tapping.
9.4.7 Duplex operation.

9.5 Quality and Capacity of Steel

10. TYPES OF STEEL **4 Hrs**

10.1 Carbon steels.
10.2 Types of plain Carbon Steel
10.3 International Designations for Steel (SAE, DIN, JIS, AISI)
10.4 Alloy steels
10.5 Alloying elements of steel and their effects
10.6 Application of carbon and alloy steels.
10.7 Eutectoid steel.
10.8 Inter-metallic compound

11. NON FERROUS METALS **5 Hrs**

11.1 Properties and uses of non ferrous metals
11.2 Ores of non ferrous metals
11.3 Extraction of non ferrous metals

12. INDUSTRIAL SHAPING OF METALS & ALLOYS **10 Hrs**

12.1 Hot working processes.
12.1.1 Rolling
12.1.2 Forging
12.1.3 Drop forging
12.1.4 Heading
12.1.5 Hot pressing
12.1.6 Extrusion

12.2 Cold working process.
12.2.1 Rolling
12.2.2 Drawing
12.2.3 Pressing
12.2.4 Deep drawing
12.2.5 Coining
12.2.6 Spinning
12.2.7 Thread forming
12.2.8 Piercing

12.3 Production of pipes
12.3.1 Methods of pipe manufacturing
12.3.2 Casting and forming methods

13. DIE-CASTING **4 Hrs**

13.1 Die casting and its uses
13.2 Materials of dies
13.3 Die casting machines and their functions

14. POWDER METALLURGY **6 Hrs**

14.1 Introduction to powder Metallurgy
14.2 Powder manufacturing methods
14.3 Properties of Powder
14.4 Fabricating procedure and Secondary operations
14.5 Application o f Powder Metallurgy

Recommended Textbooks:

1. **Engineering Metallurgy by Higgins Part I & II**
2. **Physical and Chemical Metallurgy by JE GARSIDE**
3. **Physical metallurgy by AVNER**
4. **Elementary Metallurgy by Frier**
5. **Metallurgy of Iron and Steel by Bradley**
6. **Elementary Metallurgy and Metallography by Sharager**
7. **Metallurgy and Heat Treatment by Enos Fountain**

Mech-242 METALLURGY

Instructional Objectives:

1. INTRODUCTION TO METRALLURGY

1.1 Know definition and classification
- 1.1.1 Define Metallurgy
- 1.1.2 State relationship of metallurgy with chemistry
- 1.1.3 State classification of metallurgy

1.2 Know scope of metallurgy
- 1.2.1 Describe importance of metallurgy in engineering field
- 1.2.3 Describe specific importance w.r.t. steel industry

2. ORES

2.1 Know fundamentals
- 2.1.1 Define ore and its types
- 2.1.2 Describe Quality of good ore
- 2.1.3 Select proper ore for extraction of metal

2.2 Know Iron ores and their occurrence in nature
- 2.2.1 List types of iron ore
- 2.2.2 Describe each type
- 2.2.3 List the world ore deposits along with its Quality

2.3 Know the natural ore deposits in Pakistan
- 2.3.1 Enlist the Pakistan ore deposits along with its quantity and quality

2.4 Classification and evaluation of iron ores
- 2.4.1 Describe economic use of ores in Pakistan for making of steel
- 2.4.2 Describe iron ore needs for Pakistan steel Karachi

3. PRODUCTION PROCESSES

3.1 Understand Reduction and Oxidation
- 3.1.1 Define Reduction and Oxidation
- 3.1.2 Enlist different methods
- 3.1.3 Explain each method

3.2 Understand Acid and Basic process in Metallurgical Terminology
- 3.2.1 Define acid and base in metallurgy
- 3.2.2 Describe the effects of acid and basic process in metallurgy
- 3.2.3 Explain how to control the negative effects

4. REFRACTORY MATERIAL

4.1 Understand classification of refractory materials
- 4.1.1 Define refractory material
- 4.1.2 Enlist the types of refractory material
- 4.1.3 Explain the Quality of a refractory material

4.2 Understand acidic refractory materials
- 4.2.1 Define acidic refractory material
- 4.2.2 Explain its importance and use

4.3 Understand basic refractory materials
- 4.3.1 Define basic refractory materials
- 4.3.2 Explain its use and importance

4.4 Understand neutral Refractory materials
- 4.4.1 Define neutral refractory material
- 4.4.2 Explain its use and importance

5. TREATMENT OF IRON ORE

- 5.1 Understand hand picking
  - 5.1.1 Define Hand picking
  - 5.1.2 Explain Hand picking process
- 5.2 Understand Magnetic Separation
  - 5.2.1 Define magnetic Separation
  - 5.2.2 Explain magnetic separation process
- 5.3 Understand Gravity separation
  - 5.3.1 Define gravity separation
  - 5.3.2 Explain gravity separation process
- 5.4 Understand roasting and calcination
  - 5.4.1 Define roasting and calcination
  - 5.4.2 Explain roasting and calcinations process
- 5.5 Understand froth floatation
  - 5.5.1 Define froth floatation
  - 5.5.2 Explain froth floatation process

6. PRESMELTING TREATMENT OF IRON ORES

- 6.1 Understand pre-smelting treatment of ores
  - 6.1.1 Explain concentration
- 6.2 Explain agglomeration
  - 6.2.1 Explain Sintering
  - 6.2.2 Explain Pelletizing
  - 6.2.3 Explain Nodulizing

7. BLAST FURNACE

- 7.1 Understand Blast Furnace
  - 7.1.1 Explain the construction of a Blast Furnace
- 7.2 Understand the composition of the charge in Blast Furnace
  - 7.2.1 Describe the composition of the Charge of the Blast Furnace
  - 7.2.2 Describe the quantity of ore required to be fed
  - 7.2.3 Explain the escape of hot gases through chimney
- 7.3 Understand the charging and operation of Blast Furnace
  - 7.3.1 Explain the charging procedure of Blast Furnace
  - 7.3.2 Explain the working operation of Blast Furnace
- 7.4 Understand the Chemical reactions in Blast Furnace
  - 7.4.1 Describe different chemical reactions in the Blast Furnace
- 7.5 Understand the zones of Blast Furnace
  - 7.5.1 Explain the different zones of Blast Furnace
- 7.6 Understand the tapping of molten metal
  - 7.6.1 Describe the tapping of PIG iron through Blast Furnace
- 7.7 Understand the preheating plant for Blast Furnace
  - 7.7.1 Describe the use of preheating of air for Blast Furnace
  - 7.7.2 Explain the plant for preheating the air ancillary plant
  - 7.7.3 Explain the refractory bricks used in ancillary plant
  - 7.7.4 Explain flow of hot gases from Blast Furnace to ancillary plant
  - 7.7.5 Explain flow of hot air from ancillary plant to Blast Furnace
- 7.8 Understand PIG Iron properties and its uses
  - 7.8.1 Define PIG Iron
  - 7.8.2 Explain properties of pig iron
  - 7.8.3 Explain uses of pig iron
  - 7.8.4 Describe types of pig iron obtained from Blast Furnace

8. MANUFACTURING OF WROUGHT IRON

8.1 Understand the classification of Puddling Furnace
- 8.1.1 Enlist the types of Puddling Furnace

8.2 Understand the charge of Puddling Furnace
- 8.2.1 Describe the raw materials used for wrought iron in puddling furnace
- 8.2.2 Describe the capacity of Puddling furnace

8.3 Understand the Charging and Working Operation of Puddling Furnace
- 8.3.1 Explain the Charging and Working Operation of Puddling Furnace

8.4 Understand the construction of Puddling Furnace
- 8.4.1 Explain the construction of Puddling Furnace

8.5 Understand the uses of Wrought Iron
- 8.5.1 Define Wrought Iron
- 8.5.2 Describe its properties
- 8.5.3 Explain uses of Wrought Iron

9. STEEL MANUFACTURING PROCESSES

9.1 Know basic chemistry of steel manufacturing
- 9.1.1 List the raw material used for steel manufacturing.
- 9.1.2 Describe the constituents of each raw material.
- 9.1.3 Describe chemical reactions taking place in steel manufacturing furnace

9.2 Understand open hearth process
- 9.2.1 Describe the construction of Open Hearth Furnace
- 9.2.2 Describe the operation inside Open Hearth Furnace
- 9.2.3 Describe charging/discharging of Open Hearth Furnace
- 9.2.4 Describe fuel supply/heating of Open Hearth Furnace
- 9.2.5 Explain refractory lining of Open Hearth Furnace
  - 9.2.5.1 Describe refractory lining of Open Hearth Furnace for Acid Process
  - 9.2.5.2 Describe refractory lining of Open Hearth Furnace for Basic Process
- 9.2.6 Describe quality of steel obtained through Open Hearth Furnace
- 9.2.7 Estimate the quantity of steel produced by O.H. Furnace in Pakistan and the world

9.3 Understand Bessemer converter
- 9.3.1 Describe the construction of Bessemer converter
- 9.3.2 Describe charging of converter
- 9.3.3 Describe oxidation process in convertor
  - 9.3.3.1 Explain alloying of steel in the converter
  - 9.3.3.2 Describe discharging of the convertor
  - 9.3.3.3 Describe the converter used in Pakistan Steel (L.D. converter)
  - 9.3.3.4 Explain the difference between L.D. convertor and Bessemer convertor

9.4 Understand Electric Arc Furnaces
- 9.4.1 Describe the types of electric arc furnaces (Direct Arc Furnace & Indirect Arc Furnace)
- 9.4.2 Describe the parts of electric arc furnaces
- 9.4.3 Explain the charging of electric arc furnaces
- 9.4.4 Explain the working operation of electric arc furnaces
- 9.4.5 Describe the oxidation period during steel making
- 9.4.6 (i)Describe the alloying elements added during steel making
  (ii)Describe the tapping of steel
- 9.4.7 Describe the Duplex Operation

10. TYPES OF STEEL

- 10.1 Know difference between steel and iron
  - 10.1.1 Define steel
  - 10.1.2 Define iron
  - 10.1.3 Difference between steel and iron
- 10.2 Understand Types of Plain Carbon Steel
  - 10.2.1 List the types of plain carbon steel
  - 10.2.2 Define each type
  - 10.2.3 Describe the properties of each
  - 10.2.4 Explain the uses of each carbon steel
- 10.3 Understand alloy steel
  - 10.3.1 Describe alloy steel
  - 10.3.2 Explain the types of alloy steel
  - 10.3.3 Describe the uses of different alloy steels
  - 10.3.4 Describe tool steel
  - 10.3.5 Define stainless steel
  - 10.3.6 Explain the properties of stainless steel
- 10.4 Know alloying elements and their effects on steel
  - 10.4.1 Describe the effects of alloying elements on steel (Ni, Cr, C, Va, W, Mn, Co, Mb etc.)
- 10.5 Understand applications of carbon and alloy steels
  - 10.5.1 Explain the uses of each carbon steel
  - 10.5.2 Describe the uses of different alloy steel
- 10.6 Understand the Eutectoid Steel
  - 10.6.1 Describe the Eutectoid steel and its types
- 10.7 Understand the inter metallic compound
  - 10.7.1 Describe the inter metallic compound

11. NON FERROUS METALS.

- 11.1 Know non ferrous metals
  - 11.1.1 Define a non ferrous metal
  - 11.1.2 List common non ferrous metals
  - 11.1.3 Describe the properties and uses of non-ferrous metal
- 11.2 Understand Ores of non ferrous metals
  - 11.2.1 Enlist various non-ferrous ores
  - 11.2.2 Describe the use of different non-ferrous ores and their importance
- 11.3 Understand Extraction of Non ferrous metals
  - 11.3.1 Enlist ores of Cu, Al and Zn.
  - 11.3.2 Explain methods of extraction of Cu, Al and Zn.
- 11.4 Describe the Cu, Al and Zn based alloys and their uses

12. INDUSTRIAL SHAPING OF METALS& ALLOYS

- 12.1 Know hot working processes
  - 12.1.1 Define Hot working processes (hot rolling)
  - 12.1.2 Describe Hot forging
  - 12.1.3 Describe Drop forging
  - 12.1.4 Explain Heading
  - 12.1.5 Describe Hot Pressing
  - 12.1.6 Explain Extrusion
- 12.2 Understand cold working processes
  - 12.2.1 Define cold working processes and describe cold rolling, cold forging processes
  - 12.2.2 Describe Drawing
  - 12.2.3 Describe Cold pressing
  - 12.2.4 Explain the Deep drawing
  - 12.2.5 Explain Coining

12.2.6 Explain Spinning
12.2.7 Describe thread forming
12.2.8 Describe Piercing

12.3 Understand production of pipes
12.3.1 State methods of manufacturing of pipes
12.3.2 Explain pipe manufacturing by casting and forming methods

13. DIE CASTING

13.1 Understand Die-casting and its uses
13.1.1 State Die-casting
13.1.2 Explain uses of Die-casting

13.2 Understand the materials of Dies
13.2.1 Name the materials of dies used in Die Casting and their properties

13.3 Understand Die Casting Machine
13.3.1 Describe the die casting machines (hot chamber, cold chamber and goose neck die casting machines)
13.3.2 Explain Die casting process step by step

14. POWDER METALLURGY

14.1 Understand Powder metallurgy
14.1.1 Define powder metallurgy and uses

14.2 Understand powder manufacturing methods
14.2.1 Explain the methods of making powder and their properties

14.3 Understand properties of powder
14.3.1 Describe the properties of metal powders

14.4 Understand fabricating procedure and secondary operation
14.4.1 Explain the fabricating procedures (Compacting, Sintering)
14.4.2 Explain secondary operations

14.5 Understand powder metallurgy applications
14.5.1 Explain the uses of powder metallurgy products Differentiate powder metallurgy methods from other production methods