

<b>DIPLOMA PROGRAMME: CIVIL/MECH./ELECT./COMP./E&amp;TC. ENGINEERING</b>	<b>COURSE: BASIC MATHEMATICS</b>	<b>COURSE CODE: R18SC1701</b>
<b>COURSE CATEGORY : FOUNDATION</b>		<b>CREDIT: 5</b>

**Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme						
TH	PR	TU	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
4	-	1	3	80	20	-	-	-	100

**Rationale:**

Mathematics is an important prerequisite for the development and understanding of engineering concepts. The aim of the course is to acquire some essential competencies in Mathematics by the students of diploma in Engineering. The course will help the students to think logically and systematically. The students will develop the attitude of problem solving. Hence the course provides the ability to analyze Engineering problems using determinants, matrices, trigonometry, statistics and graphs.

**Course Outcomes:**

1. Apply the rules and formulae of trigonometry to solve engineering problem.
2. Use determinant and matrices to solve simultaneous equations for engineering problem.
3. Analyze the given data using measures of central tendency and dispersion.
4. Plot the graph of functions used in Engineering field.

**Course Details:**

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs .

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS
Unit 1 <b>Trigonometry</b>	1.1 Trigonometric ratios of an angle Definition of positive and negative angles. Unit of measurement of an angle. Signs of trigonometric ratios of an angle in the four quadrants.(ASTC RULE) Trigonometric ratios of negative angles. 1.2 Trigonometric ratios of compound and allied angles. 1.3 Trigonometric ratios of multiple and sub-multiple angles.	1a. Apply the concept of Compound angle, allied angle, and multiple angles to solve the given simple engineering problem(s). 1b. Apply the concept of Sub- multiple angle to solve the given simple engineering related problem(s).	12	12
Unit 2 <b>Trigonometry</b>	2.1 Factorization and de-factorization formulae. 2.2 <b>Inverse Circular function</b> Definition of inverse circular function. Principal value of inverse circular function.	2a. Apply concept of factorization and de-factorization formulae to solve the given simple engineering problem(s). 2b. Investigate given simple problems utilizing	10	12

	Properties of inverse circular function.	inverse trigonometric ratios.		
Unit 3 <b>Algebra</b>	<p><b>3.1 Determinant:</b> Definition of determinants. Problems on expansion of determinants of order 3. Solution of simultaneous equation in three unknowns (Cramer's Rule).</p> <p><b>3.2 Partial Fractions:</b> Definition of fraction, proper and improper fraction. Resolve the given proper fraction into partial fraction for the cases</p> <ul style="list-style-type: none"> <li>a. Factors of denominator are linear and non-repeated</li> <li>b. Factors of denominator are linear but repeated.</li> <li>c. Factors of denominator are quadratic, non-repeated and irreducible</li> </ul>	3a. Calculate the area of the given triangle with vertices A, B, C using determinant. 3b. Solve the system of linear equations using determinant method for given simple engineering problem. 3c. Resolve the given proper fraction into partial fractions.	<b>14</b>	<b>16</b>
UNIT 4 <b>Matrices</b>	<p><b>Matrices:</b></p> <p>4.1 Definition of a Matrix. Types of Matrices.</p> <p>4.2 Algebra of matrices: Addition, subtraction and multiplication of matrices.</p> <p>4.3 Transpose of a matrix. Adjoint of a matrix. Inverse of a matrix by adjoint method.</p> <p>4.4 Solution of simultaneous equation by matrix method.</p>	4a. Solve the system of linear equations using matrix method and determinant method for given simple engineering problem.	<b>12</b>	<b>16</b>
Unit 5 <b>Statistics</b>	<p><b>Measures of dispersion:</b></p> <p>5.1 Mean deviation about mean of raw, ungrouped and grouped data.</p> <p>5.2 Standard deviation of raw, ungrouped and grouped data.</p> <p>5.3 Variance and coefficient of variation.</p> <p>5.4 Comparison of two sets.</p>	5a. Calculate the mean deviation of the given statistical observations of an experiment 5b. Calculate the standard deviation, variance and coefficient of variation of the given data 5c. Justify the consistency of the given simple sets of data	<b>8</b>	<b>12</b>
Unit 6 <b>Functions</b>	<p><b>6.1 Functions and Limits:</b> Definition of functions and Notation. Different types of functions. Limits -Concept of limits</p> <p><b>6.2 Graphs:</b> Graph of linear function. Graph of quadratic equation. Graph of trigonometric function. Graph of exponential function.</p>	6a. Find the value of the given function 6b. Plot the graph of the given simple function	<b>8</b>	<b>12</b>

### SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Trigonometry	12	2	4	6	12
2	Trigonometry	10	2	4	6	12
3	Algebra	14	4	4	8	16
4	Matrices	12	4	4	8	16
5	Statistics	8	-	6	6	12
6	Functions	8	2	4	6	12
<b>Total</b>		<b>64</b>	14	26	40	<b>80</b>

**Legends:** R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

**Note:** This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

### SUGGESTED EXERCISES/PRACTICALS

S. No.	Unit No.	Tutorials	Appro. Hrs. Required
1	3	Solve problems on determinant to find area of triangle, and solution of simultaneous equation by Cramer's Rules.	1
2	4	Solve elementary problems on Algebra of matrices.	1
3	4	Solve elementary problems on Algebra of matrices.	1
4	4	Solve solution of Simultaneous Equation using inversion method.	1
5	3	Resolve into partial fraction using linear non repeated, repeated linear factors.	1
6	3	Resolve into partial fraction using quadratic, irreducible factors.	1
7	1	Solve problems on Compound and Allied angles	1
8	1	Solve problems on multiple and sub-multiple angles	1
9	2	Practice problems on factorization and de factorization formula	1
10	1&2	Solve problems on trigonometry (All mixed)	1
11	2	Solve problems on inverse circular trigonometric ratios.	1
12	5	Solve problems on finding mean deviation about mean.	1
13	5	Solve problems on standard deviation.	1
14	5	Solve problems on coefficient of variation, comparison of two sets.	1
15	6	Solve problems on functions	1

S. No.	Unit No.	Tutorials	Appro. Hrs. Required
16	6	Plot the graph of the given function	1
<b>Total</b>			<b>16</b>

#### SUGGESTED STUDENT ACTIVITIES

1. Identify engineering problems based on real world problems and solve with the use of free tutorials available on the internet.
2. Use graphical software: EXCEL, DPLOT and GRAPH for related topics.
3. Prepare a seminar on any relevant topic.

#### SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- I. Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- II. '*L*' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- III. About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the *UOs/COs* through classroom presentations

#### SUGGESTED LEARNING RESOURCES

##### A) Books

Sr. No.	Title of Book	Author	Publication
1	Higher Engineering Mathematics	Grewal, B.S.	Khanna publications, New Delhi, 2015 ISBN: 8174091955
2	Advanced Engineering Mathematics	Krezig, Ervin	Wiley Publications, New Delhi, 2014 <a href="#">ISBN :978-0-470-45836-5</a>
3	Engineering Mathematics (third edition).	Croft, Anthony	Pearson Education, New Delhi, 2014 ISBN 978-81-317-2605-1
4	Advanced Engineering Mathematics	Das, H.K.	S. Chand & Co.; New Delhi; 2008, ISBN-9788121903455

##### B) Major Equipment/ Instrument with Broad Specifications

##### C) Software/Learning/ [Simulations](#) Websites

- [www.dpplot.com/](http://www.dpplot.com/) - DPlot
- [www.allmathcad.com/](http://www.allmathcad.com/) - MathCAD
- [www.wolfram.com/mathematica/](http://www.wolfram.com/mathematica/) - Mathematica
- <https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaAoddHoPig>
- [www.easycalculation.com](http://www.easycalculation.com)
- [www.math-magic.com](http://www.math-magic.com)

#### Mapping matrix of PO's and CO's: (with Justification of each cell)

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	3	2						2	-	2
<b>CO2</b>	3	2						1	-	1
<b>CO3</b>	3	2						2	2	2
<b>CO4</b>	3	2						2	2	1

**3: High 2: Moderate and 1:Low Relationship**

# CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1

## **DIPLOMA PROGRAMME: CIVIL/MECH. ENGINEERING**

**COURSE: ENGINEERING MATHEMATICS**

**COURSE CODE: R18SC1702**

**COURSE CATEGORY : FOUNDATION**

**CREDIT : 5**

### **Teaching and Examination Scheme:**

<b>Teaching Scheme</b>			<b>Examination Scheme</b>						
<b>TH</b>	<b>PR</b>	<b>TU</b>	<b>PAPER HRS.</b>	<b>TH</b>	<b>TEST</b>	<b>PR</b>	<b>OR</b>	<b>TW</b>	<b>TOTAL</b>
<b>4</b>	-	<b>1</b>	<b>3</b>	<b>80</b>	<b>20</b>	-	-	-	<b>100</b>

### **Rationale:**

Mathematics is an important prerequisite for the development and understanding of engineering concepts. The subject intends to teach students basic facts, concepts and principles of Mathematics as a tool to analyze engineering problems. It also aims to teach students to apply the basic facts of Mathematics to solve engineering problem.

### **Course Outcomes:**

1. Apply the rules and methods of derivatives to engineering field.
2. Evaluate integration of a function as anti derivative.
3. Apply appropriate methods of integration to engineering problem.
4. Apply appropriate methods of differential equation to engineering problems.
5. Utilize the concept of probability to solve related engineering problem.

### **Course Details:**

<b>UNIT</b>	<b>NAME OF THE TOPIC (with Details)</b>	<b>LEARNING OUTCOME</b>	<b>HO UR S</b>	<b>MAR KS</b>
1.  <b>Derivatives</b>	<b>Unit1-Derivatives:</b> 1.1 Concept and definition of derivative. Derivatives of standard functions. 1.2 Laws of derivatives :- Addition law. Subtraction law. Multiplication law. Division law.	1a. Solve the given simple problems based on rules of differentiation.	8	12
2.  <b>Derivatives</b>	<b>Unit2-Derivatives:</b> 2.1 Derivatives of composite functions (Chain rule) <b>Methods of Derivatives:</b> 2.2 Derivative of parametric functions. 2.3 Derivative of implicit functions. Concept of higher order derivatives	2a. Solve the given problems of differentiation for composite functions. 2b. Solve the given problems of Differentiation for parametric and implicit functions	12	12
3.  <b>Integration</b>	<b>Unit3-Integration</b> 3.1 Definition of integration as anti-derivative. 3.2 Integration of algebraic functions.	3a. Obtain the given simple integral(s) using substitution method. 3b. Integrate given simple functions using the integration by parts.	16	16

	3.3 Integration by substitution. 3.4 Integration by parts. 3.5 Integration by partial fraction	3c. Evaluate the given simple integral by partial fractions.		
4. <b>Application of Derivatives and Integration</b>	<b>Application of Derivatives</b> 4.1 Geometrical meaning of derivative. (slope of tangent and normal to the given curve) 4.2 Maxima and minima using derivative. <b>Application of Integration:</b> 4.3 Area under the curve. 4.4 Mean value of the function	4a. Apply the concept of differentiation to find slope of tangent and normal to the given curve. 4b. Apply the concept of differentiation to calculate maxima and minima of given problem. 4c. Apply the concept of definite integration to find the area under the given curve(s). 4d. Invoke the concept of definite integration to find the mean value of the function	10	16
5. <b>Differential Equation</b>	5.1 Definition of differential equation. Order and degree of differential equation. 5.2 Solution of differential equation of 1 <sup>st</sup> order and 1 <sup>st</sup> degree. Variable separable differential equation. Linear differential equation.	5a. Find the order and degree of the differential equation. 5b. Solve the differential equation using the method of variable separable for the given engineering problem. 5c. Solve the linear differential equation for the given engineering problem.	10	12
6 <b>Probability</b>	6.1 Introduction to permutation and combination. 6.2 Definition: Event, sample space and probability. Simple examples on probability. 6.3 Addition theorem for probability.	6a. Solve the given problem based on definition of probability. 6b. Utilize the concept of addition theorem for probability to solve related engineering problem	8	12

### SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Derivatives	8	4	8	-	12
2	Derivatives	12	-	8	4	12
3	Integration	16	4	4	8	16
4	Application of Derivatives & Integration	10	-	4	12	16
5	Differential Equation	10	4	-	8	12
6	Probability	8	2	2	8	12
<b>Total</b>		64	14	26	40	80

**Legends:** R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

**Note:** This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

### SUGGESTED EXERCISES/PRACTICALS

S. No.	Unit No.	Tutorials	Appro. Hrs. Required
17	1	Solve the given simple problems based on rules of differentiation.	1
18	2	Solve the given problems based on chain rule of differentiation	1
19	2	Solve the given problems of differentiation on parametric functions.	1
20	2	Solve the given problems of differentiation on logarithmic functions.	1
21	1 &2	Solve engineering problems on differentiation.	1
22	3	Solve the given simple integral(s) as anti derivative.	1
23	3	Solve the given integral(s) using substitution method.	1
24	3	Solve the given integral(s) using integration by parts and by partial fraction.	1
25	3	Solve engineering problems on integration.	1
26	4	Solve problems on slope of tangent and normal at given point on the curve and on finding maxima minima of function.	1
27	4	Solve problems on finding area under the curve and Mean value of the function.	1
28	4	Solve engineering problems on application of differentiation and integration.	1
29	5	Find order and degree of given differential equation.	1
30	5	Solve differential equation based on variable separable and Linear differential equation.	1
31	6	Solve the given problem based on definition of probability.	1
32	6	Utilize the concept of addition theorem for probability to solve related engineering problem.	1
<b>Total</b>			<b>16</b>

## SUGGESTED STUDENT ACTIVITIES

1. Identify engineering problems based on real world problems and solve with the use of free tutorials available on the internet.
2. Use graphical software: EXCEL, DPLOT and GRAPH for related topics.
3. Prepare a seminar on any relevant topic based on application of integration.
4. Prepare a seminar on any relevant topic based on application of differentiation.

## SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- I. Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
- II. 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- III. About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for self-directed learning and assess the development of the UOs/COs through classroom presentations

## SUGGESTED LEARNING RESOURCES

### D) Books

Sr. No.	Title of Book	Author	Publication
5	Higher Engineering Mathematics	Grewal, B.S.	Khanna publications, New Delhi, 2015 ISBN: 8174091955
6	Advanced Engineering Mathematics	Krezig, Ervin	Wiley Publications, New Delhi, 2014 <a href="#">ISBN :978-0-470-45836-5</a>
7	Engineering Mathematics (third edition).	Croft, Anthony	Pearson Education, New Delhi, 2014 ISBN 978-81-317-2605-1
8	Advanced Engineering Mathematics	Das, H.K.	S. Chand & Co.; New Delhi; 2008, ISBN-9788121903455

**E) Software/Learning/ [Simulations](#) Websites**

[www.dplot.com/](#) - DPlot

[www.allmathcad.com/](#) - MathCAD

[www.wolfram.com/mathematica/](#) - Mathematica

<https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaAoddHoPig>

[www.easycalculation.com](#)

[www.math-magic.com](#)

**Mapping matrix of PO's and CO's: (with Justification of each cell)**

Course Outcomes	Programme outcomes									
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
Apply the rules and methods of derivatives to engineering field.	3	1					1	1	1	3
Evaluate integration of a function using appropriate methods of integration.	3	1					1	-	-	1
Apply appropriate methods of derivatives and integration to engineering problem.	3	1					1	2	-	2
Apply appropriate methods of differential equation to engineering problems.	3	1					1	2	-	2
Utilize the concept of probability to solve related engineering problem.	3	1					1	3	2	2

**3: High 2: Moderate and 1:Low Relationship**

**DIPLOMA PROGRAMME IN: CIVIL/MECH./ELECT./E&TC. ENGINEERING**

**Course : Basic Science**  
**Course Category : Foundation**

**Course Code: R18SC1704**  
**Credits : 8**

---

**TEACHING AND EXAMINATION SCHEME:**

Teaching Scheme			ONLINE EXAM HRS	EXAMINATION SCHEME					
TH	PR	TH		TEST	PR	OR	TW	TOTAL	
<b>Physics</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>40</b>	<b>10</b>	-	-	<b>25</b>	<b>75</b>
<b>Chemistry</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>40</b>	<b>10</b>	-	-	<b>25</b>	<b>75</b>

**RATIONALE**

Basic Sciences like Physics and Chemistry are the pillars of engineering and technology. It is very essential to learn the basic sciences to understand the fundamental concepts and principles. The course content is chosen so that it should be more relevant to fulfil the needs of industries. The study of basic principles in Electrochemistry, Corrosion, Chemical Bonding, Heat, Electricity, Magnetism and Semi-Conductors will help in understanding the technical courses where emphasis is on application of these in various fields.

**COURSE OUTCOMES (COs)**

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

1. Estimate errors in measurements of physical quantities measured with appropriate measuring instruments.
2. Apply principles of Electricity, Magnetism and Semi-Conductors to solve engineering problems.
3. Apply Gas laws, use basic principle of Heat and Temperature to related engineering problems.
4. Identify different types of bonds of different compounds.
5. Apply concepts of Electrochemistry and Corrosion to solve engineering problems.
6. Describe Polymers, Lubricants and Adhesives.

**COURSE DETAILS:**

The following topics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs

UNIT	NAME OF THE TOPICS AND SUBTOPICS	LEARNING OUTCOMES (UOS)	HOUR S	MAR KS
<b>1</b>  <b>Units and Measurements</b>	<p><b>1.1</b> Physical quantity, fundamental and derived physical quantity with examples. Unit of physical quantity, fundamental units with examples and derived units with examples.</p> <p><b>1.2</b> System of units (C.G.S., M.K.S., F.P.S. and S.I.) Rules and Conventions for writing units in SI system. Tables of fundamental and derived S.I. units. Multiples and sub multiples of units. Significant figures, rules for determining the significant figures.</p> <p><b>1.3</b> Dimensions and dimensional formulae</p>	<p><b>1a.</b> Describe the concept of given physical quantities with relevant unit of measurement.</p> <p><b>1b.</b> State various systems of units and its need for the measurement of the given physical quantities.</p> <p><b>1c.</b> Determine the dimensions of given physical quantities.</p>	<b>9</b>	<b>12</b>

	<b>1.4</b> Errors, types of errors (Instrumental, systematic and random error) and methods for minimization of errors, <b>1.5</b> Estimation of errors (Absolute error, average absolute error, relative error and percentage error), Propagation of errors in measurement, Numerical	State the error in the given measurement with justification.		
<b>2</b>  <b>Electricity, Magnetism and Semiconductors</b>	<b>2.1</b> Concept of charge, Coulomb's inverse square law, Electric field, Electric lines of force and their properties, Electric field intensity, Electric potential and potential difference , Electric flux density, Electric current, Ohm's law, Specific resistance, Resistance by using colour code, Laws of series and parallel resistance, Heating effecting of electric current, Electric power, Electric energy in kWh, Electric bill, Numerical. <b>2.2</b> Magnetic field, magnetic field intensity and their units, Magnetic lines of force and their properties, magnetic flux. <b>2.3</b> Conductors, semiconductors, insulators and their energy band diagrams. <b>2.4</b> Intrinsic or pure semiconductor, extrinsic or impurity doped semiconductors, pentavalent impurity doped N-type semiconductor and trivalent impurity doped P-type semiconductor. p-n junction diode, <b>2.5 Forward</b> and reverse biasing of p-n junction diode, I-V characteristics of p-n junction, and applications of p-n junction diode.	1c. Calculate electric field, potential and potential difference of the given static charge. 1d. Describe the concept of given magnetic intensity and flux with relevant units. 1e. Explain the heating effect of the electric current. 1f. Apply laws of series and parallel combination in the given electric circuits. 1g. Distinguish the given conductors, semiconductors and insulators on the basis of energy bands. Explain the I-V characteristics and applications of the given p-n junction diodes.	<b>14</b>	<b>16</b>
<b>3</b>  <b>Heat , Temperature and Gas laws</b>	<b>3.1</b> Heat, units of heat, calorie-joule conversion, Latent heat and sensible heat. Temperature, Temperature scales, Absolute zero temperature, relations of temperatures on Celsius scale, Fahrenheit scale and Kelvin scale, Difference between heat and temperature, Numerical. <b>3.2</b> Conduction, Flow of heat along a bar, Steady state of temperature Coefficient of thermal conductivity by Searle's method. (For good conductor), Convection, Radiation, Comparison of conduction, convection and radiation.. <b>3.3</b> Applications of conduction, convection and radiation, Thermal Expansions (linear, areal, cubical), Numerical. <b>3.4</b> Principle, Construction and working of Bimetallic thermometer, Resistance thermometer and Thermocouple thermometer <b>3.5</b> Boyle's law, Charle's law and Gay–Lussac's law. General gas equation, Specific heats ( $C_p$ , $C_v$ ) of gases and their ratio, Numerical.	<b>3a.</b> Convert the given temperature in different temperature scales. <b>3b.</b> Distinguish the properties of the good and bad conductors of heat. <b>3c.</b> Relate the characteristics of the three gas laws. <b>3d.</b> Determine the ratio of specific heats for the given gas materials.	<b>9</b>	<b>12</b>
<b>4</b>  <b>Atomic structure &amp; Chemical Bonding</b>	<b>4.1</b> .Filling of electrons in the orbitals-Hund's rule of maximum multiplicity, Pauli exclusion principle, Aufbau's principle <b>4.2</b> .Electronic configuration, octet rule & duplet rule .(Electronic configuration upto atomic number 30) <b>4.3</b> .Electronic theory of valency Chemical bonds: types and characteristics , electrovalent bond( $NaCl$ , $CaCl_2$ ),covalent bond( $Cl_2$ , $O_2$ , $N_2$ )co-ordinate bond ( $SO_2$ , $SO_3$ ),Ozone ( $O_3$ ),metallic bond(Sodium and Copper metal). <b>4.4</b> .Basic Concepts of Volumetric Analysis- Titration, Titrate, Titrant, Normality, Molarity, End Point, Strength, Equivalent weight. <b>4.5</b> .Types of Titrations- Acid Base Titration	<b>4a.</b> Describe rules for arrangement of electrons <b>4b.</b> Write electronic configuration of different elements. <b>4c.</b> Distinguish the properties of given material based on the bond formation <b>4d.</b> State the concepts included in the volumetric analysis.	<b>9</b>	<b>12</b>

	A) Strong acid and strong base B) Weak acid and weak base Redox Titration, Precipitation Titration, Complexometric Titration.			
5  Electro-chemistry and Corrosion, its prevention.	<p><b>5.1.</b> Electrolyte – strong and weak , Non – Electrolyte, Electrolytic cell, Electrochemical cell, cathode ,anode , Electrode potential-oxidation and reduction , construction and working of Daniel cell ,Ionization and Dissociation</p> <p><b>5.2.</b> Faraday's first and second law and Numerical based on Faraday's law</p> <p><b>5.3.</b> Electrolysis-Definition, mechanism of electrolysis of CuSO<sub>4</sub> and NaCl using Platinum electrodes , Electroplating and electro-refining of copper</p> <p><b>5.4.</b> Primary cell and secondary cell- mechanism, examples and application of the types of cells.</p> <p><b>5.5.</b> Corrosion-Types of corrosion- Dry corrosion, Wet corrosion, Oxidation corrosion (Atmospheric corrosion due to oxygen gas ), mechanism, Types of oxide film, Wet corrosion mechanism (Hydrogen evolution in acidic medium) Concentration cell corrosion-Oxygen absorption mechanism in neutral or alkaline medium.</p> <p><b>5.6.</b> Factors affecting the rate of corrosion control- Modification of environment, Use of protective coatings-coating of less active metal like Tin (Tinning), coating of more active metal like Zinc (Galvanizing)Anodic and cathodic protection.</p>	<p><b>5a.</b> Differentiate the salient features of the given electrolytic cell, electrochemical cell.</p> <p><b>5b.</b> Distinguish the given primary and secondary electrolytic cells</p> <p><b>5c.</b> Describe the process of electrolysis for the given electrolyte</p> <p><b>5d.</b> Describe the process of electroplating for the given material</p> <p><b>5e.</b> Describe the phenomenon of the given type of corrosion and its prevention</p> <p><b>5f.</b> Identify the different factors affecting the rate of corrosion for the given type of material.</p> <p>Select the protective measures to prevent the corrosion in the given corrosive medium</p>	12	12
6  Polymers, Lubricants and Adhesives	<p><b>6.1.</b> Polymer and monomer , Classification on the basis of Molecular structure , on the basis of monomer a)homopolymer -Synthesis ,properties and application of Polyethylene, PVC, Teflon b)copolymer/heteropolymer-Nylon-6, Nylon 6,6 on the basis of thermal behaviour -Thermoplastics and thermosetting.</p> <p><b>6.2.</b> Types of polymerization reaction , Addition polymerization, Condensation polymerization</p> <p><b>6.3.</b> Definition of lubricant, function of lubricant and classification</p> <p><b>6.4.</b> Definition of lubrication, types of lubrication.</p> <p><b>6.5.</b> Physical properties-viscosity, viscosity index, oiliness, flash and fire point, volatility, cloud and pour point.</p> <p><b>6.6.</b> Chemical properties-acid value, saponification value, emulsification.</p> <p><b>6.7.</b> Properties and names of lubricants used for various machines like delicate instruments, heavy load and low speed machine, gears, cutting tools, I.C engine, steam engine</p> <p><b>6.8.</b> Definition, characteristics of adhesives, classification of adhesives and its uses</p>	<p><b>6a.</b> Differentiate the given type of structural polymers</p> <p><b>6b.</b> Describe the polymerization process of the given polymer</p> <p><b>6c.</b> State the properties and uses of the given polymers</p> <p><b>6d.</b> Describe lubricants ,its function and classification</p> <p><b>6e.</b> State the types of lubrication.</p> <p><b>6f.</b> Describe the physical and chemical properties of lubricants</p> <p><b>6g.</b> Explain selection of lubricants for various machines</p> <p><b>6h.</b> State the properties and uses of adhesives</p> <p>Describe the application of relevant adhesives</p>	11	16

### SUGGESTED SPECIFICATION TABLE WITH MARKS

UNIT NO	UNIT TITLE	Teaching Hours	DISTRIBUTION OF THEORY MARKS			
			R LEVEL	U LEVEL	A LEVEL	TOTAL
	PHYSICS					

I	Units and Measurements	9	3	5	4	12
II	Electricity, Magnetism and Semiconductors	14	5	5	6	16
III	Heat , Temperature and Gas laws	9	3	5	4	12
	<b>Total</b>	32	11	15	14	40
	<b>CHEMISTRY</b>					
IV	Atomic structure &Chemical Bonding	9	5	4	3	12
V	Electro-chemistry and Corrosion, its prevention.	12	3	4	5	12
VI	Polymers, lubricants and adhesives	11	5	4	7	16
	<b>Total</b>	32	13	12	15	40

**Legends:** R-Remembrance (Knowledge), U- Understanding, A- Application and above levels (Revised Bloom's taxonomy)

Note-This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from the above table.

## SUGGESTED PRACTICALS

*The practical in this section are psychomotor domain PrOs (i.e sub-components of the COs), to be developed and assessed in the student to lead to the attainment of the competency. Any 10 practical of Physics & Chemistry should be conducted during the Term.*

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Hrs.
<b>Physics</b>			
1	Measurement of (i) Length, Breadth and Height of a block ,(ii) Internal, External diameter and Height of a hollow cylinder, Using Vernier Callipers of different least counts.	I	4
2	Measurement of (i) Diameter of Sphere and Wire, (ii) Thickness of a plate by using Micrometer Screw Gauge.	I	4
3	Measurement of (i) Radii of concave and convex surfaces, (ii) Thickness of plate by using Spherometer.	I	2
4	Measurement of Specific resistance by voltmeter ammeter method.	II	2
5	Verification of Ohm's law	II	2
6	Measurement of Resistance in series.	II	2
7	Measurement of Resistance in parallel.	II	2
8	Magnetic lines of forces of Bar Magnet.	II	2
9	Study of PN junction diode forward and reverse bias	II	2
10	Study the effect of temperature on the resistance of – thermistor and copper coil.	II	2
11	Determination of co-efficient of thermal conductivity of a good conductor by Searle's method.	II	2
12	Verification of Boyle's law.	III	2
	Practical –assignments-student activities submission.		4
<b>Chemistry</b>			
1	Prepare the solutions of different Concentrations.	I	2
2	Determine the Strength of given acid solution using standard base solution.	I	2
3	Determine the neutralization point of weak acid and weak base using conductivity meter.	I	2
4	Precipitation titration of $\text{BaCl}_2$ with $\text{H}_2\text{SO}_4$ using conductivity meter.	I	2
5	Determine electrochemical equivalent of Cu metal using Faraday's first law.	II	2
6	Determine equivalent weight of metal using Faraday's second law.	II	2
7	Determine the electrode potential of Copper metal.	II	2
8	Determine the voltage generated from chemical reaction using Daniel Cell.	II	2
9	To determine the viscosity of oil lubricant by using Ostwald's Viscometer.	III	2
10	Determine the Acid value of given oil.	III	4
11	Determine the effect of temperature on viscosity for given lubricating oil using Redwood viscometer-1	III	4
12	Determination of saponification value of an oil.	III	2
	Practical –assignments-student activities submission.		4

## **SUGGESTED STUDENT ACTIVITIES**

Other than the classroom and laboratory learning, following are the suggested student-related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- 1) Prepare charts of vernier calliper, micrometer screw gauge, spherometer and travelling microscope.
- 2) Library survey regarding engineering material used in different industries.
- 3) Power point presentation or animation for showing different types of bonds or molecules.
- 4) Seminar on any relevant topic.

## **SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES**

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- i. Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
- ii. Not only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- iii. About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for self-directed learning and assess the development of the UOs/COs through classroom presentations (see implementation guideline for details).
- iv. Teachers need to ensure to create opportunities and provisions for co-curricular activities.

## **SUGGESTED LEARNING RESOURCES**

### **A) BOOKS**

<b>SR. NO.</b>	<b>AUTHOR</b>	<b>TITLE</b>	<b>PUBLISHER</b>
1	J.V.Naralikar,A.W.Joshi	Physics Textbook XI (part1 &2)	National Council of Education Research and Training New Delhi
2	J.V.Naralikar,A.W.Joshi	Physics Textbook XII (part1 &2)	National Council of Education Research and Training New Delhi
3	D.Haliday & R. Resnick	Fundamentals of Physics	Jhon Wiley and Sons , USA
4	R.K.Gaur, S.L.Gupta	Engineering Physics	Dhanpat Rai and Sons Publications.
5	Jain P.C. & Jain Monika	Engineering Chemistry	Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
6	S.S.Dara	Engineering Chemistry	S. Chand Publication
7	Bagotsky V S	Fundamental of electrochemistry	Wiley international NJ USA

### **B) Web site for references:**

- [www.physicsclassroom.com](http://www.physicsclassroom.com)  
[www.hyperphysics.com](http://www.hyperphysics.com)  
[www.physicsinfo.com](http://www.physicsinfo.com) <http://npTEL.ac.in/course.php?disciplineId=115>  
<http://npTEL.ac.in/course.php?disciplineId=104>  
<http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html>  
[www.physicsclassroom.com](http://www.physicsclassroom.com)  
[www.physics.org](http://www.physics.org)  
[www.fearofphysics.com](http://www.fearofphysics.com)  
[www.sciencejoywagon.com/physicszone](http://www.sciencejoywagon.com/physicszone)  
[www.science.howstuffworks.com](http://www.science.howstuffworks.com)  
[www.in.wikipedia.org](http://www.in.wikipedia.org)

**C) Video**

[www.Youtube.com](http://www.Youtube.com) (elasticity, surface tension, viscosity, sound)

**D) PPT**

[www.khanaacademy.com](http://www.khanaacademy.com)

[www.slidehare.net](http://www.slidehare.net)

**PROGRAMME OUTCOMES**

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineerin g Tools, Experimen tation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Manageme nt	PO7 Lifelon g learning	PSO1	PSO2	PSO3
CO1	3	0	0	1	1	1	1	1	0	1
CO2	3	0	0	1	1	1	1	2	0	1
CO3	3	0	0	1	1	1	1	2	0	2
CO4	3	0	0	1	1	1	1	1	0	-
CO5	3	0	0	1	1	1	1	2	0	-
CO6	3	0	0	1	1	1	1	1	0	1

1. CO1-Estimate errors in measurements of physical quantities measured with appropriate measuring instruments.
2. CO2-Apply principles of Electricity, Magnetism and Semi-Conductors to solve engineering problems.
3. CO3-Apply Gas laws, use basic principle of Heat and Temperature to related engineering problems.
4. CO4-Identify different types of bonds of different compounds.
5. CO5-Apply concepts of Electrochemistry and Corrosion to solve engineering problems.
6. CO6-Describe Polymers, Lubricants and Adhesives.

# CUSROW WADIA INSTITUTE OF TECHNOLOGY, PUNE – 1

## DIPLOMA PROGRAMME IN: CIVIL/MECH. ENGINEERING

Course : Applied Science  
 Course Category : Foundation

Course Code: R18SC1705  
 Credits : 8

### TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				EXAMINATION SCHEME					
	TH	PR	ONLINE EXAM HRS	TH	TEST	PR	OR	*TW	TOTAL
Physics	2	2	1	40	10	-	-	25	75
Chemistry	2	2	1	40	10	-	-	25	75

\*TW includes 10 marks for Science Micro Project.

### RATIONALE

Diploma engineers have to deal with various materials, methods and machines. Adequate knowledge of basic principle of Physics and Chemistry will help the students to understand the concepts better in any field of engineering. The course will develop analytical capabilities of students so that they can characterize transform and use material in engineering and apply knowledge gained in solving related engineering problems. It will develop the habit of scientific reasoning in students so that they can work with open and enquiring mind. They must learn and apply the concepts and principles of science like Metals, Alloys, Cement, Lime, Fuels, Water, Surface tension, Elasticity, Viscosity and LASERS.

### COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs:

- Analyze the physical properties of materials for selecting appropriate material for appropriate applications.
- Apply Laws of motion in various applications.
- Use equipments based on principles of LASER and Optical fibre in industrial application.
- Select the appropriate metallurgical process and properties related to engineering application of Iron and Copper
- Use appropriate Water treatment process to solve water related problems.
- Use appropriate Fuel in relevant applications.

### COURSE DETAILS:

The following topics should be taught and assessed in order to develop LO's in cognitive domain for achieving the CO's

UNIT	NAME OF THE TOPICS AND SUBTOPICS	LEARNING OUTCOMES	HOU RS	MAR KS
1 Elasticity, Surface Tension and Viscosity	<b>1.1</b> Deforming Force and Restoring Force, Elasticity, Plasticity, Rigidity. <b>1.2</b> Stress and Strain with their types, Elastic limit and Hooke's law, types of modulii of elasticity, Stress–Strain diagram, Poisson's ratio, factors affecting elasticity, <b>1.3</b> Applications of elasticity. Numerical. <b>1.4</b> Molecular forces and their nature, cohesive	<b>1a.</b> Define elasticity, plasticity and rigidity with examples. <b>1b.</b> Inter relate three types of modulii of elasticity. <b>1c.</b> Explain the behavior of the wire under continuously increasing load.	9	12

	<p>forces, adhesive forces, molecular range, sphere of influence.</p> <p><b>1.5</b> Definition of surface tension, factors affecting surface tension (Temperature, impurity, nature of the liquid).</p> <p><b>1.6</b> Concave and convex meniscus of liquid surfaces and their explanation on the basis of molecular forces, angle of contact,</p> <p><b>1.7</b> Capillary action and its explanation, applications of surface tension. Numerical</p> <p><b>1.8</b> Viscosity, viscous force in fluid, velocity gradient, Newton's law of viscosity.</p> <p><b>1.9</b> Free fall of spherical body through a viscous medium, terminal velocity, Stoke's law of viscosity with expression, formula for coefficient of viscosity by Stoke's law (no derivation).</p> <p><b>1.10</b> Streamline and turbulent flow of liquids, critical velocity, significance of Reynolds's number, Numerical.</p>	<p><b>1d.</b> Describe various intermolecular forces and their nature.</p> <p><b>1e.</b> Explain phenomena of surface tension and capillarity.</p> <p><b>1f.</b> Explain pressure-depth relation of liquids and various related laws.</p> <p><b>1g.</b> State Newton's law of viscosity. State Stokes' law for the free fall of the body through the viscous medium.</p>		
<b>2</b> <b>Linear motion, Circular motion, Simple harmonic motion and Sound</b>	<p><b>2.1</b> Displacement, velocity, acceleration and retardation. Kinematical equations of motion, equations of motion under gravity, Numerical.</p> <p><b>2.2</b> Circular motion, Uniform circular motion, Angular displacement, angular velocity, angular acceleration, three equations of angular motion, Tangential velocity and radial acceleration (No derivation),</p> <p><b>2.3</b> Centripetal and Centrifugal forces, Numerical.</p> <p><b>2.4</b> Periodic motion, simple harmonic motion, S.H.M. as a projection of uniform circular motion, equation of S.H.M., graphical representation of S.H.M.,</p> <p><b>2.5</b> concepts of oscillation, periodic time, frequency, amplitude, phase, phase difference. Numerical.</p> <p><b>2.6</b> Sound waves, propagation of sound, reflection of sound waves, echo, absorption of sound, coefficient of absorption,</p> <p><b>2.7</b> Reverberation, reverberation time, formula for reverberation time (No derivation), methods for controlling reverberation time, Numerical.</p>	<p><b>2a.</b> Solve the given Numerical based on equations of motion, equations of motion under gravity</p> <p><b>2b.</b> Establish the relation between angular and linear velocity.</p> <p><b>2c.</b> Explain the concept of Simple Harmonic Motion (SHM), explain the related parameters and solve the given Numerical.</p> <p><b>2d.</b> Explain the concept of echo, reverberation and reverberation time, solve the given Numerical</p>	<b>14</b>	<b>16</b>
<b>3</b> <b>Lasers and Fiber Optics</b>	<p><b>3.1</b> Excitation of particle, optical pumping, types of transitions – non radiative and radiative.</p> <p><b>3.2</b> Spontaneous and stimulated emission, population inversion, resonance cavity, active system,</p> <p><b>3.3</b> Types of lasers, Ruby laser, Helium–Neon laser, and comparison between ruby and He–Ne lasers, Uses of lasers.</p> <p><b>3.3</b> Reflection, refraction, laws of refraction, Total Internal Reflection (TIR). Principle, types, properties and applications of optical fibers.</p>	<p><b>3a.</b> Describe the construction and working of three energy level laser system.</p> <p><b>3b.</b> Describe the phenomena of total internal reflection for the given mediums.</p> <p><b>3c.</b> Describe light propagation in the given type of optical fiber.</p>	<b>9</b>	<b>12</b>
<b>4</b> <b>Metals, Alloys, Cement and</b>	<p>4.1. Metallurgy: Mineral, Ore, Gangue ,Flux, Slag</p> <p>4.2. Types of furnace: Muffle furnace, Blast furnace</p> <p>4.3. Extraction processes of Haematite ores: Crushing, Concentration, Reduction, Refining</p>	<p><b>4a.</b> Describe construction and working of the given furnace</p> <p><b>4b.</b> Describe the extraction</p>	<b>12</b>	<b>12</b>

<b>Lime.</b>	4.4. Properties of Iron and Copper: Hardness, Tensile Strength, Toughness, Refractoriness, Machinability Brazing, Castability . 4.5. Preparation of Alloys a) Fusion method –Brass b) Compression method-Wood's metal 4.6. Ferrous alloys: composition, properties and uses of Low carbon, medium carbon ,high carbon steels 4.7. Non-Ferrous alloys : composition, properties and uses of Brass, Bronze, Duralumin , Tinman solder, Wood's metal ,Monel metal 4.8. Cement:Portland cement, Constituents,Setting and Hardening process 4.9. Lime-Classification , composition , properties and uses	process of given ore with chemical reaction <b>4c.</b> State purposes and describe preparation methods of making alloy. <b>4d.</b> Select relevant alloy for given application stating the properties <b>4e.</b> Explain the hardening and setting process of Portland cement with Hydrolysis and hydration reactions		
<b>5 Water Treatment and Analysis</b>	5.1. Hardness-types, EDTA method,Degree of Hardness of the water in terms of equivalent amount of $\text{CaCO}_3$ , Numerical based on degree of hardness . 5.2. Effect of hard water in boilers and its prevention, Scales and Sludges 5.3. Water softening : Zeolite process,Ion exchange process (cation exchange and anion exchange ) 5.4. Municipal water treatment –Screening, Sedimentation , Coagulation , Filtration and Sterilization 5.5. Waste water- Characteristics, Dissolved oxygen ,BOD and COD,Sewage treatment , recycling of waste water 5.6. De-salination of brackish water process by reverse osmosis 5.7. Definition of pH and pOH , pH scale, Numerical problems on pH and Industrial applications	<b>5a.</b> Describe the concept of Hardness <b>5b.</b> Calculate the Hardness of water for the given data <b>5c.</b> Describe the effects of Hard water in boilers <b>5d.</b> Explain the given type of water softening process <b>5e.</b> Describe the purification of municipal water for the given process <b>5f.</b> Describe the Reverse Osmosis for the given type of water <b>5g.</b> Describe the process of Desalination of water <b>5h.</b> State the concept of pH and pOH. Numerical related with it Applications of pH in engineering	<b>12</b>	<b>16</b>
<b>6 Fuel and Combustion</b>	6.1. Fuel: Combustion reaction ,Calorific value and Ignition temperature , classification 6.2. Solid fuels: Coal , classification and composition , Proximate analysis , Ultimate analysis 6.3. Liquid Fuels: Fractional distillation of crude petroleum, Boiling range, composition, calorific value, properties and uses of petrol kerosene, diesel, biodiesel in automobile industry and IC engine. 6.4. Gaseous fuels: Composition, calorific value and ignition temperature of Biogas, LPG and CNG , combustion equation of gaseous fuels , Mass and volume of air required for complete combustion .Numerical.	<b>6a.</b> Describe properties of fuel which decide its quality <b>6b.</b> Explain the proximate and ultimate analysis of coal to decide its quality <b>6c.</b> Describe Fractional distillation process for refining of petroleum <b>6d.</b> Describe the composition , properties and application of given Gaseous fuel Calculate the mass and volume of air required for complete combustion fuel	<b>8</b>	<b>12</b>

## SUGGESTED PRACTICALS

Practicals in this section are psychomotor domain PrOs (i.e sub-components of the COs), to be developed and assessed in the student to lead to the attainment of the competency Any 10 practical of Physics and Chemistry should be conducted during the Term.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Hours.
<b>Physics</b>			
1	Determination of Young's modulus.	I	2
2	Verification of Hooke's law.	I	2
3	Verification of Archimedes principle.	I	2
4	Study the effect of length and mass of the bob on periodic time of a simple pendulum.	II	2
5	Determination of 'g' by simple pendulum.	II	2
6	Determination of surface tension of liquid by the capillary rise method.	I	2
7	Determination of surface tension by using capillaries different bores.	I	2
8	Determination of viscosity of water by Poiseuille's method.	I	2
9	Determination of viscosity of oil by Stoke's method.	I	2
10	Measurement of divergence of light beam by using laser.	III	2
11	Determination of velocity of sound by using resonance tube.	II	2
12	Study the phenomenon of Total Internal Reflection and determine critical angle of incidence.	III	2
Practical –assignments, student activities submission (micro-project )			8
<b>Chemistry</b>			
1	Determination of percentage purity of Iron from stainless steel alloy.	I	2
2	Estimation of Calcium in cement sample.	I	2
3	To determine amount of Nickel present in Monel metal.	I	2
4	Determine the Alkalinity of water sample.	II	2
5	Determine chloride content in the given water sample by Mohr's method.	II	2
6	Determine the Total Hardness of water sample by EDTA method.	II	2
7	Determine the Dissolved Oxygen present in the water sample by using Winkler's method.	II	2
8	Determine the pH value of given solution using pH meter.	II	2
9	Determination of Moisture content in given coal sample using Proximate analysis.	III	2
10	Determination of Ash content in given coal sample using Proximate analysis.	III	2
11	To determine percentage of Copper from the brass.	I	2
12	Determine the Turbidity of given water sample by Nephelometric method.	II	2
Practical –assignments, student activities submission (micro-project )			8

### SUGGESTED SPECIFICATION TABLE WITH MARKS

UNIT NO	UNIT TITLE	Teaching Hours	DISTRIBUTION OF THEORY MARKS			
			R LEVEL	U LEVEL	A LEVEL	TOTAL MARKS
<b>PHYSICS</b>						
I	Elasticity, Surface Tension And Viscosity	9	3	5	4	12
II	Linear motion, Angular motion, Simple Harmonic Motion And Sound	14	5	5	6	16
III	Lasers and Fiber Optics	9	3	5	4	12
<b>Total</b>		32	11	15	14	40
<b>CHEMISTRY</b>						
IV.	Metals ,Alloys Cement & Lime	12	3	4	5	12
V.	Water Treatment & analysis	12	4	6	6	16
VI.	Fuels and Combustion	8	3	4	5	12
<b>Total</b>		32	10	14	16	40

**Legends:** R-Remembrance (Knowledge), U- Understanding, A- Application and above levels (Revised Bloom's taxonomy)

Note-This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from the above table.

## SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

1. Market survey of different materials and compare the following points
  - a) Structure.
  - b) Properties.
  - c) Applications.
2. Library survey regarding engineering material used in different industries.
3. Power point presentation or animation for showing preparation techniques of alloys, LASER.
4. Seminar on any relevant topic.

## SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- i. Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
- ii. Not only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- iii. About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for self-directed learning and assess the development of the LOs/COs through classroom presentations (see implementation guideline for details).
- iv. Teachers need to ensure to create opportunities and provisions for co-curricular activities.
- v. Guide student(s) in undertaking micro-projects.

## SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the second semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs.

Each micro-project should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain LOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory based or field-based

- i) **Optical Fiber and TIR:** Prepare models by using water and diode laser to demonstrate total internal reflection and the working of optical fiber.
- ii) **Conductivity:** Collect different materials such as metal, plastics, glass etc. and prepare models to differentiate between good and bad conductor within collected materials.
- iii) **Gas laws:** Prepare models to demonstrate Boyle's laws, Charle's Law and Gay Lussac's law using house hold materials.
- iv) **Battery and Cell:** Collect wastage material from lab and household and prepare working model of cell.
- v) **Adhesives:** Prepare model to demonstrate the applications of various adhesives.
- vi) **Polymer:** Collect the samples of different polymers and list their uses.
- vii) **Series and parallel resistances:** Prepare models for combination of series and parallel resistances using bulbs/ LED.
- viii) **Systems and units:** Prepare chart on comparison of systems of units for different physical quantities.

- ix) **Magnetic flux:** Prepare models to demonstrate magnetic lines of forces of different types of magnets.
- x) **Types of bonds:** Prepare chart and models displaying different types of bonds with examples.
- xi) **Ionization:** Prepare chart displaying ionization phenomenon.
- xii) **Elasticity:** Prepare working model to demonstrate the stress – strain behavior of different wires of different thickness and material.
- xiii) **Viscosity:** Collect 3 to 5 liquids and prepare a working model to differentiate liquids on the basis of viscosity and demonstrate their applications.
- xiv) **Motion:** Prepare model of ball rolling down on inclined plane to demonstrate the conservation of energy and motion of an object in inclined plane.
- xv) **Properties of Laser:** Use Key chain laser to differentiate laser with ordinary light.
- xvi) **Water analysis:** Collect water samples from different water sources and find the characteristics like acidity, conductivity, dissolved solids, suspended particles.
- xvii) **Water treatment:** Collect 3 to 5 water samples to find the dosage of bleaching powder required for its sterilization.
- xviii) **Water analysis:** Prepare model to find the soap foaming capacity of bore water on addition of soda ash.
- xix) **Fuels:** Prepare chart showing different types of liquid fuels showing their calorific values and uses.
- xx) **Cement:** Collect different samples of cement and find their initial and final setting time.
- xxi) **Refractory materials:** Prepare chart showing properties of refractory materials.
- xxii) **Metal properties:** Prepare chart showing different industrial application of metal and relate it with required property or properties using internet.
- xxiii) **Alloy steel:** Find the effect of alloying elements like Mn, Cr, Ni, W, V, Co on properties of steel. Prepare chart of showing percentage composition, properties and industrial applications of different types of steel based on above alloying elements using internet.
- xxiv) **Capacitors:** Prepare the models of various types of capacitors.
- xxv) **Current electricity:** Make one circuit with bulbs/ LED/ connected in parallel or series.
- xxvi) **LASER:** Prepare the presentation on the industrial application of LASER.
- xxvii) **Water analysis:** Collect water samples from different water sources and determined the acidity, conductivity, dissolved solids, suspended particles in the sample.
- xxviii) **Water treatment:** Collect 3 to 5 water samples from borewell and determined the dosage of bleaching powder required for its sterilization.
- xxix) **Water analysis:** Determine the soap foaming capacity of bore water on addition of soda ash.
- xxx) **Energy sources:** Prepare chart showing different types of energy sources with their advantages.
- xxxi) **Electrolytic Cells:** Collect fruit and vegetable and prepare working model of cell.
- xxxii) **Electric Insulators:** Collect the samples of different insulators and list their industrial applications.
- xxxiii) **Thermocouple:** Prepare chart showing different types of thermocouples with their characteristics used in electronic and electrical industry.

## SUGGESTED LEARNING RESOURCES

### A) BOOKS

SR. NO.	AUTHOR	TITLE	PUBLISHER
1.	Physics Textbook XI (part1 &2)	J.V.Naralikar,A.W.Joshi	National Council of Education Research and Training New Delhi
2.	Physics Textbook XII (part1 &2)	J.V.Naralikar,A.W.Joshi	National Council of Education Research and Training New Delhi
3.	Fundamentals of Physics	D.Haliday & R. Resnick	Jhon Wiley and Sons , USA

4.	Engineering Physics	R.K.Gaur, S.L.Gupta	Dhanpat Rai and Sons Publications.
5.	Engineering Chemistry	Jain P.C. & Jain Monika	Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
6.	Engineering Chemistry	S.S.Dara	S. ChandPublication
7.	Fundamental of electrochemistry	Bagotsky V S	Wiley international NJ USA

**B) Web site for references:**

[www.physicsclassroom.com](http://www.physicsclassroom.com)  
[www.hyperphysics.com](http://www.hyperphysics.com)  
[www.physicsinfo.com](http://www.physicsinfo.com) <http://nptel.ac.in/course.php?disciplineId=115>  
<http://nptel.ac.in/course.php?disciplineId=104>  
<http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html>  
[www.physicsclassroom.com](http://www.physicsclassroom.com)  
[www.physics.org](http://www.physics.org)  
[www.fearofphysics.com](http://www.fearofphysics.com)  
[www.sciencejoywagon.com/physicszone](http://www.sciencejoywagon.com/physicszone)  
[www.science.howstuffworks.com](http://www.science.howstuffworks.com)  
[www.in.wikipedia.org](http://www.in.wikipedia.org)  
[www.nptel.iitm.ac.in](http://www.nptel.iitm.ac.in)  
[www.youtube.com, watch v= KjoOHqzda8 \(related to Chemical bonding\)](http://www.youtube.com/watch?v=KjoOHqzda8)

**C) Video**

[www.Youtube.com](http://www.Youtube.com) (surface tension, viscosity, sound, ultrasound)

**D) PPT**

[www.khanaacademy.com](http://www.khanaacademy.com)  
[www.slidehare.net](http://www.slidehare.net)

## PROGRAMME OUTCOMES

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineerin g Tools, Experimen tation and testing	PO5 Engineering practices for society, sustainabilit y & environment	PO6 Project Manage ment	PO7 Lifelong learning	PSO1	PSO2	PSO3
CO1	3	0	0	1	1	2	1	2	0	2
CO2	3	0	0	1	1	2	1	2	0	2
CO3	3	0	0	1	1	2	1	2	0	1
CO4	3	0	0	1	1	2	1	2	1	2
CO5	3	0	0	1	1	2	1	1	1	2
CO6	3	0	0	1	1	2	1	2	1	1

- CO1-Analyze the physical properties of materials for selecting appropriate material for appropriate applications.
- CO2-Apply Laws of motion in various applications.

3. CO3-Use equipments based on principles of LASER and Optical fibre in industrial application.
4. CO4-Select the appropriate metallurgical process and properties related to engineering application of Iron and Copper
5. CO5-Use appropriate Water treatment process to solve water related problems.
6. CO6-Use appropriate Fuel in relevant applications.

## CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1

---

### **DIPLOMA PROGRAMME: CIVIL/MECH./ELECT./COMP./E&TC. ENGINEERING**

<b>COURSE</b>	<b>: ENGLISH</b>	<b>COURSE CODE: R18SC1707</b>
<b>COURSE CATEGORY</b>	<b>: FOUNDATION</b>	<b>CREDIT : 04</b>

---

#### **Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
2	2	3	80	20	-	-	25	125

#### **Rationale:**

Competency in English enhances the employability of an engineering professional. In today's competitive world English is important for students in their academics as well as in their prospective career. The students after passing Diploma in Engineering from any discipline, need to use English as a medium of communication in various formal as well as informal situations. They need to be proficient in the four skills of language i.e. listening, speaking, reading and writing. This curriculum is need based and is designed to help the students to communicate in English effectively.

#### **Course Outcomes:**

1. Formulate grammatically correct sentences.
2. Use relevant words as per context.
3. Comprehend given passages and dialogues.
4. Prepare speeches in given formal situations.
5. Distinguish between various types of communication
6. Communicate effectively by avoiding barriers in various formal and informal situations

#### **Course Details:**

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS
1	<b>Applied Grammar</b> <ul style="list-style-type: none"> <li>1.1. Parts of Speech [Noun, Pronoun, Verb, Adverb, Adjective, Preposition, Conjunction, Interjection]</li> <li>1.2. Tenses</li> <li>1.3. Articles</li> <li>1.4. Punctuation</li> <li>1.5. Direct-indirect speech</li> <li>1.6. Active and Passive voice</li> </ul>	1a. List the various Parts of Speech 1b. Define different Parts of Speech 1c. Identify the part of speech of the given word 1d. Use appropriate prepositions to construct meaningful sentences. 1e. Use appropriate conjunctions to connect phrases and clauses in the given sentences. 1f. Use correct form of tenses in given situation. 1g. Use relevant articles in constructing sentences. 1h. Punctuate the given sentences by using correct punctuation marks. 1i. Change the narration for the given situation.	08	12

		1j. Change the voice of a given sentence		
<b>2</b>	<b>Vocabulary Building</b> 2.1 Synonyms and Antonyms. 2.2 Spellings 2.3 Words often confused 2.4 One word substitution 2.5 Engineering vocabulary	2a. Use synonyms and antonyms correctly. 2b. Correct the spelling errors in given sentences. 2c. Select appropriate word for the given context. 2d. Substitute given phrase/ sentence by one meaningful word. 2e. Apply the engineering vocabulary in the new /given context	<b>08</b>	<b>16</b>
<b>3</b>	<b>Reading Comprehension</b> 3.1 Comprehension based on dialogues 3.2 Comprehension based on unseen passage	3a. Answer the questions on a given unseen passage/ dialogue. 3b. Answer the questions orally on the given unseen passage with correct pronunciation	<b>04</b>	<b>12</b>
<b>4</b>	<b>Public Speaking</b> 4.1 Importance of public speaking 4.2 Characteristics of a good speech 4.3 Vote of thanks 4.4 Farewell speech 4.5 Introducing a guest	4a. State importance of public speaking 4b. State features of a good formal speech 4c. State characteristics of a good vote of thanks speech 4d. Write a vote of thanks speech for the given situation. 4e. State characteristics of a good farewell speech 4f. Write a farewell speech for the given situation. 4g. State characteristics of a good speech for introducing a guest 4h. Write a speech for introducing a guest in the given situation. 4i. Deliver a speech on a given situation	<b>04</b>	<b>12</b>
<b>5</b>	<b>Basics of Communication</b> 5.1 Definition 5.2 Need and importance of communication 5.3 Communication cycle and elements 5.4 Encoding and decoding 5.5 Types of communication 5.6 Verbal and non-verbal 5.7 Oral and written 5.8 Formal and informal 5.9 Difference between verbal and non-verbal, oral and written, formal and informal communication 5.10 Merits and demerits of oral and written communication	5a. Define communication 5b. State the importance of communication in business 5c. Enlist elements of communication 5d. Explain the various elements of communication. 5e. Identify the different communication elements in a given situation 5f. Draw a neat sketch of communication cycle for a given situation 5g. Explain encoding and decoding 5h. List types of communication 5i. Define verbal, non-verbal, oral, written, formal, informal communication 5j. Identify the type of communication in a given situation 5k. Distinguish between various types of communication 5l. State merits and demerits of oral and written communication 5m. Communicate effectively in a given	<b>04</b>	<b>12</b>

		formal and informal situation.		
<b>6</b>	<b>Effective Communication</b> 6.1 Barriers in communication. <ul style="list-style-type: none"> <li>• Mechanical</li> <li>• Physical</li> <li>• Psychological [Prejudice, status block, negative emotions like fear, ego, low confidence]</li> <li>• Linguistic</li> <li>• Cultural</li> </ul> 6.2 Overcoming barriers 6.3 Principles of communication <ul style="list-style-type: none"> <li>• Clarity</li> <li>• Conciseness</li> <li>• Correctness</li> <li>• Completeness</li> <li>• Feedback</li> <li>• Informality</li> <li>• Media selection</li> <li>• Flexibility</li> </ul>	6a. Define “barrier in communication” 6b. List types of barriers in communication 6c. Explain mechanical, physical, psychological, linguistic, and cultural barriers with suitable examples 6d. Identify the communication barriers in a given situation 6e. Suggest remedies to overcome the given barriers. 6f. List principles of effective communication 6g. Describe the various principles of communication with suitable examples. 6h. Apply the various principles in oral and written communication	<b>04</b>	<b>16</b>

#### SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Applied Grammar	08	03	03	06	12
2	Vocabulary Building	08	04	04	08	16
3	Comprehension	04	02	08	02	12
4	Speech Writing	04	02	02	08	12
5	Basics of Communication	04	04	04	04	12
6	Effective Communication	04	04	04	08	16
	<b>Total</b>	<b>32</b>	<b>19</b>	<b>25</b>	<b>36</b>	<b>80</b>

#### SUGGESTED EXERCISES/PRACTICALS

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. Required
1	V	Pronounce basic English words correctly.	02
2	V	Meet and greet people formally.	02
3	V	Talk about your family.	02
4	VI	Give directions about places in town.	02
5	VI	Describe your neighbourhood and region.	02

6	III	Answer the questions orally on the given unseen passage with correct pronunciation.	02
7	IV	Deliver any one of the following speeches: Vote of thanks, Farewell speech, Introducing a guest.	02
8	I	Rewrite the given sentences using correct articles.	02
9	I	Change the narration of given sentences from direct to indirect.	02
10	II	Solve the exercise based on vocabulary.	02
<b>Total</b>			<b>20</b>

### **SUGGESTED STUDENT ACTIVITIES**

5. Group reading: Read one news item from a Standard English newspaper or magazine. Form a group of 4-5 students. Discuss the news from various angles (contents, grammar, and vocabulary) with your group.
6. Conduct quiz on spellings in small groups.

### **SPECIAL INSTRUCTIONAL STRATEGIES**

1. Show video/animation, film to improve language skills
2. Use flash cards to demonstrate how to use flash cards to improve vocabulary.

### **SUGGESTED LEARNING RESOURCES**

#### **F) Books**

<b>Sl. No.</b>	<b>Title of Book</b>	<b>Author</b>	<b>Publication (with year)</b>
1	Applied Grammar and Composition	M.P. Bhatia	M.I. Publications (Eighth Revised Edition), Agra.
2	Advanced English Grammar and Composition	Alok Pandey and Deepak Pandey	Sahni Publication, Delhi-7.
3	Intermediate English Grammar	Raymond Murphy	Cambridge University Press, (Second Edition), New Delhi.
4	Essential English Grammar	Raymond Murphy	Cambridge University Press, New Delhi, ISBN: 9780-0-521-67580-9
5	Effective English with CD	Kumar, E. Suresh; Sreehari, P.; Savithri, J.	Pearson Education, Noida, New Delhi, 2009 ISBN: 978-81-317-3100-0
6	English Grammar at Glance	Gnanamurali, M.	S. Chand and Co. New Delhi, 2011 ISBN:9788121929042
7	Living English Structure	Allen, W.S.	Pearson Education, New Delhi, Fifth edition, 2009, ISBN:108131728498,99
8	English Reading Comprehension	R. Gupta	Ramesh Publishing House, New Delhi
9	The Art of Public Speaking	Dale Carnegie	Ocean Paperbacks
10	Essential Communication Skills	Shalini Aggrawal	Ane Books Pvt Ltd
11	A Course in Communication Skills	Dutt, Rajeevan, Prakash	Foundation Books
12	Word Power Made Easy	Norman Lewis	Pocket Books / Goyal Publishers & Distributors
13	Words Often Confused	Dr. B. R. Kishore	New Light Publishers
14	Perfect Your Spelling Power	Raymond Hill	Maanu Graphics Publishers

#### **G) Major Equipment/ Instrument with Broad Specifications**

Linguaphone language laboratory software

## H) Software/Learning Websites

- a. <https://english.wifistudy.com/>
- b. <https://www.britishcouncil.in/english/learn-online>
- c. <http://learnenglish.britishcouncil.org/en/content>
- d. <http://www.talkenglish.com/>
- e. [www.languagelabsystem.com](http://www.languagelabsystem.com)
- f. [www.wordsworthelt.com](http://www.wordsworthelt.com)
- g. [www.learn4good.com](http://www.learn4good.com)
- h. [www.fluentzy.com](http://www.fluentzy.com)
- i. [www.edufind.com](http://www.edufind.com)
- j. [www.khake.com](http://www.khake.com)
- k. [www.learnenglish.org.uk](http://www.learnenglish.org.uk)
- l. [www.english4engineer.com](http://www.english4engineer.com)
- m. [www.owl.english.psu.edu](http://www.owl.english.psu.edu)

### Mapping matrix of PO's and CO's:

Course Name: ENGLISH Course code: R18CE5103	PO 1 Basic and disciplin e specific knowled ge	PO 2 Prob lem Anal ysis	PO 3 Design/ develop ment of solutio ns	PO 4 Engineer ing Tools, experime ntation and testing	PO 5 The enginee ring practice s for society, sustaina bility and environ ment	PO 6 Project manag ement	PO 7 Lifelo ng learni ng	PSO 1	PSO 2	PSO3
CO1- Formulate grammatically correct sentences	3	0	0	0	0	1	1	0	0	2
CO2- Use relevant words as per context	3	0	0	0	0	1	1	0	0	2
CO3- Comprehend given passages and dialogues	2	0	0	0	0	1	1	0	0	2
CO4- Prepare speeches in given formal situations.	2	0	0	0	0	1	1	0	0	2
CO5- Distinguish between various types of communication	2	0	0	0	0	1	1	0	0	1
CO6- Communicate effectively by avoiding barriers in various formal and informal situations	3	0	0	0	0	1	1	0	0	2

Rating scale '3' for high, '2' for medium, '1' for low '0' for no correlation

## CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1

---

### DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

**COURSE: ENGINEERING GRAPHICS**

**COURSE CODE: R18ME1201**

**COURSE CATEGORY: FOUNDATION**

**CREDIT: 06**

---

#### Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
2	4	4	80	20	-	-	50	150

#### Rationale:

Drawing which is known as the language of engineers is widely used means of communication among the designers, engineers, technicians & craftsmen in an industry. The translation of ideas into practice without the use of this graphic language is really beyond imagination. Thus for the effective & efficient communication among all those involved in an industrial system, it becomes necessary for a diploma engineer to acquire the appropriate skills in the use of graphic language. This preliminary course aims at building a foundation for the further courses in drawing and other allied subjects.

#### Course Outcomes:

1. Understand the use of various drawing instruments and redraw the given figures.
2. Draw engineering curves with different methods.
3. Draw orthographic projections of the given object.
4. Draw the sectional views for given object.
5. Construct an isometric view from the given views.

#### Course Details:

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS

<b>UNIT NO.1</b> <b>Geometrical construction &amp; tangent exercises , Redraw Figures</b>	<p><b>1.1</b> Use of instruments, types of lines, types of letterings, full, enlarging and reducing scales, dimensioning technique.</p> <p><b>1.2 Geometrical constructions:</b></p> <ul style="list-style-type: none"> <li>- To construct a regular polygon of given side.</li> <li>- To construct a regular polygon in a given circle.</li> <li>- To inscribe a circle in a given polygon.</li> <li>- To circumscribe a circle around a given polygon.</li> <li>- To draw circles touching each other and sides of a given polygon internally &amp; externally.</li> </ul> <p><b>1.3 Tangent exercises :-</b></p> <ul style="list-style-type: none"> <li>- To bisect a given straight line/ arc /angle.</li> <li>- To divide a given straight line into given number of equal parts.</li> <li>- To draw a normal to a given straight line/ arc from a given point within or outside it.</li> <li>-To draw a straight line parallel to a given straight line /arc through point/ at a given distance.</li> <li>-To draw an arc touching to two straight lines / two arcs (internally/ externally)/ one line &amp; one arc.</li> <li>- To draw an internal/ external tangent to two given arcs apart from each other.</li> </ul> <p><b>1.4 Redraw figures:</b> - To redraw the given figures (using the knowledge of Geometrical constructions &amp; tangent</p>	<ol style="list-style-type: none"> <li>1. Explain elements of engineering graphics.</li> <li>2. Draw various types of geometrical constructions in Engineering Graphics.</li> <li>3. Draw various types of tangent exercises in Engineering Graphics.</li> <li>4. Redraw figures by using geometrical constructions &amp; tangent exercise.</li> </ol>	<b>04</b>	<b>12</b>
--	--	--	-----------	-----------

	exercises).			
<b>UNIT NO.2</b>  <b>Engineering Curves</b>	<p><b>2.1</b> To study the construction of following curves using the method mentioned against them: <b>Ellipse</b> -Directrix focus method, arcs of circle method &amp; concentric circles method.</p> <p><b>Parabola</b>- Directrix focus method, rectangle method.</p> <p><b>Involutes</b>- of a polygon, circle &amp; combination of polygon &amp; circle.</p> <p><b>Cycloid</b>- Epicycloid &amp; hypocycloid.</p> <p><b>Helix, Spiral</b>. Use of curves in engineering.</p> <p><b>2.2 Loci of points:</b> - Types of mechanisms- Loci of points with given condition and examples related to it.</p>	<p>1. Draw Conic curves, &amp; know their applications.</p> <p>2. Draw helix, involute, Cycloid spiral &amp; know their applications.</p> <p>3. Draw loci of points from given data.</p>	<b>04</b>	<b>12</b>
<b>UNIT NO.3</b>  <b>Introduction to orthographic projection &amp; isometric views.</b>	<p><b>3.1</b> Simple exercises to draw Orthographic Projections by first &amp; third angle methods (Wooden Models to be used).</p> <p><b>3.2</b> Simple exercises on drawing isometric views from given orthographic views.</p>	<p>1. Draw Orthographic Projections by first &amp; third angle</p> <p>2. Draw Isometric views from given orthographic views.</p>	<b>07</b>	<b>16</b>
<b>UNIT NO.4</b>  <b>Orthographic Projections</b>	<p><b>4.1</b> Conversion of given pictorial views into orthographic projections using First angle and third angle method of projections.</p> <p><b>4.2</b> Dimensioning the Views (objects including curves, slots on sloping planes).</p>	<p>1. Visualize, interpret &amp; draw orthographic views from given pictorial view.</p>	<b>07</b>	<b>12</b>
<b>UNIT NO.5</b>  <b>Sectional</b>	<b>5.1</b> Conversion of given pictorial views into sectional (full	1. Visualize, interpret & draw sectional views	<b>05</b>	<b>16</b>

<b>Views</b>	sectional) orthographic projections using first angle & third angle method of projections. Dimensioning the views.	from given pictorial view.		
<b>UNIT NO.6 Isometric projection &amp; Views</b>	<b>6.1</b> Construction & use of isometric scale. Conversion of given orthographic views into isometric projections/views (objects including curves, slots on sloping planes).	1. Differentiate natural scale and isometric scale. 2. Visualize, interpret & draw isometric view and isometric projection.	<b>05</b>	<b>12</b>

### SUGGESTED EXERCISES/PRACTICALS:

<b>S. No.</b>	<b>Unit No.</b>	<b>Practical Exercises (Outcomes' in Psychomotor Domain)</b>	<b>Approx. Hrs. Required</b>
1.	1	Geometrical construction, tangent exercises & redraw figure.	8
2.	2	Engineering curves.	8
3.	3	Introduction to orthographic projection & isometric views.	14
4.	4	Orthographic projection	14
5.	5	Sectional views	10
6.	6	Isometric Projection and Views	10
<b>Total</b>			<b>64</b>

### SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN:

<b>Unit No.</b>	<b>Unit Title</b>	<b>Teaching Hours</b>	<b>Distribution of Marks</b>			
			<b>R Level</b>	<b>U Level</b>	<b>A Level</b>	<b>Total</b>
1	Geometrical construction, tangent exercises & redraw figure.	4	4	6	2	12
2	Engineering curves.	4	4	4	4	12
3	Introduction to orthographic projection & isometric views.	7	2	12	2	16
4	Orthographic projection	7	2	10	0	12
5	Sectional views	5	4	8	4	16
6	Isometric Projection and Views	5	2	6	4	12
	<b>TOTAL</b>	<b>32</b>	<b>18</b>	<b>46</b>	<b>16</b>	<b>80</b>

**MAJOR EQUIPMENT/INSTRUMENT REQUIRED:**

<b>Sr. No.</b>	<b>Equipment Name With Broad Specifications</b>	<b>Exp. Sr. No.</b>
1	Mini drafter	All
2	Solid models	3,4

**TEACHING METHODOLOGY:**

Chalk-Board, Discussions, Charts, Models.

**i) Intellectual Skills:**

- Collection of information, data
- Analysis of data
- Report writing

**ii) Motor Skills:**

- Presentation Skills
- Use of multi media

**SPECIAL INSTRUCTIONAL STRATEGIES (if any)**

- i. Show video/animation film to demonstrate the working principles, constructional features, testing and maintenance of different types of electronic and magnetic instruments.
- ii. Arrange a visit to nearby small scale manufacturing unit and make a report of tools and equipments used.
- iii. Use Flash/Animations to explain the working of different instruments.
- iv. Give Mini projects to students.

**SUGGESTED LEARNING RESOURCES****I) REFERENCE BOOKS:**

<b>SR. NO.</b>	<b>AUTHOR</b>	<b>TITLE</b>	<b>PUBLISHER</b>
1.	N.D. Bhatt	Engineering Drawing	Charotar Publication, Anand.
2.	Mali and Chaudhary	Engineering Drawing	Vrinda Publications,Jalgaon.
3.	Kamat & Rao	Engineering Drawing	Jeevandeep Publicatons, Mumbai
4.	N.Y. Prabhu	Geometrical Engineering Drawing	Pune Vidyarthi Griha, Publications, Pune.
5.	Ozarkar & Utturkar	Engineering Drawing	Maharashtra Publishing House
6.	K. Venugopal	Engineering Drawing	New Age International Ltd., Delhi.
7.	SP 46-1988	Code of practice for general engineering drawing	Bureau of Indian Standards.(BIS)

### **Mapping matrix of CO's, PO's and PSO's:**

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PSO2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	2	2	0	0	1	0	3	2	0	0
CO2	2	0	0	0	1	0	1	2	0	0
CO3	2	0	0	0	1	0	1	2	0	0
CO4	2	2	2	0	1	0	3	2	1	2
CO5	2	3	2	0	1	0	3	2	2	2

### **3: High 2: Moderate and 1:Low Relationship**

## CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1

---

### DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

**COURSE: ENGINEERING MECHANICS**

**COURSE CODE: R18AM2101**

**COURSE CATEGORY: ALLIED**

**CREDIT: 05**

---

#### **Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
3	2	3	80	20	-	-	25	125

#### **Rationale:**

This is Allied subject which will enable the students to understand the fundamentals of mechanics. The main purpose is to help the students to develop the logical, orderly processes of thinking that characterize an engineer. The relations between a force and its components, Newton's laws of motion applied to a wide variety of practical situations in the field of civil and mechanical engineering.

#### **Course Outcomes:**

The student will be able to:

1. Identify the force systems for the given conditions by applying the basics of mechanics.
2. Apply the conditions of equilibrium to check the stability of various force system and to determine unknown forces of different engineering systems.
3. Apply the principles of friction for various conditions.
4. Locate the Centroid of various components.
5. Calculate moment of inertia of various components.
6. Understand the basic concepts of kinetics, work, power and energy.
7. Describe working of simple lifting machines such as screw jack, worm and worm wheel and calculate velocity ratio and efficiency.

#### **Course Details:**

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS
UNIT NO.1	<b>Composition and Resolution of Forces :</b> 1.1 Concept of force and its unit,	1a. Explain concepts of the given terms. 1b. Explain effects of a	08	16

	<p>system of coplanar forces, concurrent and non concurrent, like and unlike Parallel forces.</p> <p>1.2 Resultant and equilibrant of forces, composition of forces: triangle, parallelogram and polygon law of Forces. Resolution of forces in rectangular components.</p>	<p>force on the given body.</p> <p>1c. Identify the force system for the given situation.</p> <p>1d. Resolve the given single force in rectangular components.</p> <p>1e. Calculate the resultant of given force system analytically.</p>		
<b>UNIT NO.2</b>	<p><b>Equilibrium of Forces:</b></p> <p>2.1 Moment of a force, Equilibrium conditions, Types of Supports, Beam reactions, Varignon's theorem, concept of couple. Principle of transmissibility of a force.</p> <p><b>2.2 Friction :</b></p> <p>Friction as opposing force, advantages and disadvantages of friction, Laws of friction, coefficient of friction, its value for different materials in contact, angle of friction, cone of friction,</p> <p>2.3 A body resting on rough horizontal plane under applied force of different magnitude. Equilibrium of a body resting on rough inclined plane when Applied force is i) inclined to plane, ii) along the plane and iii) horizontal.</p>	<p>2a. Draw the free body diagram for the given condition.</p> <p>2b. Explain the concept of equilibrium.</p> <p>2c. Identify the types of beams required for the given condition.</p> <p>2d. Appreciate Friction and its engineering application.</p> <p>2e. Determine force friction and coefficient of friction for the given condition.</p> <p>2f. Determine unknown force in the given condition using Lami's theorem.</p>	<b>08</b>	<b>12</b>
<b>UNIT NO.3</b>	<p><b>Centre of Gravity :</b></p> <p>3.1 Concept of center of gravity and centroid. Standard case: Rectangle, circle, semicircle and Triangle.</p> <p>3.2 Determination of centroid for sections such as I, T, L and other compound sections.</p>	<p>3a.Determine the centroid of geometrical plane figures.</p> <p>3b.Calculate centroid of the composite plane lamina</p>	<b>08</b>	<b>16</b>

<b>UNIT NO.4</b>	<b>Moment of Inertia</b> 4.1 Definition, Parallel axes theorem, Perpendicular axis Theorem, radius of gyration. 4.2 Moment of Inertia of different shapes : rectangle, Triangle, circle, semicircle and compound sections.	4a.State Parallel axes theorem, Perpendicular axis theorem. 4b.Define radius of gyration. 4c. Compute moment of inertia of different plane laminas	<b>08</b>	<b>12</b>
<b>UNIT NO.5</b>	<b>Kinetics :</b> 5.1 Momentum, impulse, impulsive force, Newton's laws of motion, 5.2 Direct impact, D'Alembert's Principle, Law of conservation of momentum.	5a. State Newton's Laws, Impulse, Momentum equation.	<b>08</b>	<b>12</b>
<b>UNIT NO.6</b>	<b>Work, Power and Energy :</b> 6.1 Definitions of work, power and energy and their units, graphical representation of work, work done by a torque. 6.2 Definition, forms of energy – kinetic and potential, law of conservation of energy, work energy principle.	6a. Define work, power and energy, work done by torque. 6b. Compute work, Power and Energy. 6c.State work energy principle.	<b>08</b>	<b>12</b>

#### SUGGESTED EXERCISES/PRACTICALS/ ASSIGNMENTS:

<b>Sr. No.</b>	<b>Practical</b>	<b>Topic No.</b>	<b>Hours Allotted</b>	<b>Mapped CO</b>
1.	To verify Lami's Theorem.	1	2	CO2
2.	To verify law of parallelogram of forces.	1	2	CO1
3.	To verify law of triangle.	1	2	CO1
4.	To verify the law of polygon of forces.	1	2	CO1
5.	To verify principle of moment.	1	2	CO2
6.	To find the coefficient of friction between wood and glass using a rough horizontal plane.	2	2	CO3
7.	To find the coefficient of friction between wood and glass using a rough inclined plane.	2	2	CO3
8.	To find mechanical advantage, velocity ratio and efficiency of worm and worm wheel.	--	2	CO7
9.	To find mechanical advantage, velocity ratio and efficiency of screw jack.	--	2	CO7
10	To find the support reactions of a simple beam.	2	2	CO2
11.	To find the forces in jib and tie of a jib crane.	1	2	CO1
12.	Determination of centroid of plane laminas	3	2	CO4
<b>Total</b>			<b>24</b>	

Sr. No.	Assignments	Topic No.	Hours Allotted	Mapped CO
1.	Assignment based on basic concepts of mechanics, force systems, composition and resolution of force, equilibrium conditions.	1,2	2	CO1 CO2
2.	Assignment based on friction.	2	2	CO3
3.	Assignment based on centroid and moment of inertia.	3,4	2	CO4, CO5
4.	Assignment based on kinetics, work, power, energy.	5,6	2	CO6

Sr. No.	Student activity	Topic No.	Hours Allotted	Mapped CO
1.	Observe and list different activities in our surroundings where principals of Mechanics are involved	1	2	CO1 CO2 CO3
2.	Illustrate situations wherein friction is essential and not essential.	6	2	CO4
3.	Observe and list different activities in our surroundings where simple machines are used.	2	2	CO7
<b>Total</b>			<b>6</b>	

Unit No.	Unit Title	Teaching Hours	Distribution of Marks			
			R Level	U Level	A Level	Total
1	Composition and Resolution of Forces.	08	4	6	6	16
2	Equilibrium of Forces, Friction	08	2	4	6	12
3	Centre of Gravity	08	4	6	6	16
4	Moment of Inertia	08	2	4	6	12
5	Kinetics	08	2	4	6	12
6	Work, Power, Energy	08	2	4	6	12
<b>TOTAL</b>		<b>48</b>	<b>16</b>	<b>28</b>	<b>36</b>	<b>80</b>

**Instructions:**

1. Practical will be carried out in groups of students.
2. Each group will consist of about five students.
3. Each student from the group shall be given chance to handle the instrument, to understand the function of different components & use of the instrument.
4. Drawing, plotting should be considered as part of practicals.

**Remarks:**

1. The list of practicals/tutorials/student activities given above is suggestive. One or more such practicals/tutorials/student activities can be replaced with another or modified to attain the expected outcomes and proficiency more effectively.

2. The practicals/assignments/student activities should be so designed that students acquires outcomes in all domains - cognitive, psychomotor and affective.
3. Even though mainly outcomes in psychomotor domain are listed under practicals/assignments/student activities, it will also lead to development of outcomes in affective domain also.
4. The affective domain outcomes (social skills & attitudes) those will be developed through practicals/assignments/student activities includes – practice good housekeeping, maintain instruments & tools, demonstrate working as a team member & a leader and follow safety & etc. Acquisition of outcomes such as valuing, organizing and characterizing under affective domain will take place in the student gradually over three years of diploma program.
5. The skills associated with each of the practical/assignment/student activity are to be assessed using the ‘Rubrics’ given under ‘Evaluation Scheme for Practicals/Assignments/Student Activities’.

**TEACHING METHODOLOGY:**

Chalk-Board, Discussions, Charts, Models.

**MAJOR EQUIPMENT/INSTRUMENT REQUIRED:**

Sr. No.	Equipment Name with Broad Specifications	Exp. Sr. No.
1	Universal force table with all accessories.	1,2,3,4
2	Law of moment apparatus.	6
3	Beam reaction apparatus.	11
4	Friction apparatus along with horizontal and vertical plane adjustments. Two weight box. One wooden box having wooden surface. One wooden box having glass surface.	7,8
5	Worm and worm wheel (wall mounted unit with threaded spindle, load drum, effort wheel with necessary slotted weights, hanger and thread.	9
6	Simple screw jack(table mounted metallic body, screw with a pitch of 5mm.	10
7	Model of jib crane	4

**SUGGESTED LEARNING RESOURCES:**

**J) REFERENCE BOOKS:**

Sr. No	AUTHOR	TITLE	PUBLISHER
1	Engineering Mechanics	Beer and Johnston	Tata McGraw Hill
2.	Engineering Mechanics	S.P. Timoshenko	Schaum Outline Series
3.	Fundamentals of Applied Mechanics	Dadhe Jamdar and Walavalkar	Sarita Prakashan,Pune.
4	Elements of Applied Mechanics	S.B.Junnarkar	Charotor Book Stall, Anand.

### B) Websites

Sr. No.	ADDRESS
1	<a href="http://www.nptel.ac.in">www.nptel.ac.in</a>
2	<a href="http://www.youtube.com">www.youtube.com</a>
3	<a href="http://www.discoveryforengineers.com">www.discoveryforengineers.com</a>

### Mapping matrix of CO's, PO's and PSO's:

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PSO2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	3	0	0	0	0	0	0	2	0	1
CO2	3	0	0	0	0	0	0	1	0	1
CO3	3	0	0	0	0	0	0	0	0	1
CO4	3	0	0	0	0	0	0	1	0	1
CO5	3	0	0	0	0	0	0	1	0	1
CO6	3	0	0	0	0	0	0	2	1	1

CO7	3	0	0	0	0	0	0	0	1	1
-----	---	---	---	---	---	---	---	---	---	---

**3: High Relationship, 2: Medium Relationship, 1: Low Relationship**

## **CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1**

---

### **DIPLOMA PROGRAMME: MECHANICAL ENGINEERING**

**COURSE: COMPUTER AIDED DRAFTING**

**COURSE CODE: R18ME2204**

**COURSE CATEGORY: ALLIED COURSE**

**CREDIT: 03**

---

#### **Teaching and Examination Scheme:**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>						
<b>TH</b>	<b>PR</b>	<b>PAPER HRS.</b>	<b>TH</b>	<b>TEST</b>	<b>PR</b>	<b>OR</b>	<b>TW</b>	<b>TOTAL</b>
<b>1</b>	<b>2</b>	-	--	--	@50	--	<b>50</b>	<b>100</b>

@ Internal Examination.

#### **Rationale:**

Now a day, manual drafting is obsolete in Industry. Computers being the inevitable part in an engineer's life due to its inbuilt characteristics which helps him to do various task with acceleration. Using computers and CAD software it is easy to create and modify drawings ultimately it saves time. It also may be useful to generate assembly and manufacturing drawings. In mechanical Industry operating skills to diploma student are essential for computer aided drafting, handling of printers & plotters.

#### **Course Outcomes:**

1. Understand various tool bars of software.
2. Draw engineering drawing using software.
3. Use of software to present production drawing.
4. Use of software to present assembly production drawing.
5. Use of software to draw isometric drawing.

#### **Course Details:**

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS
UNIT NO.1  Introduction to Auto-CAD	<p><b>1.1 Introduction to Computer Aided Drafting (CAD):</b> Need, applications in Industry, and advantages.</p> <p><b>1.2 Co-ordinate system:</b> Cartesian &amp; Polar-Absolute, Relative mode.</p> <p><b>1.3 CAD Initial Settings:</b> snap, grid, grid setting, ortho, osnap, precision limits, units, otrack and other advance setting.</p> <p><b>1.4 Object Selection Methods:</b> Picking, window, crossing, fence, last, previous etc .OR other advance selection method if any.</p>	1.Initial settings of Auto CAD before start work. 2.Understand and use of co-ordinate system. 3.Use of commands to select entities and object.	<b>03</b>
UNIT NO.2  Working with Drawing Aids	<p><b>2.1. Visualization:</b> Zoom commands –all, previous, out, in, extent, real time, dynamic, window, and pan. OR other advance visualization method if any.</p> <p><b>2.2. Draw Command:</b> Line, arc, circle, rectangle, polygon, ellipse, spline.</p> <p><b>2.3. Formatting Commands:</b> Layers, block, line type, line weight, color. OR other advance formatting method if any.</p>	1. Use of visualization commands to observe drawing critically. 2. Apply draw commands to draw different entities of drawing. 3. Use of formatting commands in the drawing to differentiate the entities of the drawing.	<b>03</b>
UNIT NO.3  Modify Commands	<p><b>3.1. Edit &amp; Modify Commands:</b> Erase, break, trim, copy, move, mirror, offset, fillet, chamfer, and array, extend, rotate, scale, lengthen, stretch, measure, divide, explode, and align. OR other advance modifies method if any.</p> <p><b>3.2. Enquiry commands:</b> distance, area, perimeter etc. OR other advance enquiry method if any.</p>	1. Apply the edit and modify commands to construct the given drawing as per requirement. 2. Use of enquiry commands to complete the drawing.	<b>03</b>
UNIT NO.4  Dimension & Tolerance	<p><b>4.1. Dimensioning Commands:</b> Dimension types, dimensional tolerances and geometrical tolerances.</p> <p><b>4.2. Text Commands:</b> Create text and its methods.</p> <p><b>4.3. Plotting of Drawing:</b> Various setting for plot commands.</p>	1. Specify the dimensions, tolerances, geometrical tolerances to the drawing. 2. Insert the information of the drawing in the form of text using text commands. 3. Understand plot commands.	<b>03</b>

<b>UNIT NO.5</b>  <b>Isometric Drawings</b>	<p><b>5.1. Isometric Setting:</b> Drafting setting, isometric crosshair orientation.</p> <p><b>5.2. Isometric Ellipse:</b> Construct ellipse on front, side and top plane.</p> <p><b>5.3. Isometric Arcs:</b> Constructions of arcs at different plane.</p> <p><b>5.4. Isometric Text:</b> Text style and settings.</p> <p><b>5.5. Isometric Dimensioning:</b> Oblique dimensioning.</p>	<p>1. Construction of isometric drawing using appropriate commands and its presentation.</p>	<b>04</b>
<b>Total</b>			<b>16</b>

### SUGGESTED EXERCISES/PRACTICALS:

<b>Sr. No.</b>	<b>Unit No.</b>	<b>Practical Exercises (Outcomes' in Psychomotor Domain)</b>	<b>Hrs. Required</b>
01	1	Plan & prepare template for your institute and department of A4/A3 size paper with title block.(Conventionally)	02
02	1, 2, 3	Use the software to draw simple 2D geometries using various draw and modify software commands. (Problem 1)	02
03	1, 2, 3	Use the software to draw simple 2D geometries using various draw and modify software commands. (Problem 1 continued)	02
04	1, 2, 3	Use the software to draw complex 2D geometries using various draw and modify software commands. (Problem 2)	02
05	1, 2, 3	Use the software to draw complex 2D geometries using various draw and modify software commands. (Problem 2 continued)	02
06	1, 2, 3	Use the software to draw complex 2D geometries using various draw and modify software commands. (Problem 2 continued)	02
07	4, 5	Use the software to estimate a Area, Perimeter , Centroid for the given 2G geometries Circle ,Pentagon, Hexagon. (Problem 3)	02
08	4, 5	Use the software to estimate Area, Perimeter ,Centroid for the given 2G geometries Circle ,Pentagon, Hexagon .(Problem 3 continued)	02
09	4, 5	Use the software to draw simple production drawing using all commands.(Problem 4)	02
10	4, 5	Use the software to draw simple production drawing using all commands.(Problem 4 continued)	02

11	4, 5	Use the software to draw simple production assembly drawing using all commands.(Problem 5)	02
12	4, 5	Use the software to draw simple production assembly drawing using all commands.(Problem 5 continued)	02
13	5	Use the software to draw simple production assembly drawing using all commands.(Problem 5 continued)	02
14	5	Use the software to draw simple production assembly drawing using all commands.(Problem 5 continued)	02
15	5	Use software to draw simple isometric drawing using isometric mode.(Problem 6 continued)	02
16	5	Use software to draw complex isometric drawing of circles using isometric mode.(Problem 6 continued)	02
<b>Total</b>			<b>32</b>

#### **MAJOR EQUIPMENT/COMPUTERS/SOFTWARES:**

SR. NO.	EQUIPMENT NAME WITH BROAD SPECIFICATIONS	EXP. SR. NO.
1	Hardware: Personal Computer 25 Nos, (i3/ i5 or higher), RAM minimum 4 GB; A3 / A4 size printer / plotter (1 Nos). Display-wide Screen preferably (1 Nos). Software:Auto-CAD software.( 25 Nos)	All practical's
2	Projector :1 Nos.	

#### **TEACHING METHODOLOGY:**

Chalk-Board, Discussions, Charts, PPT, Projector etc

#### **Intellectual skills:**

1. Select and develop coordinate system.
2. Interpret a drawing to draw in CAD software.
3. Select & use appropriate CAD commands for given situation.

#### **Motor Skills:**

1. Use pull down menu and their submenu, toolbars
2. Setting the initial drawing setup.
3. Draw, edit and modify drawings.
4. Use printers and plotters for plotting production drawings.

## SUGGESTED LEARNING RESOURCES:

### K) REFERENCE BOOKS:

Sr. No.	Author	Title	Publisher / Edition
1	Sham Tickoo	AutoCAD: A Problem-Solving Approach	Thomson Learning EMEA, Limited
2	George Omura	Mastering Auto CAD	BPB Publication
3	George Omura	ABC's of Auto CAD	BPB Publication
4	Gautam Purohit & Gautam Ghosh	M/c Drawing with AutoCAD	Pearson Publication
5	T Jeyapoovan	Engineering Graphics Using AutoCAD	Vikas Publishing House Pvt. Ltd. Fifth Edition
6	-	Various software manuals	-

### MAPPING MATRIX OF CO's, PO's & PSO's:

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PSO2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	1	0	0	2	0	1	2	1	1	2
CO2	1	0	0	2	0	1	2	1	1	2
CO3	1	0	0	2	0	1	2	1	1	2
CO4	1	0	0	2	0	1	2	1	1	2
CO5	1	0	0	2	0	1	2	1	1	2

**3: High 2: Moderate and 1: Low Relationship**

## CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1

### DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

**COURSE: ENVIRONMENTAL STUDIES**

**COURSE CODE: R18ME2207**

**COURSE CATEGORY: ALLIED**

**CREDIT: 04**

#### **Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
2	2		-	-	-	@50	50	100

#### **Rationale:**

Environment essentially comprises of our living ambience, which gives us the zest and verve in all our activities. The turn of the twentieth century saw the gradual onset of its degradation by our callous deeds without any concern for the well being of our surrounding we are today facing a grave environmental crisis. The unceasing industrial growth and economic development of the last 300 years or so have resulted in huge ecological problems such as overexploitation of natural resources, degraded land, disappearing forests, endangered species, dangerous toxins, global warming etc.

The existing methods of producing conventional energy will be inadequate in providing the needs of the future demands. Considerable research is being done to investigate the possibility of producing energy from non conventional sources. Development of appropriate designs may be necessary to make use of non conventional sources. This course produces the background to the understanding of the different types of Alternate Energy Sources.

The curriculum covers the aspects about environment such as Environment and Ecology, Environmental impacts on human activities, Water resources and water quality, Mineral resources and mining, Forests, etc.

#### **Course Outcomes:**

6. To explain importance of environment.

7. To analyze key issues about environment.
8. To give reasons for environment degradation.
9. To study initiatives taken by the world bodies to restrict and reduce degradation.
10. To analyze different components of solar energy and wind energy devices.
11. To study the principles of biomass, geothermal and tidal energy.

**Course Details:**

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS
<b>UNIT NO.1</b>  <b>Nature of Environmental Studies</b>	<b>1.1</b> Definition, Scope and Importance of the environmental studies. <b>1.2</b> Importance of the studies irrespective of course. <b>1.3</b> Need for creating public awareness about environmental issues.	1.Define scope and importance of the environmental studies. 2.Describe the Need for creating public awareness about environmental issues.	<b>02</b>
<b>UNIT NO.2</b>  <b>Natural Resources and Associated Problems</b>	<b>2.1</b> Renewable and Nonrenewable resources- Definition, Associated problems. <b>2.2</b> Forest Resources <ul style="list-style-type: none"> <li>• General description of forest resources.</li> <li>• Functions and benefits of forest resources</li> <li>• Effects on environment due to deforestation, Timber extraction, Building of dams, waterways etc.</li> </ul> <b>2.3</b> Water Resources <ul style="list-style-type: none"> <li>• Hydrosphere: Different sources of water.</li> <li>• Use and overexploitation of surface and ground water.</li> <li>• Effect of floods, draught, dams etc. on water resources and community.</li> <li>• Water bodies &amp; effect of human activity on it</li> </ul> <b>2.4</b> Mineral Resources: <ul style="list-style-type: none"> <li>• Categories of mineral resources</li> <li>• Basics of mining activities</li> <li>• Mine safety</li> <li>• Effect of mining on environment</li> </ul> <b>2.5</b> Food Resources: <ul style="list-style-type: none"> <li>• Food for all</li> </ul>	1.Define natural resources 2.Identify uses of natural Resources, their over exploitation and Importance for environment.	<b>04</b>

	<ul style="list-style-type: none"> <li>• Effects of modern agriculture</li> <li>• World food problem</li> <li>a. “Effect of industrialisation / Development” on Natural resources and in general on environment.</li> <li>b. Water bodies &amp; effect of human activity on it.</li> </ul>		
<b>UNIT NO.3</b> <b>Ecosystems, Biodiversity and Its Conservation</b>	<b>3.1 Concept of Ecosystem</b> <b>3.2 Structure and functions of ecosystem</b> <b>3.3 Energy flow in ecosystem</b> <b>3.4 Major ecosystems in the world</b> <b>3.5 Definition of Biodiversity</b> <b>3.6 Levels of biodiversity</b> <b>3.7 Value of biodiversity</b> <b>3.8 Threats to biodiversity</b> <b>3.9 Conservation of biodiversity</b>	1. Define Ecosystem and Biodiversity. 2. Describe various functions of ecosystem. 3. Describe major ecosystem in world. 4. Suggest measures for Conservation of biodiversity. 5. State levels of biodiversity	<b>04</b>
<b>UNIT NO.4</b> <b>Environmental Pollution</b>	<b>4.1 Definition</b> <b>4.2 Air pollution: definition, classification, sources, effects, prevention</b> <b>4.3 Water Pollution: Definition, classification, sources, effects, prevention</b> <b>4.4 Soil Pollution: Definition, sources, effects, prevention</b> <b>4.5 Noise Pollution: Definition, sources, effects, prevention.</b> <b>4.6 Climate Change, Global warming, Acid rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust: Basic concepts and their effect on Climate.</b>	1. Classify different types of pollution. 2. Enlist sources of pollution. 3. State effect of pollution. 4. Identify measures for prevention of pollution. 5. Identify effects of Climate Change, Global warming, Acid rain and Ozone Layer	<b>04</b>

<b>UNIT NO.5</b>  <b>Social Issues and Environmental Protection</b>	<p><b>5.1</b> Concept of development, sustainable development</p> <p><b>5.2</b> Water conservation, Watershed management, Rain water harvesting: Definition, Methods and Benefits.</p> <p><b>5.3</b> Concept of Carbon Credits and Brief description of the following acts and their provisions:</p> <p><b>5.4</b> Environmental Protection Act.</p> <p><b>5.5</b> Air (Prevention and Control of Pollution) Act.</p> <p><b>5.6</b> Water (Prevention and Control of Pollution) Act.</p> <p><b>5.7</b> Wildlife Protection Act.</p> <p><b>5.8</b> Forest Conservation Act.</p> <p><b>5.9</b> Population Growth: Aspects, importance and effect on environment</p> <p><b>5.10</b> Human Health and Human Rights. its advantages.</p>	<ol style="list-style-type: none"> <li>1. Describe methods of water management.</li> <li>2. Explain Concept of Carbon Credits.</li> <li>3. State important provisions of acts related to environment.</li> </ol>	<b>04</b>
<b>UNIT NO.6</b>  <b>Wind Energy and Solar Energy</b>	<p><b>6.1 Wind Energy:</b> Availability of wind, Types of wind mills for water pumping and generation of electricity. Power transmission mechanism, Blade design, Rotor design, Tower design, Locking devices and Radar.</p> <p><b>6.2 Solar Energy:</b> Availability, limitations, efficiency by first and second law of thermodynamics, Application of solar energy. Energy radiated by Sun. Angular relationship of Earth and Sun positions, Sun path diagram Measurement of solar radiations (on horizontal and tilted surfaces).</p> <p><b>6.3 Solar Collectors and Concentrators</b> : Types and constructional details of flat plate collectors, energy balance for flat plate collectors, limitations of flat plate collectors, various types of concentrators, their advantages, energy balance equation, heliostats, selection of materials for collectors and concentrators.</p> <p><b>6.4 Application :</b> Solar water and space heating systems, solar stills, construction and selection. Solar timber</p>	<ol style="list-style-type: none"> <li>1. State the importance of wind and solar energy.</li> <li>2. To design elements of blades and rotor.</li> <li>3. Describe the types of Solar Collectors and Concentrators.</li> <li>4. State the types of PV cells and working principle of it.</li> </ol>	<b>08</b>

	<p>seasonary plants, solar cold storage and air conditioning, solar cookers with different designs, solar thermal power plant.</p> <p><b>6.5 P.V Cell :</b> Types, working principle, performance and rating. Solar power installations with its important components on a layout diagram.</p>		
<b>UNIT NO. 7</b>  <b>Biomass, Geothermal and Tidal Energy</b>	<p><b>7.1Biomass :</b>Chemistry of biogas generation, biomass gasification, types of digesters, their construction and working, uses and application of biogas. Variables affecting simple gas plants. Use of biogas for diesel engine. Emission norms: emissions from renewable fuels and its effect on environment. Study of environment protection norms.</p> <p><b>7.2Geothermal and Tidal Energy:</b> Sources and application of Geothermal energy, types of Geothermal energy plants. Tidal energy availability, suitable locations, study of single ebb and double ebb cycle. Tidal power plant.</p> <p><b>7.3Fuel Cells:</b> Types and working, analysis of operations and actual performance. Applications of fuel cells in industries (like automobile, power etc)</p>	<ol style="list-style-type: none"> <li>1. State the importance of Biomass, Geothermal and tidal Energy.</li> <li>2.Describe the variables affecting on the gas plants</li> <li>3. State the types of Geothermal Energy.</li> <li>4. State the types of Fuel cells and working principle of it</li> </ol>	<b>04</b>
<b>UNIT NO. 8</b>  <b>Energy Conservation And Energy Audit</b>	<p><b>8.1Need</b> of energy conservation, energy management, energy conservation. Energy audit – types, cost comparison of energy resources and conversions, energy conservation opportunities.</p>		<b>02</b>

#### SUGGESTED EXERCISES/PRACTICALS:

S. No.	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
1.	1	Visit to a local area to document environmental assets such as river / forest / grassland / hill / mountain.	<b>04</b>

<b>2.</b>	<b>5</b>	Visit to a local polluted site: Urban/Rural/Industrial/Agricultural.	<b>04</b>
<b>3.</b>	<b>3</b>	Study of common plants, insects, birds.	<b>02</b>
<b>4.</b>	<b>3</b>	Study of simple ecosystems of ponds, river, hill slopes etc.	<b>02</b>
<b>5.</b>	<b>2</b>	To study natural resources & associated problems.	<b>02</b>
<b>6.</b>	<b>3</b>	Case study of various types of ecosystems.	<b>02</b>
<b>7.</b>	<b>3</b>	Visit to study organic farming/Vermiculture/biogas plant and writing a report on it.	<b>04</b>
<b>8.</b>	<b>4</b>	To study environmental pollution.	<b>02</b>
<b>9.</b>	<b>5</b>	Video Demonstration /Expert Lecture Report on environmental social issues.	<b>02</b>
<b>10.</b>	<b>7</b>	Write important provisions of Acts related to Environment/ Air (Prevention and Control of Pollution) Act/Water (Prevention and Control of Pollution) Act/ Wildlife Protection Act/ Forest Conservation Act.	<b>04</b>
<b>11.</b>	<b>6</b>	Visit to a Renewable energy site/plant.	<b>04</b>
<b>Total</b>			<b>32</b>

### **Teaching Methodology: Chalk board, Power Point Presentation**

#### **i) Intellectual Skills:**

- Collection of information, data
- Analysis of data
- Report writing

#### **ii) Motor Skills:**

- Presentation Skills
- Use of multi media

### **SPECIAL INSTRUCTIONAL STRATEGIES (if any)**

- v. Show video/animation film to demonstrate the working principles, constructional features, testing and maintenance of different types of electronic and magnetic instruments.
- vi. Arrange a visit to nearby small scale manufacturing unit and make a report of tools and equipments used.
- vii. Use Flash/Animations to explain the working of different instruments.
- viii. Give Mini projects to students.

### **SUGGESTED LEARNING RESOURCES:**

#### **L) REFERENCE BOOKS:**

SR. NO.	AUTHOR	TITLE	PUBLISHER
1.	Anindita Basak	Environmental Studies	Pearson Education
2.	R. Rajgopalan	Environmental Studies from crises to cure	Oxford University Press

3.	Dr. R.J. Ranjit Daniels Dr. Jagdish Krishnaswamy	Environmental Studies	Wiley India
4.	Sukhatme S.P	Solar Energy	Tata McGraw Hill Publications, New Delhi.
5.	Garg H.P. and Prakash J.	Solar Energy Fundamentals and Applications	Tata McGraw Hill Publications, New Delhi.
6.	Dr.B.B.Parulekar and S.Rao	Energy Technology	Khanna Publishers.
7.	G. D. Rai	Alternate Energy Sources	Khanna Publishers.

### Mapping matrix of CO's, PO's and PSO's:

CO' s	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PSO2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	2	1	2	0	0	3	2	0	0	0
CO2	2	1	0	0	0	3	2	0	1	1
CO3	2	0	3	0	0	3	0	0	1	1
CO4	2	0	0	0	0	3	0	0	2	0
CO5	2	1	0	0	1	2	2	1	1	1
CO6	2	1	0	0	2	1	2	1	0	1

### 3: High 2: Moderate and 1:Low Relationship

## CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1

### DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

**COURSE: WORKSHOP PRACTICE**

**COURSE CODE: R18ME3201**

**COURSE CATEGORY: CORE**

**CREDIT: 04**

#### Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
-	4	-	-	-	25	-	25	50

#### Rationale:

Workshop Practice is a basic practical engineering course. The knowledge of basic workshops such as wood working, fitting, welding, plumbing and sheet metal shop is essential for technician to perform his/her duties in industries. Students are able to perform various operations using hand tool equipment and machineries in various shops. Working in workshop develops the attitude of group working and safety awareness. This course provides miniature industrial environment in the educational institute.

#### Course Outcomes:

1. Select tools and machinery according to job.
2. Use hand tools in different shops for performing different operation.
3. Operate equipment and machinery in different shops.
4. Prepare job according to drawing.
5. Maintain workshop related tools, equipment and machinery.

#### Course Details:

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME
UNIT NO.1 <b>General Workshop Practice</b>	1.1 Safety practices, causes of accidents, general safety rules, safety signs and symbols.	1. Locate the specified equipment in workshop. 2. Describe the ways to maintain good house keeping in given situation.
UNIT NO.2 <b>Fitting</b>	2.1 Fitting hand tools: bench vice, hammers, chisels, hacksaw, surface plate, try square, marking block, steel	1. Explain operations of given fitting machines. 2. Describe the procedure to use

	<p>rule , twist drill , tap set: use and their specifications.</p> <p>2.2 Operations of fitting shop machineries- drilling machine and bench grinders: their specifications and maintenance.</p> <p>2.3 Basic processes- chipping, filing, scraping, grinding, marking, sawing, drilling, tapping.</p>	<p>given fitting tools.</p> <p>3. Describe the operation of given machinery</p> <p>4. Describe the procedure to perform fitting operations.</p> <p>5. Describe the procedure to maintain tools, equipment and machinery.</p>
<b>UNIT NO.3 Plumbing</b>	<p>3.1 Plumbing tools- pipe vice, pipe wrenches, dies and their specifications.</p> <p>3.2 Pipe fittings- bends, elbows, tees, coupler, socket, reducer, cap, plug, nipple and their specifications.</p> <p>3.3 Basic processes: cutting and threading.</p>	<p>1. Describe the procedure to use given plumbing tools.</p> <p>2. Describe the procedure to maintain the given type of plumbing machinery.</p> <p>3. Describe the procedure to maintain the given type of plumbing tools, equipment and machinery.</p>
<b>UNIT NO.4 Metal Joining</b>	<p>4.1 Arc welding hand tools: electrode holder, cable connector, cable lugs, chipping hammer, earthing clamp, wire brush and their specifications.</p> <p>4.2 Operation of machineries in welding shops- arc welding transformer their specifications and maintenance.</p> <p>4.3 Welding electrode, filler rod, fluxes.</p>	<p>1. Describe the procedure to identify &amp; use the given metal joining tools.</p> <p>2. Explain the given type of welding procedure.</p>
<b>UNIT NO.5 Sheet metal</b>	<p>5.1 Sheet metal hand tools: snips, shears, sheet gauge, straightedge, punches, scribes, groovers, stakes- their specifications.</p> <p>5.2 Basic process - marking, bending, folding, edging, seaming, staking, riveting.</p>	<p>1. Identify sheet metal tools. Explain operation of sheet metal machineries.</p> <p>2. Describe the procedure to operate the sheet metal machinery.</p> <p>3. Describe the procedure to maintain the given sheet metal tools, equipments and machinery.</p>
<b>UNIT NO.6 Carpentry</b>	<p>6.1 Types of artificial woods such as plywood, hardboard, laminated boards, fibre boards and their applications.</p> <p>6.2 Wood working handtools and their applications.</p> <p>6.3 Basic processes: marking, sawing, planning, chiseling, grooving, boring.</p>	<p>1. Select wood working tools as per job/requirements with justification.</p> <p>2. Explain operation of wood working machines.</p> <p>3. Describe the procedure to operate the given wood working machines.</p> <p>4. Describe the procedure to maintain given wood working tools, equipments and machinery.</p>

## SUGGESTED EXERCISES/PRACTICALS:

S. No.	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
1.	I	Prepare a sheet metal job using the following operations(tin smithy shop): <ul style="list-style-type: none"> <li>1] Cutting &amp; bending</li> <li>2] Edging</li> <li>3] End curling</li> <li>4] lancing</li> <li>5] Soldering OR riveting</li> </ul> Prepare a plumbing job using the following operations(plumbing shop): <ul style="list-style-type: none"> <li>1. Cutting</li> <li>2. Die threading</li> </ul>	16
2.	II	Prepare a fitting job using the following operations(fitting): <ul style="list-style-type: none"> <li>1]Marking operation as per drawing</li> <li>2]Punching operation as per drawing</li> <li>3]Filing operation as per drawing</li> <li>4] Chamfering operation as per drawing</li> <li>5] Sawing operation as per drawing</li> <li>6] Drilling operation as per drawing</li> <li>7] Tapping operation as per drawing</li> </ul>	16
3.	III	Prepare a job . Fabrication operation involves measuring, marking, cutting, edge preparation, welding. b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part.	16
4.	IV	Prepare a job . Carpentry operation involve measuring, marking cutting and assembly with fabrication part.	16
<b>Total</b>			<b>64</b>

## MAJOR EQUIPMENT/INSTRUMENT REQUIRED:

Sr.No.	Equipment Name With Broad Specifications	Experiment Sr. No.
01	Wood working tools – marking and measuring tools,saws , claw hammer,mallet,chesels,plns,squares	IV
02	Carpentry vice	IV
03	Work benches	I,II,III,IV
04	Bench Drilling Machine	II
05	Power saw machine	I,II,III
06	Bench grinder	I,II,III
07	Vernier height gauge	II
08	Surface plate	II

09	Angle plate	II
10	Welding machine	III
11	Pipe vice and pipe cutters	I
12	Bench Vice	I,II,III
13	Portable hammer drill machine	II
14	Sheet cutting and sheet bending machine	I
15	Fitting Tools: hammers , chisels , files, hacksaw,surface plate,punch, v-block,angle plate,try square,marking block,steel rule,twist drills, reamers,tap set, die set	II
16	Plumbing tools- pipe vice,pipe wrenches,dies	I
17	Arc welding hand tools – electrode holder,cable connector,cable lugs,chipping hammer , earthing clamp, wire brush.	III
18	Sheet metal hand tools- snip,shears,sheet gauge,straight edge,L-Square,scriber,divider,trammel,punches,pliers	I

### **TEACHING METHODOLOGY:**

Chalk-Board, Discussions, Charts, Models.

#### **i) Intellectual Skills:**

- Collection of information, data
- Analysis of data
- Report writing

#### **ii) Motor Skills:**

- Presentation Skills
- Use of multi media

### **SUGGESTED STUDENT ACTIVITIES:**

Other than the classroom and laboratory learning, following are the suggested student related co-curricular activities which can be undertaken to accelerate the attainment of various outcomes in this course:

- Prepare work diary based on practical performed in workshop. Workdiary consist of job drawing , operations to be performed , required raw materials , tools , equipments, date of performance with teacher signature.
- Prepare a journal consist of free hand sketches of tools and equipments in each shop, detail specifications and precautions to be observed while using tools and equipments.
- Prepare /download specifications of –
  - Various tools and equipments in various shops.
  - Precision equipment in workshop.
  - Various machineries in workshop.
- Under take a market survey of local dealers for procurements of workshop tools, equipments , machineries and raw material.
- Visit any fabrication /wood working/sheet metal workshop and prepare a report.

## SUGGESTED LEARNING RESOURCES:

### M) REFERENCE BOOKS:

Sr. No.	Title of Book	Author	Publication
1.	Elements of workshop Technology-Volume I & II	S. K. Hajra Chaudhary, Bose, Roy	Media Promoters and Publishers Limited
2.	Workshop Technology, Vol.- I &II	Raghuvanshi B.S.	Dhanpat Rai, Delhi.

### Mapping matrix of CO's, PO's AND PSO's:

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 LIFE long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PSO2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	3	2	0	2	1	0	1	3	0	1
CO2	3	0	0	2	0	0	1	3	0	1
CO3	3	0	0	0	0	1	1	3	0	1
CO4	3	1	2	0	0	1	1	3	2	1
CO5	3	2	1	2	1	0	1	3	1	1

### 3: High 2: Moderate and 1:Low Relationship

**DIPLOMA PROGRAMME: MECHANICAL ENGINEERING**

**COURSE: ENGINEERING DRAWING**

**COURSE CODE: R18 ME3202**

**COURSE CATEGORY: CORE**

**CREDIT: 06**

---

**Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
2	4	4	80	20	-	-	50	150

**Rationale:**

This second course in engineering drawing has been designed to further reinforce & enhance the drafting skills and the ability of spatial visualization acquired in the foundation course in Engineering Graphics. The course envisages learning understanding of basic concepts in solid geometry. Student is also expected to learn about sketching of elementary components like bolts, nuts, keys, rivets, coupling, etc.

**Course Outcomes:**

12. Draw missing view from given orthographic view.
13. Distinguish mechanical components for various applications / products.
14. Interpret lines, planes and solids at different positions.
15. Generate true shape of components at different sections.
16. Prepare development of surfaces for various sheet metal components.

**Course Details:**

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS
<b>UNIT NO.1</b>  <b>Missing Views</b>	<b>1.1</b> Types of sections- full, half, revolved, removed, offset. <b>1.2</b> Conventional breaks for circular and rectangular sections. <b>1.3</b> Interpretation of given orthographic views and	1. Visualize and draw missing views using given section views. 2. Draw conventional breaks for circular and rectangular sections 3. Visualize and draw missing views using	<b>06</b>	<b>16</b>

	addition of non given (Missing) view.	Interpretation of given orthographic views.		
<b>UNIT NO.2</b> <b>Free Hand Sketches</b>	<p><b>2.1</b> Threads and thread profiles. Conventional representation of threads. Types of nuts, bolts, washers, locking arrangements, set screws</p> <p><b>2.2</b> Types of rivet heads and riveted joints.</p> <p><b>2.3</b> Keys, Couplings (Muff, Flanged and Flexible), Pulleys, Bearings, Pipe Joints and Fittings.</p>	1. Explain and Draw Fasteners, Nuts and know their applications. 2. Explain and Draw Rivets, Rivet Joint and know their applications. 3. Explain and Draw Keys, Couplings, Pulleys, Bearings, Pipe joints and fittings.	<b>04</b>	<b>12</b>
<b>UNIT NO.3</b> <b>Projections of lines &amp; Planes.</b>	<p><b>3.1</b> Lines inclined to both the reference planes.</p> <p><b>3.2</b> Planes normal to one reference plane and inclined to other reference plane.</p>	1. Draw Projection of Lines. 2. Draw Projection of planes.	<b>06</b>	<b>12</b>
<b>UNIT NO.4</b> <b>Projection of Solid &amp; Section of Solids</b>	<p><b>4.1</b> Right regular solids- Prisms, Cylinders, Pyramids, Cone and their combinations only. For projections- Prism, Cylinder, Pyramids and Cone axis parallel to one reference plane and inclined to the other reference plane.</p> <p><b>4.2</b> For sections- (sectional views and true shape of sections) Prisms and cylinders- axis parallel to one reference plane and inclined to the other reference plane. Pyramids and cone- resting on their bases on horizontal plane only.</p>	1. Draw Projections of Right regular solids. 2. Draw Projection of section of regular solids.	<b>06</b>	<b>16</b>

<b>UNIT NO.5</b>  <b>Development of surfaces</b>	<b>5.1</b> Surface developments of all the solids considered in the topic number four. <b>5.2</b> Their applications such as tray, hopper, funnel, pipe bends etc. <b>5.3</b> Anti development exercises.	1. Draw surface and anti surface development of regular solids. 2. Explain applications of tray, hopper, funnel, pipe bends etc. 3. Draw antidevelopment on various models.	<b>05</b>	<b>12</b>
<b>UNIT NO.6</b>  <b>Inter-penetration of Solids</b>	<b>6.1</b> Interpenetration of Prism with Prism, Cylinder with Cylinder, Prism with Cylinder (Axes of both the solids are perpendicular to each other).	1. Draw Interpenetration of regular solids.	<b>05</b>	<b>12</b>

### SUGGESTED EXERCISES/PRACTICALS:

<b>S. No.</b>	<b>Unit No.</b>	<b>Practical Exercises (Outcomes' in Psychomotor Domain)</b>	<b>Approx. Hrs. Required</b>
1.	1	Missing views	8
2.	2	Free hand sketches	8
3.	3	Projection of lines and planes	8
4.	4	Projections of solids	8
5.	4	Section of solids	8
6.	5	Surface developments	16
7.	6	Interpenetration of solids	8
<b>Total</b>			<b>64</b>

### SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN:

<b>Unit No.</b>	<b>Unit Title</b>	<b>Teaching Hours</b>	<b>Distribution of Marks</b>			
			<b>R Level</b>	<b>U Level</b>	<b>A Level</b>	<b>Total</b>
1	Missing views	6	4	10	2	16
2	Free hand sketches	4	4	4	4	12
3	Projection of lines & planes	6	2	10	0	12
4	Projection of solids & section of solids	6	2	14	0	16

5	Development & antidevelopment of solids	5	4	4	4	12
6	Interpenetration of regular solids.	5	2	10	0	12
	<b>TOTAL</b>	<b>32</b>	<b>18</b>	<b>52</b>	<b>10</b>	<b>80</b>

### MAJOR EQUIPMENT/INSTRUMENT REQUIRED:

Sr. No.	Equipment Name With Broad Specifications	Exp. Sr. No.
1	Mini drafter	All
2	Solid models	3,4

### TEACHING METHODOLOGY:

Chalk-Board, Discussions, Charts, Models.

### SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- ix. Show video/animation film to demonstrate the working principles, constructional features, testing and maintenance of different types of electronic and magnetic instruments.
- x. Arrange a visit to nearby small scale manufacturing unit and make a report of tools and equipments used.
- xi. Use Flash/Animations to explain the working of different instruments.
- xii. Give Mini projects to students.

### SUGGESTED LEARNING RESOURCES

#### N) REFERENCE BOOKS:

SR. NO.	AUTHOR	TITLE	PUBLISHER
1.	N. D. Bhatt	Machine Drawing	Charotar Publication, Anand.
2.	Mali and Chaudhary	Machine Drawing	Vrinda Publications, Jalgaon.
3.	Kamat & Rao	Machine Drawing	Jeevandep Publications, Mumbai
4.	K.L. Narayana, P. Kannaiah, K. Venkata Reddy	Production Drawing	New Age International Publications, New Delhi
5.	P.S. Gill	Machine Drawing	S.K. Kataria & Sons Publications, New Delhi.
6.	K. Venugopal	Engineering Drawing	New Age International Ltd., Delhi.

### **Mapping matrix of CO's, PO's and PSO's:**

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PS2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	1	0	1	0	1	0	1	0	0	2
CO2	1	0	1	0	1	0	2	1	0	3
CO3	1	1	2	0	1	0	1	1	1	0
CO4	1	1	3	0	1	0	2	0	1	2
CO5	1	1	3	0	1	0	3	1	0	3

### **3: High 2: Moderate and 1:Low Relationship**

**DIPLOMA PROGRAMME: MECHANICAL ENGINEERING**

**COURSE : MECHANICAL ENGINEERING MATERIALS**

**COURSE CODE: R18ME3206**

**COURSE CATEGORY: CORE**

**CREDIT: 03**

---

**Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
3	-	3	80	20	-	-	--	100

**Rationale:**

The world of technology is very much depending on various materials especially engineering materials. A mechanical engineering diploma holder deals with various materials required for cutting tools, dies, gears, bearings and other many applications. He should be able to select the proper tool material for machining, heat treatment to be adopted for specific materials, ferrous & nonferrous materials & their alloys for various engineering field applications, as well as insulating, refractory and plastic materials as per the requirements. So it is virtually important to give suitable exposure to various materials.

**Course Outcomes:**

1. Know the importance of engineering materials.
2. To understand Iron-Carbon equilibrium diagram and its importance.
3. Know the various heat treatment processes, non destructive tests and their applications.
4. Know the significance of powder metallurgy.
5. To select suitable material for different applications.

**Course Details:**

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS
<b>UNIT NO.1</b>  <b>Introduction to Engineering Materials and their Properties</b>	<ol style="list-style-type: none"> <li>1. Define various mechanical and physical properties of engineering materials.</li> <li>2. Describe a Importance, classification, characteristics and applications of engineering materials.</li> <li>3. Explain the term corrosion and preventing measure of corrosion.</li> <li>4. List basic types and crystal structure of material.</li> </ol>	<p><b>1.1</b> Introduction to engineering materials and their Importance, Classification</p> <p>of engineering materials, characteristics and applications of metals, non metals, ferrous metals and non ferrous metals, Properties of metals:</p> <p><b>1.2</b> Physical properties- structure, density, melting point.</p> <p><b>1.3</b> Mechanical properties- strength, stiffness, elasticity, plasticity, ductility, malleability, resilience, toughness, hardness, brittleness, fatigue, creep, thermal conductivity, electrical conductivity.</p> <p><b>1.4</b> Introduction to corrosion, types of corrosion, corrosion control- protective coatings.</p> <p><b>1.5</b> Introduction to space lattices, unit cell, crystal structures- BCC,FCC,HCP</p>	<b>09</b>	<b>16</b>

<b>UNIT NO.2</b>  <b>Ferrous Metals and Alloys</b>	<ol style="list-style-type: none"> <li>1. Draw allotropy of pure iron diagram and phase equilibrium diagram of iron and iron carbon alloy.</li> <li>2. Describe classification and composition of ferrous alloys.</li> <li>3. Describe effect of various alloying elements on properties of ferrous alloys.</li> <li>4. Describe composition and uses of nickel steel, manganese steel and stainless steel.</li> <li>5. Suggest suitable steels/ cast irons in specifications for particular applications.</li> </ol>	<p><b>2.1</b> Phase equilibrium diagram for iron and iron carbon alloy. Allotropy of pure iron</p> <p><b>2.2</b> Flow diagram for the production of iron and steel.</p> <p><b>2.3</b> Classification, composition and uses of cast iron, effect of sulphur, silicon and phosphorous.</p> <p><b>2.4</b> Classification, composition and uses of low carbon steel, medium carbon steel and high carbon steel.</p> <p><b>2.5</b> Alloy Steels: Effect of various alloying elements such as aluminium, chromium, nickel, manganese, molybdenum, tungsten, vanadium, sulphur etc.</p> <p><b>2.6</b> Composition and uses of nickel steel, manganese steel and stainless steel.</p>	<b>07</b>	<b>12</b>
<b>UNIT NO.3</b>  <b>Non Ferrous Metals and Alloys</b>	<ol style="list-style-type: none"> <li>1. Describe composition, properties and uses of Copper and Aluminium alloys.</li> <li>2. Compare properties of copper and aluminium alloys.</li> <li>3. Suggest suitable copper or aliminium alloys in specifications for particular applications.</li> </ol>	<p><b>3.1</b> Properties and uses of Copper and Aluminium alloys.</p> <p><b>3.2</b> Composition, properties and uses of Brass and types of brass (naval brass, muntz metal and gilding brass).</p> <p><b>3.3</b> Composition, properties and uses of Bronze and types of bronzes</p>	<b>07</b>	<b>12</b>

		<p>such as gun metal, aluminium bronze, and phosphor bronze( for journal bearing and gear application).</p> <p><b>3.4</b> Composition, properties and uses of Duralumin, Y-alloy, Babbits and Hindalium, Requisite qualities of bearing materials.</p>		
<b>UNIT NO.4</b>  <b>Heat Treatment and Cutting Tool Materials</b>	<ol style="list-style-type: none"> <li>Define heat treatment and surface hardening process.</li> <li>Describe various heat treatment process such as Annealing, Normalising, Hardening, Tempering and surface hardening process such as Case hardening, Flame hardening.</li> <li>Suggest suitable heat treatment process, surface hardening process and cutting tool material for particular applications.</li> </ol>	<p><b>4.1</b> Heat treatment of metals: Introduction to heat treatment, detailed description of processes such as- Annealing, Normalizing, Hardening, Tempering.</p> <p><b>4.2</b> Surface hardening methods such as Case hardening, Flame hardening, Induction hardening and Nitriding.</p> <p><b>4.3Cutting Tool Materials:</b> Requirements of cutting tool materials, properties of tool steels and die steels, properties and uses of High Speed Steel, Stellite, Tungsten Carbide and Diamond.</p>	<b>10</b>	<b>16</b>
<b>UNIT NO.5</b>  <b>Important Non Metallic Materials</b>	<ol style="list-style-type: none"> <li>Describe a Importance, characteristics and applications of important non metallic materials.</li> <li>Differentiate</li> </ol>	<p><b>5.1 Plastic Materials:</b> Introduction to plastic, types of plastic. Characteristics, properties and uses of :- Thermoplastic materials</p>	<b>08</b>	<b>12</b>

	<p>thermoplastic materials and thermosetting materials.</p> <p>3. Suggest suitable non metallic material for particular applications.</p>	<p>(ABS, Acrylics, Nylons, Vinyls), Thermosetting materials (Polyester, Epoxies, Melamines And Ureas).</p> <p><b>5.2 Insulating Materials -</b> Introduction to heat and sound insulating materials, description, properties and uses of Cork, elastomers, Asbestos, Thermocole and Glass wool.</p> <p><b>5.3 Composite Materials:</b> Properties and uses of Laminated and fiber reinforced composite materials.</p>		
<b>UNIT NO.6</b> <b>Nondestructive Testing &amp; Powder Metallurgy</b>	<p>1. Explain concepts of powder metallurgy process with their advantages, limitations and applications.</p> <p>2. Compare Different Non destructive testing processes.</p> <p>3. Suggest suitable Nondestructive test for particular materials.</p>	<p><b>6.1 Importance of nondestructive tests,</b> difference between destructive and nondestructive testing, Radiography (X ray and Gamma ray ),Ultrasonic crack detection, Dye penetrate test, Magna-flux test, Sound and Visual test.</p> <p><b>6.2 Powder Metallurgy:</b> Advantages, limitations and applications of powder metallurgy, Powder metallurgy process.</p>	<b>07</b>	<b>12</b>

## **TEACHING METHODOLOGY:**

Chalk-Board, Discussions, Charts, PPT.

### **i) Intellectual Skills :**

- Identify suitable heat treatment process for particular application.
- Understand various non – destructive tests.
- Select suitable cutting tool material for various applications.

### **ii) Motor Skills:**

- Graphical presentation of various microstructures of steel and cast iron.
- Observe the results under electron microscope.

## **SUGGESTED LEARNING RESOURCES**

### **O) REFERENCE BOOKS:**

<b>SR. NO.</b>	<b>AUTHOR</b>	<b>TITLE</b>	<b>PUBLISHER</b>
1.	O. P. Khanna	A Text Book Of Material Science And Metallurgy	Dhanpat Rai and Sons.
2.	Dr. Kodgire	Material Science And Metallurgy	Everest Publishing House.
3.	R. K. Rajput	Material Science And Engineering	S.K.Kataria and Sons.
4.	S. K. Hazra Choudhary	Material Science And Processes	Indian Book Distribution Company.
5.	Kenneth G. Budinski and Micheal K. Budinski	Engineering Materials Properties and Selection	Prentice Hall Of India Pvt. Ltd.

### **Mapping matrix of CO's, PO's and PSO's:**

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PS2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	2	0	0	1	2	1	2	1	0	2

CO2	1	0	0	0	1	0	1	1	0	3
CO3	0	2	2	1	1	1	2	1	1	3
CO4	2	0	0	1	0	1	2	0	1	2
CO5	2	0	0	1	2	1	2	2	2	3

**3: High Relationship, 2: Medium Relationship, 1: Low Relationship,**

# CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1

## DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

**COURSE: STRENGTH OF MATERIALS**

**COURSE CODE: R18AM2102**

**COURSE CATEGORY: ALLIED**

**CREDIT: 06**

### Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
4	2	3	80	20	-	-	25	125

### Rationale:

This is allied subject which will enable the students to understand the fundamentals of solid Mechanics and deals with elementary knowledge of stresses, strains, shear forces and bending moments, its applications in the field of civil and mechanical engineering.

### Course Outcomes:

The student will be able to:

1. Understand the basic properties of materials & Determine the stress, strain and their relationship.
2. Analyze shear force diagram and bending moment diagram.
3. Determine the stresses and strains in the members subjected to shear, bending loads with stress distribution diagram.
4. Determine the stresses in members subjected to combine direct and bending loading.
5. Determine principal stresses, principal planes, maximum shear stress and their planes as well as stresses in thin cylindrical shells.
6. Determine the stresses and strains in the members subjected to torsional loads.

### Course Details:

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS
UNIT NO.1	<b>Simple Stresses and Strain :</b> 1.1 Concept of stress and strain, direct, tensile, compressive and shear stress and strain, lateral strain, Poisson's ratio. Stresses in composite sections under direct loading only. Temperature stresses for homogeneous bar only. 1.2 Stress strain curve for mild steel	1a. Define different properties of Material. 1b. Analyze simple, composite /compound sections and Calculate direct stress, different strains. 1c. Calculate temperature stresses in	12	16

	<p>and cast iron, Salient points such as limit of proportionality, elastic limit, yield point, ultimate stress and breaking stress, plastic stage, % elongation, % reduction in area, proof stress working stress, and factor of safety.</p> <p>1.3 Concept of elasticity, Hook's law, Young's modulus of elasticity, modulus of rigidity and bulk modulus, relation between three elastic module and Poisson's ratio.</p>	homogeneous bar only.		
<b>UNIT NO.2</b>	<p><b>Beams and bending:</b></p> <p>2.1 Concept of beam, Bending moment and shear force diagrams for cantilevers and simply supported beams with and without overhangs subjected to point loads, uniformly distributed loads (u.d.l.), couples, uniformly varying load (u.v.l.).</p> <p>2.2 Location of point of contra flexure. Relation between bending moment, shear force and rate of loading.</p>	2a. Draw Shear Force & Bending Moment Diagram for Statically Determinate Beams	<b>10</b>	<b>12</b>
<b>UNIT NO.3</b>	<p><b>Bending Stresses and Shear Stresses:</b></p> <p>3.1 Theory of simple bending, flexural formula (No derivation), concept of bending stress, assumptions in the theory of bending, moment of resistance, section modulus, neutral axis, comparative strengths of rectangular, circular, I, T, channel section</p> <p>3.2 Concept of shear stresses in a beam, average shear stress, max shear stress shear stress distribution diagrams for rectangular, circular, I, T, channel sections.</p>	3a. Apply Bending Theory. 3b. Calculate Bending Stress 3c. Draw stress distribution diagram.	<b>10</b>	<b>12</b>
<b>UNIT NO.4</b>	<p><b>Combined bending and direct stresses :</b></p> <p>4.1 Axial load, eccentric load, eccentricity, direct stress, bending stress, uniaxial bending biaxial bending. Maximum and minimum total stress, no tension condition, limiting eccentricity, core of section, middle third rule, total stress variation diagrams.</p> <p>4.2 Strain energy, Resilience, proof resilience and modulus of resilience.</p>	4a. Calculate Direct & Bending Stresses of various structural components 4b. Compute Strain Energy under Different Types of Loading 1a. Compare stresses developed due to the axial load and eccentric load in the given	<b>10</b>	<b>12</b>

	Stresses due to gradual, sudden and impact loads.	situation. 1b. Evaluate resultant stresses at the base of given column and chimney under given loading conditions. 1c. Draw stress distribution diagram		
<b>UNIT NO.5</b>	<b>Principal planes and principal stresses :</b>  5.1 Stresses on inclined planes, planes, planes of max. shear stress, definition of principal plane and principal stresses, location of principal planes, expression for normal and tangential stress, max. shear stress, Mohr's circle of stresses, condition of max. obliquity of resultant stress  5.2 Thin cylindrical shells: Longitudinal and circumferential (hoop) stresses in seamless thin walled cylindrical shells, shear stress.	5a. Calculate Normal and shear stress on a inclined plane in a element subjected to plane stress condition.  5b. Calculate Principal Stresses, Principal Planes, maximum shear stress and their Planes.	<b>12</b>	<b>16</b>
<b>UNIT NO.6</b>	<b>Torsion:</b>  6.1 Concepts of torsion, Torsional equation (No derivation) for solid circular shaft, hollow circular shaft, shear stress distribution over cross section.  6.2 Comparison between a solid and hollow shaft for same strength and same weight, power transmitted by shafts, average torque, maximum torque and torsional rigidity.	6a. Calculate shear stresses produced in circular shafts.  6b. Calculate power transmitted by circular shafts.	<b>10</b>	<b>12</b>

#### SUGGESTED EXERCISES/PRACTICALS/ ASSIGNMENTS:

Sr. No.	Practical	Topic No.	Hours Allotted	Mapped CO
1.	Tensile test on mild steel bar (ductile material).	1	2	CO1
2.	Tensile test on tor steel bar (brittle material).	1	2	CO1
3.	Shear test on two different metals under single and double shear.	1	2	CO1
4.	Bending test on a wooden beam.	3	2	CO3
5.	Izod Impact Test.	4	2	CO1
6.	Compression Test on Metals.	1	2	CO1

7.	Torsion test on ductile material.	6	2	CO6
8.	Torsion test on brittle material.	6	2	CO6
9.	Flexural Test on plywood.	3	2	CO3
10	Water Absorption Test on bricks.	--	2	--
11.	Compressive Test on Bricks.	1	2	CO1
12.	Hardness test on metals: Brinell's hardness test.	1	2	CO1
13.	Tensile test on mild steel bar (ductile material).	1	2	CO1
<b>Total</b>			<b>26</b>	

Sr. No.	Assignments	Topic No.	Hours Allotted	Mapped CO
1.	Problems on topic Simple stresses and strains, beams and bending.	1,2	2	CO1, CO2
2.	Problems on topic shear stresses and bending stresses combined direct and bending stresses.	3,4	2	CO3, CO4
3.	Problems on topic Principal planes and principal stresses, Torsion	5,6	2	CO5, CO6

#### SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Marks			
			R Level	U Level	A Level	Total
1	Simple Stresses and Strain	12	4	4	8	16
2	Beams and bending	10	4	4	4	12
3	Bending Stresses and Shear Stresses	10	4	4	4	12
4	Combined bending and direct stresses	10	4	4	4	12
5	Principal planes and principal stresses	12	4	4	8	16
6	Torsion	10	4	4	4	12
<b>TOTAL</b>		<b>64</b>	<b>24</b>	<b>24</b>	<b>32</b>	<b>80</b>

#### MAJOR EQUIPMENT/INSTRUMENT REQUIRED:

Sr. No.	Equipment Name with Broad Specifications	Exp. Sr. No.
1	Universal Testing machine of capacity 1000KN, Digital type with all attachments and accessories.	1,2,3,4,6,10
2	Compression testing machine of capacity 200 tons analog type with all attachments and accessories.	12
3	Izod impact testing machine.	5
4	Hot air oven with thermostatic control having temperature range 100 to 105° C	11
5	Accessories : Vernire caliper, meter scale, weighing balance, weights, hammer, screw driver, pliers ,punch, file	3

Sr. No.	Equipment Name with Broad Specifications	Exp. Sr. No.
6	Brinell hardness testing machine	13

### TEACHING METHODOLOGY:

Chalk-Board, Discussions, Charts, Models.

### SUGGESTED LEARNING RESOURCES:

#### A) REFERENCE BOOKS:

Sr. No	AUTHOR	TITLE	PUBLISHER
1.	Strength of Materials	R. S. Khurmi	S. Chand & Company Delhi
2.	Mechanics of materials	R. C. Hibbeler	Pearson Education
3.	Strength of Materials	S. S. Bhavikatti	Vikas Publishing House
4.	Strength of Materials	B. K. Sarkar	Tata McGraw -Hill
5.	Strength of Materials	S. Ramamurtham	Dhanpat Rai and sons
6.	Strength of Materials	R. K. Bansal	Laxmi Publications

#### B) Websites

Sr. No.	ADDRESS
1	<a href="http://www.nptel.ac.in">www.nptel.ac.in</a>
2	<a href="http://www.nitttr.com">www.nitttr.com</a>

### Mapping matrix of CO's, PO's and PSO's:

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PSO2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	3	0	0	0	0	0	0	2	0	1
CO2	3	0	0	0	0	0	0	1	0	2
CO3	3	0	0	0	0	0	0	1	0	2
CO4	3	0	0	0	0	0	0	1	0	1

CO5	3	0	0	0	0	0	0	0	1	1
CO6	3	0	0	0	0	0	0	0	1	1

**3: High Relationship, 2: Medium Relationship, 1: Low Relationship**

## CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1

### DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

COURSE: Elements of Electrical Engg. & Basic Electronics COURSE CODE: R18EX2509

COURSE CATEGORY: ALLIED

CREDIT: 08

#### Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
4	4	3	80	20	-		50	150

#### Rationale:

Diploma engineering technologists of mechanical and allied engineering have to deal with electrical and electronics engineering principles and applications in manufacturing processes. It is therefore necessary for a diploma holder of Mechanical and allied disciplines to apply fundamentals of electrical and electronics engineering in production processes. Therefore, this course will greatly benefit in smooth manufacturing and process control in mechanical and allied engineering based industries.

#### Course Outcomes:

1. Apply principles of electric and magnetic circuits to solve plastics engineering problems.
2. Determine voltage and current in A.C. circuits.
3. Connect transformers and electrical machines for specific requirement.
4. Identify electronics components in processing plant circuit.
5. Interpret working of diodes in processing plant circuit.
6. Interpret working of a transistor in processing plant circuit.

**Course Details:**

<b>COURSE DETAILS:</b>	<b>NAME OF THE TOPIC</b>	<b>LEARNING OUTCOME</b>	<b>HOURS</b>	<b>MARKS</b>
<b>ELECTRICAL ENGINEERING</b>				
<b>UNIT NO.1</b>  <b>Electric and Magnetic Circuits.</b>	1.1 Concepts of EMF, Current, Potential Difference, Power and Energy. 1.2 Concepts of M.M.F, magnetic force, permeability, hysteresis loop, reluctance, leakage factor. 1.3 Concepts of magnetic and electric circuits, Faraday's laws of electromagnetic induction. 1.4 Dynamically induced emf. 1.5 Statically induced emf.- 1.6 (a) Self induced emf (b) Mutually induced emf. 1.7 Equations of self & mutual inductance.	1. Validate the direction of induced emf in the given circuit process/production machine. 2. Compare the characteristics of electric and magnetic circuits 3. Explain the significance of B-H curve and hysteresis loop. 4. Analyze the given B-H Curve. 5. Apply Fleming's left hand rule and Lenz's law for determination of direction of induced emf for the given situation. 6. Explain self and mutual inductance.	<b>10</b>	<b>12</b>
<b>UNIT NO.2</b>  <b>A.C. Circuits</b>	2.1 A.C. circuit parameter: Cycle, Frequency, Periodic time, Amplitude, Angular velocity, current, RMS value, Average value, Form Factor & Peak Factor, impedance, phase angle, and power factor. 2.2 Phasor representation of emf and current. 2.3 Mathematical representation of an alternating emf &current. 2.4 A.C. through: resistors, inductors and capacitors. 2.5 A.C. through: R-L series, R-C series, R-L-C series and parallel circuit 2.6 Power in A. C. Circuits. Concept of power triangle.	1. Explain the various basic parameters of AC fundamentals. 2. Solve simple numerical problems related to AC circuits. 3. Derive the current and voltage relationship in star and delta connections. 4. Find currents and voltages in the given series and parallel AC circuits. 5. Determine the current and voltage in the given star and delta connection for the given processing / production machine.	<b>10</b>	<b>12</b>

	2.7 Voltage and Current relationship in Star and Delta connections.			
<b>UNIT NO.3</b> <b>Transformer and single phase induction motors</b>	3.1 General construction and principle of transformers. 3.2 Emf equation and transformation ratio of transformers. 3.3 Various losses in transformers and efficiency equation. 3.4 Auto transformers. 3.5 Construction and Working principle of single phase A.C. motor. 3.6 Various types of single phase motors. 3.7 Starting of single phase induction motor. 3.8 Applications of single phase motors.	1. Explain the construction of single phase transformer. 2. Calculate transformer performance Parameters. 3. Explain working principle of Autotransformer. 4. Describe the construction of a typical single phase motor. 5. Explain working principle of single phase induction motors. 6. Validate the given circuit comprising transformer and induction motor.	<b>12</b>	<b>16</b>

### ELECTRONICS ENGINEERING

<b>UNIT NO.4</b> <b>Electronic Components &amp; Signals.</b>	4.1 Active and passive components. 4.2 Resistor, capacitor, inductor symbols, working principals and applications, colour codes, specifications. 4.3 Voltage and Current Source. 4.4 Signal, waveform, Time and frequency domain representation, Amplitude, frequency, phase, wavelength. 4.5 Types of Signals: sinusoidal, triangular and square Integrated Circuits - analog and digital.	1. Differentiate between active and passive electronic components. 2. Calculate value of resistor and capacitor using colour code. 3. Compare voltage and current source. 4. Describe signal parameters with sketch. 5. Differentiate various types of ICs. 6. Justify the selection of ICs for the given circuit of process/production machine.	<b>12</b>	<b>16</b>
---	---	---	-----------	-----------

<b>UNIT NO.5</b>  <b>Diodes and Applications</b>	<p>5.1 Symbol, construction and working principle of P-N junction diode.</p> <p>5.2 Rectifiers: Half wave, Full wave and Bridge Rectifier, working principle , circuit diagram, performance parameters PIV, ripple factor, efficiency, Need for filters: circuit diagram and working of 'L', 'C' and 'π' filter.</p> <p>5.3 Zener diode working principle, symbol, Zener diode as voltage regulator</p> <p>5.4 Working principle and block diagram of regulated power supply.</p> <p>5.5 Symbol, construction and working principle of light emitting diode (LED).</p>	<ol style="list-style-type: none"> <li>Explain working of PN junction diode with the help of V-I characteristics.</li> <li>Describe the applications of PN Junction diode.</li> <li>Describe the working principle of Zener diode.</li> <li>Measure zener voltage on V-I characteristics of Zener diode.</li> <li>Compare working principle types of various types of rectifiers.</li> <li>Describe the construction of LED.</li> <li>Corroborate selection of rectifier, diode, power supply and LEDs for given circuit of process/production machine.</li> </ol>	<b>10</b>	<b>12</b>
<b>UNIT NO.6</b>  <b>Bipolar Junction Transistor</b>	<p>6.1 Unipolar and Bipolar devices.</p> <p>6.2 Symbol, construction and working principle of NPN transistor.</p> <p>6.3 Transistor as switch and amplifier.</p> <p>6.4 Input and Output characteristics of CE, CB and CC configurations.</p> <p>6.5 Regions – Cut-off, saturation and Active region.</p> <p>6.6 Transistor parameters- alpha, beta, input and output resistance and relation between alpha and beta.</p>	<ol style="list-style-type: none"> <li>Differentiate unipolar and bipolar devices.</li> <li>Describe the application of transistor as switch.</li> <li>Determine the current gain of CE, CB and CC transistor configurations.</li> <li>Compare working of given transistor configuration.</li> <li>Explain the effect of cascading on bandwidth and voltage gain of amplifiers.</li> <li>Corroborate selection of transistors and their configurations for given circuit of process/product machinery.</li> </ol>	<b>10</b>	<b>12</b>

**SUGGESTED EXERCISES/PRACTICALS:**

S. No.	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
1.	I	Determine the permeability of magnetic material by plotting its B-H curve.	02
2.	II	Measure voltage, current and power in 1-phase circuit (with resistive load).	02
3.	II	Measure voltage, current and power in R-L series circuit.	02
4.	III	Measure transformation ratio (K) of 1-phase transformer.	02
5.	III	Connect single phase transformer and measure input & output quantities.	02
6.	III	Make Star & Delta connection in induction motor starters and measure the line and phase values.	04
7.	III	Changing the direction of rotation of single phase induction motor	02
8.	IV	Identify various passive electronic components in the given circuit.	02
9.	IV	Connect resistors in series and parallel combination on bread board and measure its value using digital multimeter.	02
10.	IV	Connect capacitors in series and parallel combination on bread board and measure its value using multimeter.	02
11.	IV	Identify various active electronic components in the given circuit.	02
12.	IV	Measure the value of given resistor using multimeter.	02
13.	IV	Measure the value of given capacitor ad inductor using LCR-Q tester.	02
14.	IV	Determine the value of given resistor using digital multimeter to confirm with colour code.	02
15.	V	Test the PN-junction diodes using digital multimeter.	02
16.	V	Test the performance of PN-junction diode.	02
17.	V	Test the performance of Zener diode.	02
18.	V	Test the performance of LED.	02
19.	V	Identify three terminals of a transistor using digital multimeter.	02
20.	VI	Test the performance of NPN transistor.	02
21.	VI	Determine the current gain of CE transistor configuration.	02
22.	VI	Test the performance of transistor switch circuit.	02
23.	VI	Test the performance of transistor amplifier circuit.	02

## MAJOR EQUIPMENTS REQUIRED FOR PRACTICALS:

<b>SR. No.</b>	<b>Equipment Name with Broad Specifications</b>	<b>Practical Sr. No.</b>
1	Single Phase Transformer: 1kVA, single-phase, 230/115 V, air cooled, enclosed type.	1, 5
2	Single phase auto transformer (Dimmerstat) - Single-Phase, Air cooled, enclosed model, Input: 0 ~ 230, 10A, Output: 0 ~ 270Volts	1, 2, 3, 4
3	Lamp Bank - 230 V 0-20 A	1, 2, 3
4	Single phase Induction motor – ½ HP, 230 V, 50 Hz, AC supply	7
5	Different types of starters	6
6	Digital multimeter , 3and ½ digit, seprate range for resistancs and capacitance, component tester, AC and DC measurement.	8, 9, 11, 13, 14, 15, 16, 17
7	Dual trace CRO/DSO, 50MHz.	4, 5, 17, 18, 19, 20, 21, 22, 23
8	Function generator, 0-2MHz., Sin ,square, pulse, triangular wave shape generation	17, 21, 22, 23
9	LCR-Q Meter/Tester	13

## SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN:

<b>Unit No.</b>	<b>Unit Title</b>	<b>Teaching Hours</b>	<b>Distribution of Marks</b>			
			<b>R Level</b>	<b>U Level</b>	<b>A Level</b>	<b>Total</b>
<b>ELECTRICAL ENGINEERING</b>						
I	Electric and Magnetic Circuits	10	6	4	2	12
II	A.C. Circuits	10	4	6	2	12
III	Transformer and single phase induction motors	12	4	8	4	16
<b>ELECTRONICS ENGINEERING</b>						
IV	Electronic components and Signals	12	6	8	2	16
V	Diodes and applications	10	4	4	4	12
VI	Bipolar Junction Transistor	10	4	4	4	12
<b>TOTAL</b>		<b>64</b>	<b>28</b>	<b>34</b>	<b>18</b>	<b>80</b>

### TEACHING METHODOLOGY:

Chalk-Board, Discussions, Charts, Models.

Skills to be developed:

i) **Intellectual Skills:**

- Interpret manometer readings.
- Compare different pressure measuring devices and flow measuring devices.
- Analyze the performance of pumps and turbines.

ii) **Motor skills:**

- Measuring the discharge through various devices.
- Priming and starting of centrifugal pump.

## **SUGGESTED STUDENT ACTIVITIES:**

- a. Make star delta connections of transformer for a processing/production unit.
- b. Connect the various types of meters to measure the current and voltage of induction motor for a processing unit.
- c. Visit the site and interpret the name plate ratings and identify the parts of a transformer for processing/production unit. .
- d. Present seminar on any of the above or relevant topic.
- e. Conduct market survey and interpret the name plate ratings and identify the parts of an induction motor used in processing/production unit.

## **SUGGESTED LEARNING RESOURCES:**

### **B) REFERENCE BOOKS:**

<b>SR. No.</b>	<b>Title of Book</b>	<b>Author</b>	<b>Publication</b>
1	Fundamentals of Electrical Engineering	Saxena, S. B. Lal	Cambridge University Press, latest edition ISBN : 9781107464353
2	Basic Electrical Engineering	Mittle and Mittal	McGraw Education, New Delhi, latest edition ISBN : 97800700885725
3	Electrical Technology Vol – I	Theraja, B. L.	S. Chand publications, New Delhi, latest edition ISBN: 9788121924405
4	Electrical Technology Vol – II	Theraja, B. L.	S. Chand publications, New Delhi, latest edition ISBN: 9788121924375
5	Basic Electrical & Electronics Engineering	Jegathesan, V.	Wiley India, New Delhi ISBN : 97881236529513
6	A text book of Applied Electronics	Sedha, R.S.	S.Chand ,New Delhi, 2008 ISBN-13: 9788121927833
7	Electronics Principles	Malvino, Albert Paul, David	McGraw Hill Eduction, New Delhi, ISBN-13: 978-0070634244
8	Principles of Electronics	Mehta, V.K. Mehta, Rohit	S. Chand and Company, New Delhi, 2014, ISBN-13: 9788121924504
9	Fundamental of Electronic Devices and Circuits	Bell Devid	Oxford University Press, New Delhi 2015 ISBN : 9780195425239

## **SOFTWARE/LEARNING WEBSITES:**

- a. Electronics Workbench
- b. [www.nptel.iitm.ac.in](http://www.nptel.iitm.ac.in)
- c. <http://en.wikipedia.org/wiki/Transformer>
- d. <http://www.animations.physics.unsw.edu.au/jw/AC.html>
- e. <http://www.alpharubicon.com/altenergy/understandingAC.htm>
- f. <http://www.electronics-tutorials>
- g. <https://learn.sparkfun.com/tutorials/transistors>
- h. <http://www.pitt.edu/~qiw4/Academic/ME2082/Transistor%20Basics.pdf>
- i. <http://www.technologystudent.com/elec1/transis1.htm>
- j. <http://www.learningaboutelectronics.com/>
- k. <http://www.electrical4u.com>

## **Mapping matrix of CO's, PO's and PSO's:**

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PS2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	2	1	2	0	1	1	2	1	1	2
CO2	2	0	2	0	1	1	2	0	0	1
CO3	2	0	2	0	1	1	2	0	1	1
CO4	1	0	1	0	1	2	1	0	1	2
CO5	1	1	1	0	1	2	1	0	1	1
CO6	1	1	1	0	1	2	1	0	1	1

**3: High 2: Moderate and 1: Low Relationship**

**DIPLOMA PROGRAMME: MECHANICAL ENGINEERING**

**COURSE: INTRODUCTION TO MACHINE DESIGN**

**COURSE CODE: R18ME2206**

**COURSE CATEGORY: ALLIED**

**CREDIT: 04**

---

**Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
2	2	-	-	-	-	50@	50	100

**Rationale:**

The course aims at providing exposure to the students in design considerations of various mechanical components, design and drafting of machine components incorporating various aspects of design.

**Course Outcomes:**

1. Understand the nature of stresses and strain.
2. Design simple machine parts.
3. Understand bolted joints and terminology of screw threads.
4. Design machine parts carrying a combined load.
5. Understand different types of welded joints.

**Course Details:**

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS
<b>UNIT 01 Simple Stresses and Strain</b>	<p>1.1 Definition of Stress, Strain, Yield Point, factor of safety, factors governing the selection of factor of safety, types of stresses such as tensile, compressive, shear, bearing, crushing, Fatigue, Endurance Limit, S_N curve. Factors governing selection of material.</p> <p>1.2 Designation of materials as per B.I.S.</p> <p>1.3 Use of Handbook, Design Data</p>	<p>1. Understand the basic terms/ concepts related to machine design</p> <p>2. To understand the use of handbook and design data book.</p>	<b>08</b>

	Book, Standardization.		
<b>UNIT 02 Design of Simple Machine Parts</b>	<p>2.1 Design of simple machine parts subjected to direct tension, compression, shear such as cotter joint, knuckle joint and turn buckle.</p> <p>2.2 Forces resulting in bending stresses – Design of cross section of (rectangular and circular only) Levers, Design of Hand &amp; Foot Levers, Bell Crank Lever..</p>	<p>1. Design of knuckle joint, cotter joint and turnbuckle.</p> <p>2. Calculate dimensions of various types of levers.</p>	<b>06</b>
<b>UNIT 03 Combined loading (Bending and twisting)</b>	<p>3.1 Design of machine parts subjected to combined Loading such as Direct and Bending, Direct and twisting</p> <p>3.2 Design of bracket cross sections, C clamp frames, Offset links, Overhung crank.</p>	<p>1. Calculate dimensions for machine parts subjected to combined loading.</p> <p>2. Design sections for C clamp, offset link etc.</p>	<b>06</b>
<b>UNIT 04 Bolted Joints</b>	<p>4.1 Design of bolted and riveted joints under eccentric loading about one axis only.</p> <p>4.2 Stresses in Screwed Fastenings, bolts of uniform strength, bolts of cylinder cover. Basic types of Screw Fastening</p> <p>4.3 Terminology of Screw Threads, Material and Manufacture, Bolted Joint Simple Analysis, Eccentrically Loaded Bolted Joints in Shear, Eccentric Load Perpendicular to Axis of Bolt.</p>	<p>1. Understand salient features of bolted joints and concept of bolts of uniform strength.</p> <p>2. Explain the design procedure for bolted joint.</p> <p>3. Explain the various stresses induced in screwed fastening.</p>	<b>06</b>
<b>UNIT 05 Welded Joints</b>	<p>5.1 Welded joints, welding processes, Design of parallel and transverse fillet welds.</p> <p>5.2 Circular welds subjected to torsion, Axially loaded symmetrical sections, Merits and demerits of screwed joints and welded joints. Welded Joints, Butt Joints</p>	<p>1. Understand salient features of welded joints.</p> <p>2. Understand the use of Butt joint and Lap joint.</p> <p>3. Determine weld dimensions for various conditions.</p>	<b>06</b>

## SUGGESTED EXERCISES/ PRACTICALS/ ASSIGNMENTS:

<b>S. No.</b>	<b>Unit No.</b>	<b>Practical Exercises (Outcomes' in Psychomotor Domain)</b>	<b>Approx. Hrs. Required</b>
1.	1	Assignment on factor of safety, its significance and selection of material.	4
2.	2	Design of bell crank lever or lever of safety valve.	4
3.	3	Design of unsymmetrical (I or T) section for C clamp.	4
4.	4	Design along with derivation for eccentrically loaded bolted joint.	4
5.	5	Design of symmetrical and unsymmetrical welded joint.	4
<b>Total</b>			<b>20</b>

<b>S. No.</b>	<b>Unit No.</b>	<b>DESIGN PROJECTS</b>	<b>Approx. Hrs. Required</b>
1.	2	Design and draw Cotter Joint.	6
2.	2	Design and draw knuckle joint	6
<b>Total</b>			<b>12</b>

The design project consist of half imperial sheets involving assembly drawing with overall dimensions, bill of material and details of individual components with dimensional tolerances, geometrical tolerances, surface finish symbols etc. so as to make it a working drawing. A design report giving all necessary calculations of the design of components along with the sketches shall be submitted in a separate file.

### TEACHING METHODOLOGY:

Chalk-Board, Discussions, Charts, Models.

#### i) Intellectual Skills:

- Apply and use the basic knowledge of earlier courses like mechanical engineering materials, strength of materials.
- Understanding the types of failure of machine component and decide the design criteria and equations.

#### ii) Motor Skills:

- Use of various IS codes(Standards) to select standard sizes of component.

## SUGGESTED LEARNING RESOURCES

### C) REFERENCE BOOKS:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	V.B.Bhandari	Introduction to Machine Design	Tata McGraw Hill Pub Ltd.
2	P.V.Mandke	Machine design	Nirali Prakashan Pune
3	G.E.Dieter	Engineering Design: A material and processing Approach	Tata McGraw Hill Pub Ltd.
4	R.S. Khurmi	Text Book of Machine Design	S. Chand and Co. Ltd., New Delhi
5		Design Data Book	PSG College of Technology, Coimbatore

### Mapping matrix of CO's, PO's and PSO's:

CO's	PO1 Basic knowledge Discipline specific Knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PSO2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	3	2	2	0	0	0	2	2	2	2
CO2	3	3	3	0	0	0	2	2	2	2
CO3	2	1	1	0	0	0	0	2	1	1
CO4	2	2	2	0	0	0	2	2	2	2
CO5	2	1	0	0	1	0	1	2	1	1

### 3: High 2: Moderate and 1:Low Relationship

**DIPLOMA PROGRAMME: MECHANICAL ENGINEERING**

**COURSE: ENTREPRENEURSHIP DEVELOPMENT**

**COURSE CODE: R18ME2208**

**COURSE CATEGORY: ALLIED**

**CREDIT: 03**

---

**Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
1	2	-	-	-	-	@25	25	50

@ Internal Examination

**Rationale:**

This course consists of topics related to the development of entrepreneurial skills and other details such as selection of product lines, site selection, financial aspects, personnel management, quality control and creative thinking. The course includes case studies in the related field. The course emphasizes the development of enterprising qualities among young engineers.

**Course Outcomes:**

1. Identify various business opportunities.
2. Analyze selected business idea.
3. Prepare business plan for enterprise.
4. Generate awareness about enterprise management.

**Course Details:**

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS
UNIT NO.1	<b>1.1 Introduction :</b> Definition of entrepreneur, concept of entrepreneur and entrepreneurship, Importance of entrepreneur. Types of entrepreneur: Innovative, Imitative, Fabian, Drone and according to type of business. Difference between Entrepreneur and Intrapreneur.  <b>1.2 Entrepreneurial Competencies: -</b> Characteristics of an entrepreneur, qualities of an entrepreneur, competencies of entrepreneur.	1. Explain concept of entrepreneur and entrepreneurship. 2. State characteristics and qualities of entrepreneur. 3. Difference between Entrepreneur and Intrapreneur. 4. Explain Women entrepreneurship with examples. 5. Discuss causes of limited growth of Women entrepreneurship.	03

	<b>1.3 Women Entrepreneur:</b> Definition, characteristics of women entrepreneur. Causes of limited growth in India, remedies for limited women Entrepreneurship development.		
<b>UNIT NO.2</b>	<b>2.1 Motivation :</b>  Definition and concept of motivation, types of motivation: affiliation, power, and achievement motivation. Need and importance of achievement motivation. Challenges of motivation. Motivating factors. Theories of motivation: a) Maslow Hierarchy theory, b) Mc Gregory X-Y theory.	1. Explain concept of motivation and types of motivation. 2. Explain challenges of motivations. 3. Explain theories of motivations.	<b>02</b>
<b>UNIT NO.3</b>	<b>3.1 Creativity and Innovation :</b>  Definition and concept of Innovation. Definition and concept of Creativity. Characteristics of creative people. Discussion of various examples with respect to creativity and innovation.	1. Explain concept of Innovation and Creativity. 2. Discuss characteristics of creative people. 3. Discuss various examples of Innovation and Creativity.	<b>02</b>
<b>UNIT NO.4</b>	<b>4.1 Business Opportunity Search and Scanning:</b>  Opportunities available in different sectors such as manufacturing, services and trading. Classification of opportunities on the following: - Natural resource based, Demand based, Local industrial based, Service sector based, Export based, Skill based, Off-farm based.  <b>4.2 Business Idea :</b>  Search for business idea, sources of business idea, ways of generating ideas, Ideas processing & selection (factors affecting product idea). SWOT Analysis.  <b>4.3 Sources of Business Idea :</b>  Market survey & techniques, prospective consumers, development in other nation, study of project profile, government organization,	1. Discuss the Business Opportunities. 2. Describe classification of opportunities. 3. Explain search and generation of business idea. 4. Discuss Sources of Business Idea.	<b>04</b>

	trade fair and exhibitions. Checklists for information collection.		
<b>UNIT NO.5</b>	<b>5.1 Government and Non-Government Agencies for Promotion and Development:</b> Importance of funds, types of funds. Various schemes of assistance of Government, Government policies and incentives. Registration with various Government agencies, definition of SSI and Ancillary.	1. Discuss Government and Non-Government Agencies associated with entrepreneurship. 2. State importance of funds and government fund schemes. 3. Explain SSI and Ancillary.	<b>02</b>
<b>UNIT NO.6</b>	<b>6.1 Business Plan Preparation :</b>  Project identification, project formulation, feasibility analysis, Estimation of cost of production, Cost volume profit relationship at different levels, Interpretation of financial statements, Institutionalized and Non-institutionalized sources of working capital, Funds flow statements, Loan application form for appraisal. Project report preparation.	1. Explain concept of Business Plan. 2. Explain project formulation and analysis. 3. State sources of capital. 4. Calculate cost of production. 5. Describe cost volume profit relationship. 6. Calculate cost of production. 7. Discuss loan application form for appraisal.	<b>03</b>

### SUGGESTED EXERCISES/PRACTICALS:

<b>S. No.</b>	<b>Unit No.</b>	<b>Practical Exercises (Outcomes' in Psychomotor Domain)</b>	<b>Approx. Hrs. Required</b>
1.	I	Biography of any entrepreneur	02
2.	I	Self Disclosure Exercise (Who am I?)	02
3.	II	Self rating questionnaire.	02
4.	III	Thematic Appreciation Test (TAT)	02
5.	III	Ring Toss Exercise	04
6.	III	Tower Building Exercise	04
7.	II	Convince and Crown	02
8.	III	Creativity and Problem solving	02
<b>Professional exercises</b>			
9.	IV	Walking through Market	04
10.	V,VI	Business plan preparation	04
11.	I,V,VI	Interview of a successful entrepreneur	02
12.	I	Interview / Biography of a successful women entrepreneur	02
<b>Total</b>			<b>32</b>

**MAJOR EQUIPMENT/INSTRUMENT REQUIRED:**

Sr. No.	Equipment Name With Broad Specifications	Exp. Sr. No.
1.	LCD Projector	ALL
2.	Rings, Pegs, Line Marker	5
3.	Work Table	5,6
4.	Wooden Blocks, Sticks	6

**TEACHING METHODOLOGY:**

Chalk Board, Discussions, Power Point Presentations, Transparencies, Visits, Charts.

**i) Intellectual Skills:**

- Identify various opportunities in market.
- Identify individual's entrepreneurial competencies.
- Interpret risk to be taken during a task.
- Interpret SWOT of individual.
- Prepare a report of business plan.
- Enhance/Improve presentation and writing skills.

**ii) Motor Skills:**

- Presentation Skills
- Use of multi media

**SUGGESTED LEARNING RESOURCES:****D) REFERENCE BOOKS:**

SR. NO.	AUTHOR	TITLE	PUBLISHER
1.	Vasant Desai	Dynamics Of Entrepreneurial Development And Management.	Himalaya Publishing House, 1997, Reprint-1999.
2.	Dilip M. Sarwate	Entrepreneurial Development Concept and Practices	Everest Publishing House, 1996
3.	Gupta Srinivasan Entrepreneurial Development	Entrepreneurial Development	Sultan Chand & Sons, 1993.
4.	D. D. Mali	Training of Entrepreneurship and Self Employment.	Mittal Publications, 1999.

**Mapping matrix of CO's, PO's and PSO's:**

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PS2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	1	1	0	1	0	2	2	0	1	0
CO2	1	2	1	1	1	2	2	0	1	0
CO3	1	0	2	1	1	2	3	1	1	0
CO4	1	0	0	0	0	3	2	0	0	1

**3: High 2: Moderate and 1:Low Relationship**

# CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1

## DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

COURSE: MACHINE DRAWING

COURSE CODE: R18ME3203

COURSE CATEGORY: CORE

CREDIT: 06

### Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
2	4	4	80	20	-	25	25	150

### Rationale:

Drawing is a graphical language of Engineer. Diploma Technician has to work in different situations like supervision of production, maintenance of machine, inspection, drafting etc. In whatever capacity he/she may be working, diploma technician has to read, interpret & prepare drawing of various types of different machine components, dies, assemblies etc. He/she is required to understand, assimilate & analyze the drawings completely which eventually leads to efficient performance of manufacturing, so basic skills of reading & interpreting drawings is utmost important & involves preparation of sketches of parts using different symbols as fit, tolerance, surface finish.

### Course Outcomes:

1. Draw missing views.
2. Draw auxiliary views.
3. Represent drawing with symbols, conventions and tolerances.
4. Assemble / Disassemble different parts of product.

### Course Details:

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS
UNIT NO.1  Advanced missing views	1.1 Types of section such as full section, half section, offset section, broken section, revolved section, removed section, aligned	1. Understand the object. 2. Draw the missing view using given views. 3. Drawing of sectional representation.	4	16

	<p>section.</p> <p>1.2 Conversion of given orthographic views into sectional views and addition of the third view, change of method of projection.</p>			
<b>UNIT NO.2</b> <b>Auxiliary Views</b>	<p>1.1 Study of auxiliary planes, projections of objects on auxiliary planes.</p> <p>1.2 Completing the regular views with the help of given auxiliary views.</p>	<p>1. Understand need of auxiliary Plane.</p> <p>2. Obtain true shape of object.</p>	<b>5</b>	<b>12</b>
<b>UNIT NO.3</b> <b>Welding symbols and surface roughness</b>	<p>3.1 General welding symbols sectional representation and symbols used in engineering practices. Representation of welding symbols in structural drawings.</p> <p>3.2 Terminology of spur gears, spur gears in mesh.</p> <p>3.3 Surface roughness: Process capability, Machining symbol, Indication of machining symbol, Symbol for direction of lay, Roughness values (Ra) and CLA , Roughness grade numbers, conventional representation on Drawings.</p>	<p>1. Representation of welding symbol.</p> <p>2. Requirement of surface roughness values and symbols.</p> <p>3. Study of different terminology used in gears.</p>	<b>6</b>	<b>12</b>

<b>UNIT NO.4</b> <b>Conventional representations and Tolerances</b>	<p>4.1 SP46 of the following:-</p> <p>Conventional breaks, conventional representation of materials, External and internal threads, angle &amp; multi start threads, right and left hand threads. Bolts, slotted heads of set screws, bearing in position, serrated shafts, splined shafts, chain wheels, knurling, square ends and flat surfaces, holes on linear and circular pitches, repeated parts, tapers, chamfers, counter sunk &amp; counter bores, springs, pipe fitting and pipe joint, gears, springs ( helical, leaf &amp; spiral), abbreviations used in drawing as per IS Code SP46</p> <p>4.2 <b>Limits, Fits and Tolerances:</b> ISO system of tolerances. Tolerance charts, Whole basis &amp; Shaft basis system, Types of fit, Selection of fit, Selection of tolerance value from chart.</p> <p>4.3 <b>Geometric Tolerances:</b> Form And position tolerances, their types, conventional representation on drawings.</p>	<ol style="list-style-type: none"> <li>1. Representation of conventional drawings as per SP46.</li> <li>2. Interpretation of type of fits &amp; its calculations.</li> <li>3. Understand need of geometric Tolerances.</li> </ol>	<b>5</b>	<b>12</b>
<b>UNIT NO.5</b> <b>Details to Assembly</b>	<p>To prepare assembly drawings from given details (number of details limited to 6-8 for semester examination) such as-</p> <p>5.1 Couplings- Universal coupling (Hooke's joint).</p> <p>5.2 Pipe joints &amp; valves - Expansion joint, Non-return</p>	<ol style="list-style-type: none"> <li>1. Study of different parts and understand working mating position.</li> <li>2. Drawing of assembly in two views.</li> </ol>	<b>6</b>	<b>12</b>

	<p>valve, steam stop valve.</p> <p>5.3 Engine parts- Cross head, Stuffing box.</p> <p>5.4 Bearings- Plummer block, Bushed &amp; Foot Step bearing.</p> <p>5.5 Pulleys-Fan belt pulley, Pulley with supports.</p> <p>5.6 Other parts- Tool post, Screw Jack, Water Tap.</p> <p>5.7 Vices- Pipe Vice, Bench Vice.</p>			
<b>UNIT NO.6</b>	<p>6.1 To draw details from given Assembly drawing and answering questions on it. Number of details should be limited to 6 to 8. List of assemblies in topic 5 should be taken as reference.</p> <p>6.2 Interpretation of given drawing and answering questions related to chapter 3 and 4.</p>	<ol style="list-style-type: none"> <li>1. Study of given assembly.</li> <li>2. Drawing of different parts of assembly.</li> <li>3. Interpretation of different symbols provided in assembly.</li> </ol>	<b>6</b>	<b>16</b>

#### SUGGESTED EXERCISES/PRACTICALS:

<b>S. No.</b>	<b>Unit No.</b>	<b>Practical Exercises (Outcomes' in Psychomotor Domain)</b>	<b>Approx. Hrs. Required</b>
<b>1.</b>	<b>1</b>	Two sheets on advanced missing views	<b>12</b>
<b>2.</b>	<b>2</b>	Two sheets on auxiliary views	<b>12</b>
<b>3.</b>	<b>3</b>	One sheet on welding symbols and surface roughness	<b>08</b>
<b>4.</b>	<b>4</b>	One sheet on conventional representation and tolerances	<b>08</b>
<b>5.</b>	<b>5</b>	Two sheets on details to assembly	<b>12</b>
<b>6.</b>	<b>6</b>	Two sheets on assembly to details	<b>12</b>
<b>Total</b>			<b>64</b>

## SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN:

Unit No.	Unit Title	Teaching Hours	Distribution of Marks			
			R Level	U Level	A Level	Total
1	Missing views	6	4	10	2	16
2	Free hand sketches	4	4	4	4	12
3	Projection of lines & planes	6	2	14	0	16
4	Projection of solids & section of solids	6	2	14	0	16
5	Development & antidevelopment of solids	5	4	4	4	12
6	Interpenetration of regular solids.	5	2	10	0	12

### MAJOR EQUIPMENT/INSTRUMENT REQUIRED:

Sr. No.	Equipment Name With Broad Specifications	Exp. Sr. No.
1	Mini drafter	All
2	Solid models	3,4

### TEACHING METHODOLOGY:

Chalk-Board, Discussions, Charts, Models.

#### i) Intellectual Skills:

- Collection of information, data
- Analysis of data
- Report writing

#### ii) Motor Skills:

- Presentation Skills
- Use of multi media

### SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- i. Show video/animation film to demonstrate the working principles, constructional features, testing and maintenance of different types of electronic and magnetic instruments.
- ii. Arrange a visit to nearby small scale manufacturing unit and make a report of tools and equipments used.
- iii. Use Flash/Animations to explain the working of different instruments.
- iv. Give Mini projects to students.

## SUGGESTED LEARNING RESOURCES

### E) REFERENCE BOOKS:

SR. NO.	AUTHOR	TITLE	PUBLISHER
1.	N. D. Bhatt	Machine Drawing	Charotar Publication, Anand.
2.	Mali and Chaudhary	Machine Drawing	Vrinda Publications, Jalgaon.
3.	Kamat & Rao	Machine Drawing	Jeevandeep Publications, Mumbai
4.	K.L. Narayana, P. Kannaiah, K. Venkata Reddy	Production Drawing	New Age International Publications, New Delhi
5.	P.S. Gill	Machine Drawing	S.K. Kataria & Sons Publications, New Delhi.
6.	K. Venugopal	Engineering Drawing	New Age International Ltd., Delhi.

### Mapping matrix of CO's, PO's and PSO's:

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PSO2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	1	1	1	0	0	0	2	1	0	1
CO2	1	0	1	0	0	0	2	1	0	1
CO3	2	1	0	1	0	1	2	2	2	2
CO4	2	2	2	1	0	2	2	2	2	2

### 3: High 2: Moderate and 1:Low Relationship

# CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1

## DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

**COURSE: MANUFACTURING PROCESSES**

**COURSE CODE: R18ME3204**

**COURSE CATEGORY: CORE**

**CREDIT: 07**

### Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
3	4	3	80	20	50	-	50	200

### Rationale:

Diploma engineers comes across various types of basic manufacturing processes like forming, turning, drilling, shaping, pattern making, casting and plastic moulding. He /she during working in industry it is required to select, operate and control the appropriate processes for specific applications. He /she are also required to know about various cutting tools, improvements in manufacturing processes. This is a core technology subject. The diploma engineers should know how the raw material gets converted into finished goods using manufacturing processes. Hence it is required to understanding of basic manufacturing processes, machines, tools and equipments. With sound knowledge of this subject, the diploma technician will be able to handle and control practical situations more effectively and confidently in industry.

### Course Outcomes:

**CO1:** Illustrate the basic principles of foundry practices &special casting processes, their advantages, limitations and applications.

**CO2:** Explain and relates the basics of hot working and cold working processes, their advantages, limitations and applications.

**CO3:** Explain /illustrate various types of joining and plastic manufacturing processes and select appropriate one according to application.

**CO4:** Illustrate basic principles of working of lathe and drilling.

**CO5:** Select appropriate cutting parameters like speed, feed and depth of cut for component and machine.

**Course Details:**

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS
<b>UNIT NO.I</b>  <b>Fundamentals of Metal Cutting</b>	<p><b>1.1 Fundamentals of Metal Cutting:</b> Basic elements of machining, Principles of metal cutting, Chip formation, Types of chips, Oblique &amp; orthogonal cutting, Chip breaker, Cutting tool geometry and tool signature of single point cutting tool.</p> <p><b>1.2 Cutting Tool Material and Cutting Fluids:</b> characteristics of tool material. Functions &amp; desirable properties of cutting fluid.</p> <p><b>1.3 Tool Life:</b> Definition of tool speed &amp; tool life, factors affecting tool life, Tool failure: causes of tool failure, various types of tool wear, methods for improving the tool life, study of cutting parameters like feed, depth of cut, cutting speed.</p>	<ol style="list-style-type: none"> <li>1. Discuss the desired properties to be possessed by cutting tool materials.</li> <li>2. Discuss the desired properties to be possessed by cutting fluids.</li> <li>3. Select different cutting fluids for various applications.</li> <li>4. Classify cutting tool materials with respect to HSS, carbides and ceramics and also distinguish between them.</li> <li>5. Explain the single point cutting tool nomenclature and geometry.</li> <li>6. Explain the concepts of tool wear, tool failure, tool life and Taylor's tool life equation.</li> <li>7. Discuss the effect of cutting parameters on tool life.</li> </ol>	<b>07</b>	12
<b>UNIT NO.II</b>  <b>Welding Processes</b>	<p><b>2.1 Gas Welding:</b> Advantages, limitations, applications of oxy-acetylene welding, types of gas flames (neutral, oxidizing, carburizing).</p> <p><b>2.2 Arc Welding:</b> Working principle, electrodes, types of electrodes, functions and applications of fluxes, concept of arc blow Various arc-welding processes like TIG, MIG, SMAW, with their working principle, advantages, limitations &amp; applications.</p> <p><b>2.3 Resistance Welding:</b> working principle, advantages, limitations, applications of spot, seam, projection, welding.</p>	<ol style="list-style-type: none"> <li>1. Definition, Principles, Classification, Application, Advantages &amp; limitations of welding.</li> <li>2. Describe Chemical Reaction in Gas welding, Flame characteristics. Gas torch: Construction &amp; working. Forward and backward welding.</li> <li>3. Explain with sketches the principles of Arc Welding, Shielded Metal Arc</li> <li>4. Welding (FSMAW), Principles Oxy acetylene gas welding and flame characteristics, Inert Gas Welding (TIG &amp; MIG)</li> </ol>	<b>07</b>	12

	<p>Working principle, advantages, limitations and applications of thermit welding process.</p> <p><b>2.4 Welding Defects:</b> Causes &amp; remedies.</p> <p><b>2.5 Introduction to soldering and brazing:</b> Process, fillers, heating methods &amp; applications.</p>	<p>Submerged Arc Welding (SAW).</p> <p>5. Explain the steps for Cleaning of welding. Basic steps, and sketch and explain the various welding defects.</p>		
<b>UNIT NO.III</b>  <b>Metal forming processes</b>	<p><b>3.1 Metal Forming Process:</b> Hot &amp; cold working: definition, advantages, and limitations. Difference between hot working &amp; cold working.</p> <p><b>3.2 Drop Forging:</b> open die &amp; closed die forging, forging operations</p> <p><b>3.3 Rolling:</b> Principle of rolling, hot &amp; cold rolling, Types of rolling mill, application of rolling, wire drawing.</p> <p><b>3.4 Extrusion:</b> Direct and indirect extrusion, Advantages, disadvantages and Applications.</p>	<p>1. Explain working principal of Processes like Drop forging, Rolling and Extrusion.</p> <p>2. Select Forming Processes for a specific Component.</p> <p>3. Differentiate between forging, rolling and extrusion.</p>	<b>07</b>	<b>12</b>
<b>UNIT NO.IV</b>  <b>Casting</b>	<p><b>4.1 Pattern Making:</b> Basic steps in making casting, Pattern: types, materials and allowances, tools, color coding of patterns.</p> <p><b>4.2 Moulding:</b> Types of moulding sands, properties of sand, moulding methods, cores Elements of gating system, bench moulding, floor moulding, pit moulding, machine moulding.</p> <p><b>4.3 Casting:</b> Furnaces: Working of cupola furnace, Electric arc furnace. Methods&amp; applications of Centrifugal casting, shell moulding, investment casting, hot chamber and cold chamber die casting, Die casting.</p> <p>Casting defects - Causes &amp; remedies.</p>	<p>1. Explain difference between pattern, mould and casting.</p> <p>2. Explain different types of pattern and their applications.</p> <p>3. State various types of pattern allowances.</p> <p>4. Describe various types of molding sands and their properties.</p> <p>5. Describe various types of casting processes.</p> <p>6. Describe construction and working principle of Copula Furnace.</p> <p>7. Explain the steps for Cleaning of castings. Basic steps, and sketch and explain the various Casting defects.</p> <p>8. Explain various Binders used, core sand moulding. Gating &amp; Risers.</p> <p>Principle and types.</p>	<b>10</b>	<b>16</b>

<b>UNIT NO.V</b>  <b>Lathe &amp;Drilling Machine</b>	<p><b>5.1 Lathe Machine:</b> Introduction, classification and basic parts of center lathe &amp; their functions, working principle, parts of center lathe Size &amp; specification of lathe, classification of lathes, Lathe operations like facing, plain turning, taper turning, thread cutting, chamfering, grooving, knurling. Cutting parameters.</p> <p><b>5.2 Thread Cutting:</b> lathe setup for thread cutting operations, thread cutting calculations.</p> <p><b>5.3 Drilling Machine:</b> Introduction, classification, basic parts of radial drilling machine and their functions, twist drill nomenclature, drilling machine operations like drilling, reaming, boring, counter sinking, counter boring, spot facing. Cutting parameters.</p>	<ol style="list-style-type: none"> <li>1. Explain the working principal of lathe.</li> <li>2. Describe various operations that can perform on lathe.</li> <li>3. Describe the set up for thread cutting operation on lathe.</li> <li>4. Calculate cutting speed, feed, depth of cut and machining time for lathe.</li> <li>5. Explain the working principal of drilling machines.</li> <li>6. Describe various operations that can be performed on drilling machines.</li> <li>7. Calculate cutting speed, feed, depth of cut and machining time for drilling machine.</li> </ol>	<b>11</b>	<b>16</b>
<b>UNIT NO.VI</b>  <b>Miscellaneous Manufacturing Methods &amp;Introduction to maintenance</b>	<p><b>6.1 Plastic Moulding Methods:</b> compression moulding, injection moulding, blow moulding, extrusion, [working principle, advantages, limitation and applications of each process].</p> <p><b>6.2 Composite Material Manufacturing Methods:</b> Hand Laid –up process, Filament winding process, Pultrusion, resin transfer moulding process.</p> <p><b>6.3 Maintenance of Machine Tools:</b> Need and importance of maintenance activity, Types of maintenance.</p>	<ol style="list-style-type: none"> <li>1. Describe various plastic moulding methods like Injection, blow moulding.</li> <li>2. Describe various polymer composite manufacturing methods.</li> <li>3. State and explain various types of maintenance.</li> </ol>	<b>06</b>	<b>12</b>

## SUGGESTED EXERCISES/PRACTICALS:

Sr. No.	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
1.	V	Prepare one turning job on lathe containing the operations like plain turning, step turning, taper turning, grooving, knurling, chamfering and drilling.	20
2.	V	Assembly and dissemble of tail stock, Three jaw chuck, Four jaw, tool post assemble, Carriage, Drill Chuck (Any two).	06
3.	V	Prepare one job on Shaping and drilling Machine operations like keyway slotting, drilling, reaming, counter boring, counter sinking.	20
4.	IV	One Job on Pattern making practice wooden / Thermo coal.	18
<b>Total</b>			<b>64</b>

## SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Marks			
			R Level	U Level	A Level	Total
1	Fundamentals of Metal Cutting	07	04	04	04	12
2	Welding Processes	07	04	02	06	12
3	Metal forming processes	07	02	04	06	12
4	Casting	10	04	04	08	16
5	Lathe & Drilling Machines	11	04	04	08	16
6	Miscellaneous Manufacturing Methods & Introduction to maintenance	06	03	03	06	12
<b>TOTAL</b>		<b>48</b>	<b>21</b>	<b>21</b>	<b>38</b>	<b>80</b>

## MAJOR EQUIPMENT/INSTRUMENT REQUIRED:

Sr. No.	Equipment Name With Broad Specifications	Exp. Sr. No.
1.	Center Lathe Machine.	All PRACTICALS
2.	Radial Drilling Machine.	
3.	Shaping / Slotting machine	
4.	Pattern making, molding and casting shop.	
5.	LCD Projector facility.	

## SUGGESTED STUDENT ACTIVITIES:

Other than the classroom and laboratory learning, following are the suggested student-related co-curricular activities, which can be undertaken to accelerate the attainment of the various outcomes in this course:

Report writing on any one of following topic by a group of 3-4 students:

Information search be made through manufacturers catalogue, Handbooks, magazines, journal and websites, and submit a report on any one topic in a group of 3 to4 students, report size shall not be more than 10 pages.

- Manufacturing of various types of composites.
- Advance manufacturing methods for enhancement of cutting tool material properties.
- Present scenario of Machine tool industry in India.
- Foundry industry in India.
- Maintenance of workshop equipments and tools.
- Different surface coating techniques.
- Advance welding processes.
- Recycling and control of waste materials on work shop floor.
- Material handling equipments commonly used in mechanical industries.
- Metal forming industry in India.
- Feed mechanisms in machine tools.
- Drive mechanisms in machine tools.

#### **TEACHING METHODOLOGY:**

Chalk-Board, Discussions, Charts, Models.

##### **i) Intellectual Skills:**

- Collection of information, data
- Analysis of data
- Report writing

##### **ii) Motor Skills:**

- Presentation Skills
- Use of multi media

#### **SUGGESTED LEARNING RESOURCES**

##### **F) REFERENCE BOOKS:**

<b>Sr. No.</b>	<b>Title of Book</b>	<b>Author</b>	<b>Publication</b>
1.	Elements of workshop Technology-Volume I & II	S. K. Hajra Chaudhary, Bose, Roy	Media Promoters and Publishers Limited
2.	Workshop Technology, Vol.- I &II	Raghuvanshi B.S.	Dhanpat Rai, Delhi.

#### **LEARNING WEBSITES:**

1. <http://nptel.ac.in>
2. [www.egr.msu.edu/~pkwon/me478](http://www.egr.msu.edu/~pkwon/me478)
3. [www.basicmechanicalengineering.com/lathe-machine-operations-basic-turning- operations/](http://www.basicmechanicalengineering.com/lathe-machine-operations-basic-turning- operations/)

4. [www.planomillers.com/drilling-machine.html](http://www.planomillers.com/drilling-machine.html)
5. [www.jsw.co.jp/en/products/injection\\_molding/](http://www.jsw.co.jp/en/products/injection_molding/)
6. <https://www.opm.gov/fedclass/fws3869.pdf>

### Mapping matrix of CO's, PO's and PSO's:

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PS2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	1	2	0	0	1	0	1	1	0	1
CO2	1	0	0	0	1	0	1	1	0	0
CO3	1	0	0	0	1	0	1	1	0	0
CO4	1	2	2	0	1	0	3	0	1	2
CO5	1	3	2	0	1	0	3	0	2	2

**3: High 2: Moderate and 1:Low Relationship**

**DIPLOMA PROGRAMME: MECHANICAL ENGINEERING**

**COURSE: THERMAL ENGINEERING**

**COURSE CODE: R18ME3205**

**COURSE CATEGORY: CORE**

**CREDIT: 06**

---

**Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
4	2	3	80	20	-	25	25	150

**Rationale:**

Diploma engineers work in different areas of operation like production, maintenance, power generation, etc. In all these areas he/she comes across energy conversion processes and related devices. Mainly energy conversion takes place in the form of conversion of heat energy to other form of energies. It is therefore essential that knowledge and familiarization with basic Laws, sources of energies, processes of energy conversion, various related devices like I.C. Engines, Boilers, Turbines, Gas Turbines, Air Compressor is necessary.

**Course Outcomes:**

5. Apply basic concept, laws and principles of thermodynamics to use and select equipment's/ machine based on thermodynamics.
6. Demonstrate the limitations, application and comparison of Thermodynamic cycles based on different parameter.
7. Use thermodynamic relations in evaluation of thermodynamic properties.
8. Use suitable modes of heat transfer.
9. Use relevant steam boiler, nozzle, condenser and turbine.

**Course Details:**

UNIT	NAME OF THE TOPIC (with Details)	LEARNING OUTCOME	HOURS	MARKS
UNIT NO.1	1.1 Basic Concept:- Thermodynamics, thermodynamic systems, boundary, surroundings, types of systems. Properties, point and path function, Process, cycle, and thermodynamic	1. Explain the concept of system and surrounding. 2. Determine the properties 3. State and explain the Zeroth law, First Law and Second law of thermodynamics of system.	13	16

	<p>equilibrium. Pressure, Temperature.</p> <p><b>1.2 Energy and work transfer:-</b> Energy, Thermodynamic work, Pdv work, potential energy, kinetic energy, flow energy, heat, specific heat, internal energy, Enthalpy. Change in internal energy and enthalpy and entropy for ideal gas.</p> <p><b>1.3 Laws of Thermodynamics-</b> Zeroth law, First law of thermodynamics for closed system. Second law of thermodynamics, Kelvin Plank and Clausius statement, reversible and irreversible process, factors making process irreversible, Concept of perpetual motion machine 1 and 2.</p> <p><b>1.4 Application of laws of Thermodynamics-</b> Steady flow energy equation (SFEE) &amp; its application to open systems (like Boilers, engine, nozzle, turbine and compressor), continuity equation. Application of Second law of thermodynamic sheet engine, heat pump and refrigerator.</p>	<ol style="list-style-type: none"> <li>4. Apply S.F.E.E to Thermodynamic open system.</li> <li>5. Calculate efficiency of heat engine.</li> <li>6. Calculate C.O.P of heat pump and refrigerator.</li> </ol>		
<b>UNIT NO.2</b>	<p><b>2.1 Thermodynamic Cycles-</b> Introduction to Carnot cycle, Rankine cycle &amp; reversed Carnot cycle, limitations of Carnot cycle and reversed Carnot cycle, Determination of efficiency of above cycles.</p> <p><b>2.2 Combustion of Fuels:</b> Fuels –Types, Calculation of air requirements, gravimetric and volumetric analysis, conversion of weight analysis to volume</p>	<ol style="list-style-type: none"> <li>1. Represent different processes of given cycle on P-V, T-S diagram.</li> <li>2. Calculate efficiency of given cycle.</li> <li>3. Explain the limitations of given cycle.</li> <li>4. Calculate percentage of mass of air fuel.</li> <li>5. Calculate air fuel ratio.</li> </ol>	<b>09</b>	<b>12</b>

	analysis and vice versa, air fuel ratio.			
<b>UNIT NO.3</b>	<p>3.1 Ideal Gases and Gas Processes : Definition of ideal gas laws, Boyle's law, Charle's law, Gay Lussac's law, Avogadro's law, calculate molar volume, equation of state or characteristic gas equation, specific and universal gas constant, specific heats.</p> <p>3.2 Ideal gas processes- Isobaric, isochoric, isothermal, reversible adiabatic, polytrophic, Throttling and their representation on p-V and T-S diagram. Determination of work, Heat, internal energy, enthalpy change and entropy change.</p>	<ol style="list-style-type: none"> <li>Evaluate the work done and heat transfer according to Boyle's law for the given situation.</li> <li>Evaluate the work done and heat transfer according to Charles law for the given situation</li> <li>Determine work done, heat transfer, internal energy, enthalpy change, and entropy change for various ideal gas processes.</li> <li>Determine characteristic gas constant.</li> </ol>	<b>10</b>	<b>12</b>
<b>UNIT NO.4</b>	<p>4.1 Modes of heat transfer- Modes of heat transfer, conduction, convection and radiation.</p> <p>4.2 Conduction heat transfer, Fourier's law of heat conduction, thermal conductivity, Conduction through cylinder, composite wall's and composite cylinder's, thermal resistance, list of conducting and insulating materials.</p> <p>4.3 Convection -heat transfer coefficient, Newton's Law of cooling, free and forced convection, combined conduction and convection.</p> <p>4.4 Radiation- Black and grey bodies, Stephan-Boltzmann Law, heat transfer by radiation, absorptivity, reflectivity, Transmissivity, emmisivity.</p> <p>4.5 Heat Exchangers-</p>	<ol style="list-style-type: none"> <li>Calculate the rate of heat transfer by conduction for composite wall and composite cylinder.</li> <li>Calculate the rate of heat transfer by convection.</li> <li>Use Stefan Boltzmann law of radiation in the given situation.</li> <li>Select heat exchanger for given application with proper justification.</li> </ol>	<b>10</b>	<b>12</b>

	Classification, construction and working of shell and tube, shell and coil, pipe in pipe type and plate type heat exchanger and its applications.			
<b>UNIT NO.5</b>	<p>5.1 Steam fundamentals- Application of steam, Generation of steam at constant pressure, representation on various charts such as P-V, T-S, h-S.Critical point and Triple point, Properties of steam and use of steam table ,dryness fraction, degree of superheat, sensible and latent heat, boiler efficiency, Mollier chart.</p> <p>5.2 Vapour Processes-Constant pressure, constant volume, constant enthalpy, constant entropy process (Numerical using steam table to determine dryness fraction and enthalpy).</p> <p>5.3 Steam Boilers- Classification, construction and working of –Cochran, Babcock and Wilcox, Lamont and Loffler boiler, Packaged boilers.Boiler,supercritical boiler, draught, Indian Boiler regulation (IBR) (to be covered in practical period)</p> <p>5.4 Boiler mounting and accessories.</p> <p>5.5 Boiler instrumentation.</p> <p>5.6Methods of energy conservation in Boilers.</p>	<ol style="list-style-type: none"> <li>Determine dryness fraction of steam.</li> <li>Use of stem table.</li> <li>Calculate different properties of steam.</li> <li>Draw mollier chart.</li> <li>Classify boilers.</li> <li>Demonstrate various boiler mountings and accessories</li> <li>Calculate efficiency of given boiler.</li> <li>Understand various energy conservation opportunities in boilers.</li> </ol>	<b>13</b>	<b>16</b>
<b>UNIT NO.6</b>	<p>6.1Types of Steam nozzle, continuity equation, velocity of steam leaving the nozzle.</p> <p>6.2 Steam turbines Principles of working, classification – Impulse and Reaction,</p>	<ol style="list-style-type: none"> <li>List the types of nozzle. Classify steam turbines.</li> <li>Explain principles of working of impulse and Reaction Turbine.</li> <li>Calculate power, stage efficiency and digram</li> </ol>	<b>09</b>	<b>12</b>

	<p>compounding of steam turbine. Parson's reaction turbine. Velocity diagrams of simple impulse turbine, calculation of power, stage efficiency, diagram efficiency. Governing of steam turbines.</p> <p><b>6.3 Condenser-</b> Function of condenser, types of condenser, sources of air leakage and condenser efficiency.</p> <p><b>6.4 Cooling Towers –</b> Construction and working - Forced draught, Induced draught and Natural draught.</p>	<p>efficiency.</p> <p>4. Know the function of condenser.</p> <p>5. Explain different cooling towers.</p>		
--	---	--	--	--

### SUGGESTED EXERCISES/PRACTICALS:

S. No.	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Appro. Hrs. Required
1	I	Application of first law of thermodynamics to various devices.	04
2	V	Trace the path of flue Gases and Water Steam circuit in water tube and fire tube boilers.	04
3	V	Identify various boiler mountings, draw their sketches and describe their working	04
4	V	Identify various boiler accessories, draw their sketches and describe their working.	04
5	V	Prepare the heat balance sheet for a given boiler.	02
6	VI	Identify different parts of impulse and reaction turbines, draw their sketches and describe their working.	04
7	VI	Draw the sketches of steam condensers and cooling towers, describe their working and dismantle given model of condenser.	04
8	IV	Determination of Stefan Boltzmann's constant.	02
9	IV	Determination of thermal conductivity of metal rod.	02
10	V	Determine convective heat transfer coefficient for given fluid.	02
11	V	Determination of Heat Transfer Coefficient in a free Convection on a vertical tube.	02
12	IV	Determination of performance of parallel flow and counter flow heat exchanger.	02
13	V	Visit to a process industry involving boiler and turbines such as sugar factory / Dairy / steam power Plant; write the specifications of boiler and turbine.	04
<b>Total</b>			<b>32</b>

## SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN:

Unit No.	Unit Title	Teaching Hours	Distribution of Marks			
			R Level	U Level	A Level	Total
I	Basic Thermodynamics	13	06	06	04	16
II	Thermodynamic Cycles, Combustion of Fuels	09	04	04	04	12
III	Ideal Gases and Gas Processes	10	03	06	03	12
IV	Heat Transfer	10	04	04	04	12
V	Properties of Steam and Steam Generators	13	05	05	06	16
VI	Steam Turbine	09	03	06	03	12
<b>TOTAL</b>		<b>64</b>	<b>25</b>	<b>31</b>	<b>24</b>	<b>80</b>

### MAJOR EQUIPMENT/INSTRUMENT REQUIRED:

Sr. No.	Equipment Name With Broad Specifications	Exp. Sr. No.
1	Model of water tube and fire tube boilers ( Complete and cut section model)	2
2	Various mountings and accessories of boilers for assembly and dismantling purpose.	3,4
3	Cut section models of impulse turbine and reaction turbine.	7
4	Cut section model of surface condenser.	6
5	Experimental setup of Air reciprocating compressor test rig.	
6	Experimental setup of Thermal conductivity of metal rod.	4
7	Experimental setup for Determination of Stefan Boltzmann's constant.	4
8	Experimental setup for Determination Heat Transfer Coefficient in a free Convection on a vertical tube	4
9	Experimental setup for Determination of performance of parallel flow and counter flow heat exchanger.	4

### TEACHING METHODOLOGY:

Chalk Board, Discussions, Power Point Presentations, Transparencies, Visits, Charts, Models.

#### i) Intellectual Skills:

- Understand concepts and laws of ideal gasses.
- Apply steady flow energy equation to simple systems.
- Understand modes of heat transfer and concept of heat exchangers.
- Interpret steam tables, Mollier chart and relationship between different thermodynamic properties.

#### ii) Motor Skills:

- Demonstrate various Boiler and Mountings.
- Measure various parameters of Different modes of heat transfer.

## SUGGESTED LEARNING RESOURCE

### G) REFERENCE BOOKS:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Prof. R. C. Patel & Shri. C. J. Karamchandani	Elements of Heat Engines	Volumes I, II, III, Acharya Publications.
2	Yunus A Cengel, Michael A Boles	Thermodynamics An Engineering Approach	Sixth Edition, Tata McGraw-Hill publishing Company Ltd.
3	M.M Rathore	Thermal Engineering	McGraw Hill Education (India) private Ltd- New Delhi.
4	R. S. Khurmi	Thermal Engineering	S Chand Publications, New Delhi.
5	R.K. Rajput	Thermal Engineering	Laxmi Publications, New Delhi.
6	V.M. Domkundwar	Heat Engines	Dhanpatrai and Sons Publications, New Dehli.

### Mapping matrix of CO's, PO's and PSO's:

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PSO2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	3	1	0	0	0	0	0	3	0	0
CO2	3	1	0	0	0	0	1	3	1	1
CO3	2	2	1	0	0	1	0	2	0	0
CO4	2	2	1	1	1	0	1	2	1	1
CO5	1	2	1	2	1	1	1	1	2	1

**3: High 2: Moderate and 1: Low Relationship**

**DIPLOMA PROGRAMME: MECHANICAL ENGINEERING**

**COURSE : THEORY OF MACHINES & MECHANISMS COURSE CODE: R18ME3207**

**COURSE CATEGORY: CORE**

**CREDIT: 06**

---

**Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
4	2	3	80	20	-	-	25	125

**Rationale:**

Mechanical Engineering diploma holder often comes across different machines & mechanisms in practice. He should be able to analyze, identify & interpret various mechanisms of machines in day-to-day life. In maintaining various machines a Diploma technician should have sound knowledge of fundamentals of machines & mechanisms. Basic principles of mechanisms will be helpful in understanding the machines, devices & equipments in a better way.

**Course Outcomes:**

1. Describe types of links and mechanisms.
2. Justify use of clutches and bearings for different applications.
3. Estimate brake power required to stop vehicle.
4. Select power transmission method.

**Course Details:**

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS
<b>UNIT NO.1</b>  <b>Fundamentals and Mechanism</b>	1.1 Definitions of kinematics and dynamics, kinematic link, kinematic pairs & their types, kinematic chain, constrained motions & their types, mechanisms, inversions, machines, structures.  1.2 Inversions of Mechanisms: <ul style="list-style-type: none"> <li>• Single slider crank</li> </ul>	3. Define various terms related to mechanisms. 4. Explain construction and working of various mechanisms with its inversions.	12	12

	<p>chain &amp; its inversions like hand pump mechanism, oscillating cylinder engine mechanism, quick return mechanism and rotary I.C. Engine mechanism.</p> <ul style="list-style-type: none"> <li>Double slider crank chain mechanism &amp; its inversions. Four bar chain mechanism &amp; its inversions like coupling of locomotive.</li> </ul>			
<b>UNIT NO.2</b> <b>Velocity and Acceleration in Mechanism</b>	<p>2.1 Concept of relative velocity and relative acceleration of a point on a link, angular velocity, angular acceleration.</p> <p>2.2 Analytical method of determining velocity and acceleration of different links in single slider crank mechanism. (Simple Numericals).</p> <p>2.3 Concept of centripetal &amp; tangential acceleration, drawing of velocity and acceleration diagrams from configuration diagram of simple mechanisms.</p>	<p>3. Determine velocity and acceleration of various links for given mechanism.</p> <p>4. Draw velocity and acceleration diagram for given mechanism.</p>	<b>10</b>	<b>16</b>
<b>UNIT NO.3</b> <b>Flywheel, Governor, Cams and Followers</b>	<p><b>3.1 Flywheel and Governor:</b></p> <ul style="list-style-type: none"> <li>Flywheel- Turning moment on crankshaft, Turning moment diagram for I.C.Engines, mechanical press, concept of coefficient of fluctuation of speed &amp; fluctuation of energy. (No Numericals)</li> <li>Governor- Function, types-centrifugal &amp;</li> </ul>	<p>3. Differentiate between flywheel and governor.</p> <p>4. Explain with neat sketch of various governors.</p> <p>5. Define the terms related to cam.</p> <p>6. Classify cams and followers.</p> <p>7. Draw cam profile as per given applications.</p>	<b>10</b>	<b>12</b>

	<p>inertia governor, terminology, comparison of governor with flywheel.</p> <p><b>3.2 Cams and Followers:</b></p> <ul style="list-style-type: none"> <li>• Concept &amp; definition of cam &amp; follower, classification of cams &amp; followers, Cam terminology.</li> <li>• Different follower motions &amp; their displacement diagrams like uniform velocity, S.H.M., uniform acceleration &amp; retardation.</li> </ul> <p>Drawing of cam profile for knife-edge &amp; roller follower without offset.</p>			
<b>UNIT NO.4</b>  <b>Clutches and Bearings</b>	<p><b>4.1 Clutches:</b> Uniform pressure and Uniform wear theory, Single plate clutch, multi-plate clutch, cone clutch, centrifugal clutch and their applications. (Simple numerical on single &amp; multi-plate clutch).</p> <p><b>4.2Bearings:</b> Laws of dry friction, simple pivot &amp; collar bearings, and conical pivot derivations for torque &amp; power absorbed / transmitted by using uniform pressure and uniform wear theory. (Simple numerical).</p>	<ol style="list-style-type: none"> <li>1. Explain the difference between uniform pressure &amp; uniform wear theories.</li> <li>2. Explain with neat sketch of various clutches.</li> <li>3. Calculate torque &amp; power absorbed / transmitted by clutches and bearings.</li> </ol>	<b>12</b>	<b>12</b>
<b>UNIT NO.5</b>  <b>Brakes, Dynamometers, Vibrations and Balancing</b>	<p><b>5.1 Brakes and Dynamometers:</b></p> <ul style="list-style-type: none"> <li>• <b>Brakes:</b> Functions of brakes, types –Shoe, band &amp; block, internally expanding shoe brake, derivation of braking torque and braking force.</li> </ul>	<ol style="list-style-type: none"> <li>1. Difference between brakes and dynamometers.</li> <li>2. Explain with neat sketch of various types of brakes and dynamometers.</li> <li>3. Calculate braking torque and braking force in brakes.</li> </ol>	<b>10</b>	<b>12</b>

	<ul style="list-style-type: none"> <li><b>Dynamometers:</b> Concepts, principles and working of dynamometers such as rope brake, transmission types dynamometer, belt &amp; epicyclic gear train type dynamometer.</li> </ul> <p><b>5.2 Vibrations :</b></p> <ul style="list-style-type: none"> <li><b>Vibrations:</b> types, causes, effects and remedies.</li> </ul> <p>Balancing: Concept of balancing, balancing of single rotating mass, and Analytical / Graphical method for balancing of several masses revolving in same plane.</p>	<p>4. Explain the concept of vibration with their effects and remedies.</p>		
<b>UNIT NO.6</b> <b>Power Transmission Devices</b>	<p><b>4.1 Belt Drives:</b> Types of belts &amp; its applications slip &amp; creep, determination of velocity ratio, tension ratio, initial tension, centrifugal tension &amp; condition for maximum power transmission.</p> <p><b>6.2 Rope drives:</b> Types, advantages, limitations, applications.</p> <p><b>6.3 Chain Drives:</b> Construction of sprockets and chain.</p> <p><b>6.4 Gear Drive &amp; gear trains:</b> Types of gears and their applications, types of gear trains, train value, Comparison between belt, rope, chain and gear drives.</p>	<p>1. Give broad classification of drives.</p> <p>2. Select suitable drives for a particular application.</p> <p>3. Calculate various terms like velocity ratio, belt tensions, slip, angle of contact, power transmitted in belt drives.</p>	<b>10</b>	<b>16</b>

## SUGGESTED EXERCISES/PRACTICALS:

S. No.	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
1.	I	Draw and explain Link, Pair, Chain, Mechanism and Machine.	02
2.	I	Draw and explain inversions of four bar chain mechanism.	02
3.	I	Draw and explain inversions of single slider mechanism.	02
4.	I	Draw and explain inversions of double slider mechanism.	02
5.	II	Graphical solutions of problems on velocity by relative velocity (on A3 size sheets).	04
6.	II	Graphical solutions of problems on acceleration by relative acceleration methods. (On A3 size sheets).	04
7.	III	Draw the sketches of governors and describe.	04
8.	III	To draw displacement diagrams & cam profiles with knife-edge follower. (On A3 size sheets).	04
9.	III	To draw displacement diagrams & cam profiles with roller follower. (On A3 size sheets).	04
10.	IV	To draw the sketches of different types of clutches, brakes and describe.	04
<b>Total</b>			<b>32</b>

## SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN:

Unit No.	Unit Title	Teaching Hours	Distribution of Marks			
			R Level	U Level	A Level	Total
1.	Fundamentals and Mechanism.	12	06	06	-	12
2.	Velocity and Acceleration in Mechanism.	10	04	06	06	16
3.	Flywheel, Governor, Cams and Followers.	10	04	04	04	12
4.	Clutches and Bearings.	12	04	06	02	12
5.	Brakes, Dynamometers and Vibrations.	10	05	05	02	12
6.	Power Transmission Devices.	10	04	06	06	16
<b>TOTAL</b>		<b>64</b>	<b>27</b>	<b>33</b>	<b>20</b>	<b>80</b>

## MAJOR EQUIPMENT/INSTRUMENT REQUIRED:

SR. NO.	EQUIPMENT NAME WITH BROAD SPECIFICATIONS	EXP.SR.NO.
1.	Models of Four bar chain mechanism & its inversions.	2
2.	Models of Single slider mechanism & its inversions.	3
3.	Models of Double slider mechanism & its inversions.	4
4.	Model of centrifugal governor.	7

5.	Model of cam and follower.	8,9
----	----------------------------	-----

### TEACHING METHODOLOGY:

Chalk-Board, Discussions, Charts, Models.

#### i) Intellectual Skills:

- Identify various inversions of mechanisms.
- Select suitable power transmission device for a particular application.

#### ii) Motor Skills:

- Graphical representation of cam profile.
- Drawing velocity and acceleration diagrams for a given mechanism.

### SUGGESTED LEARNING RESOURCES

#### H) REFERENCE BOOKS:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	P.L. Ballaney	Theory of Machines	Khanna Publishers, New Delhi.
2	R.S. Khurmi	Theory of Machines	Eurasia Publishing House, New Delhi.
3	S. S. Rattan	Theory of Machines	Tata McGraw Hill Publications.
4	Dr. Jagdish Lal	Theory of Mechanisms & Machines	Metropolitan Book Co.
5	Ghosh-Mallik	Theory of Machines	Affiliated East west press

#### Mapping matrix of CO's, PO's and PSO's:

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PSO2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	3	2	2	2	1	1	2	1	1	1
CO2	3	2	2	2	1	0	2	1	1	1
CO3	3	2	2	2	2	1	2	2	2	2
CO4	3	2	2	2	1	2	2	2	2	2

#### 3: High 2: Moderate and 1:Low Relationship

# CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1

## DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

**COURSE: FLUID MECHANICS AND FLUID MACHINERY COURSE CODE: R18ME3208**

**COURSE CATEGORY: CORE**

**CREDIT: 06**

### Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
4	2	3	80	20	25	-	25	150

### Rationale:

The course aims at imparting basic knowledge in fluid mechanics and fluid machinery, understanding of fluid properties, fluid statics, principles of conservation of mass and energy, theoretical concepts and operating procedures of turbines and centrifugal pumps is emphasized.

### Course Outcomes:

7. Calculate pressure using various manometers and calculate forces exerted by fluid on surfaces.
8. Apply conservation of mass principle and Bernoulli's theorem to find rate and direction of flow.
9. Calculate various energy losses in pipe flow.
10. Apply impulse momentum principle to calculate force exerted by jet on vanes.
11. Classify hydraulic turbines and pumps and evaluate their performance

### Course Details:

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS
UNIT NO.1 <b>Fluid – Definitions and Properties</b> :	1.1 Fluid – Definitions and Properties : Ideal Fluid, Real fluid, compressible and incompressible Fluid, Fluid properties – density, specific weight, specific gravity, viscosity (dynamic & kinematic), vapour pressure, surface tension, capillarity,	1. Define fluid properties. 2. Differentiate between fluid pressure intensity and pressure head. 3. Solve numerical related to properties of fluid, fluid pressure and manometers. 4. Calculate total pressure	14	16

<p><b>s</b></p> <p>Compressibility, Newton's law of viscosity.</p> <p><b>1.2 Pressure and its Measurement :</b> Definition of pressure, Pascal's law, Hydrostatic law, pressure head, Measuring devices-Piezometer, manometer, U-tube manometer, inclined tube manometer, differential- U tube &amp; inverted U tube manometer, Bourdon's pressure gauge, desirable properties and commonly used manometric liquids.</p> <p><b>1.3 Hydrostatics – Total pressure &amp; centre of pressure on an immersed surface, for general case (circular, triangular &amp; rectangular laminas).</b></p>	<p>and centre of pressure for surface immersed in fluid.</p>			
<p><b>UNIT NO.2</b></p> <p><b>Basic Equations of Fluid Flow</b></p>	<p>2.1 Types of flow – Laminar &amp; Turbulent (concept of Reynolds number), uniform, non-uniform, steady, unsteady flow. 2.2 Continuity quation. 2.3 Various forms of energies present in fluid – Potential energy, Kinetic energy, Pressure energy. 2.4 Bernoulli's theorem -assumptions, Bernoulli's equation. 2.5 Applications of Bernoulli's equation – Venturimeter (derivation of discharge), Orifice plate, Pitot tube, <b>V and Rectangular Notches (derivation of discharge)</b>.</p>	<p>1. State Bernoulli's theorem and assumptions in it. 2. Apply Bernoulli's theorem to venturimeter and solve numerical.</p>	<b>9</b>	<b>12</b>
<p><b>UNIT NO.3</b></p>	<p>3.1 <b>Flow Through Orifices</b> -Vena contracta, Coefficient of contraction, Coefficient of velocity and Coefficient of discharge, Experimental determination of <math>C_c</math>, <math>C_d</math> and <math>C_v</math>.</p> <p>3.2 <b>Flow through Pipes:</b> Types of losses, Major and Minor head loss, Head losses due to sudden enlargement and sudden contraction (derivation), Pipe friction factors and use of Darcy Wiesbach equation.</p> <p><b>Equivalent pipe.</b> Concept of Hydraulic Gradient Line &amp; Total Energy Line, Numerical on <b>Series and parallel pipes</b>, equivalent pipes. Power transmission through pipes &amp; transmission efficiency</p>	<p>1. Calculate <math>C_v</math>, <math>C_d</math> and <math>C_c</math> for orifice. 2. List various energy losses for flow through pipe and formulae to calculate them. 3. Calculate total loss of energy for flow through pipes.</p>	<b>9</b>	<b>12</b>

<b>UNIT NO.4</b>	<b>Impact of Jet:</b> 4.1 Momentum Equation and application of momentum equation. 4.2 Impact of jet on flat plates (stationary and moving, vertical and inclined), Impact of jet on curved vanes (stationary and moving). Torque exerted and work done by water on a series of curved vanes mounted on a radial runner.	1. Explain the impact of jet on vanes in various conditions. 2. Solve numerical on impact of jet on vanes in various conditions.	<b>13</b>	<b>16</b>
<b>UNIT NO.5</b>	<b>Water Turbines:</b> 5.1 Layout of a hydro electric power plant. 5.2 Classification of turbines, Construction and working of Pelton, Francis and Kaplan turbines. Work done by Pelton wheel runner. 5.3 Specific speed of turbine, Performance characteristics of turbines, Governing of turbines, Water hammer, Cavitation in turbines, Surge tank, Draft tubes. 5.4 Selection of turbines.	1. Explain working principle of various hydraulic turbines viz. Pelton wheel, Francis turbine and Kaplan turbine. 2. Differentiate the different turbines based on working principle, structure and use 3. Calculate work done, power generated and various efficiencies of hydraulic turbines (Pelton wheel).	<b>10</b>	<b>12</b>
<b>UNIT NO.6</b>	<b>Centrifugal and Reciprocating Pumps :</b> 6.1 Principle, construction & working of centrifugal pump, Types of casings and impellers, Velocity diagram, calculation of manometric, mechanical and overall efficiency, specific speed, NPSH, Performance characteristics of pump, Priming of pump, Cavitation in pump, Multistaging of pumps, Selection of centrifugal pumps, troubleshooting in centrifugal pump. 6.2 Construction and working of reciprocating pump, comparison between centrifugal and reciprocating pump.	1. Classify pumps and understand the working principle of centrifugal pump. 2. Draw velocity triangle for centrifugal pump and calculate the performance parameters. 3. Differentiate reciprocating pump with centrifugal pump.	<b>9</b>	<b>12</b>

## SUGGESTED EXERCISES/PRACTICALS (Any 8)

S. No.	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
1.	1	Pressure measuring instruments-Principle, working, operating range, advantages and limitations.	4
2.	2	Verification of modified Bernoulli's theorem.	4
3.	2	To find coefficient of discharge of venturimeter.	4
4.	3	To find Cd, Cv & Cc of sharp edged circular orifice.	4
5.	3	Calibration of V-notch.	4
6.	3	To determine friction factor for turbulent flow through pipe.	4
7.	4	Trial on Impact of Jet apparatus.	4
8.	5	Study & trial on Pelton wheel & plotting of operating characteristics.	4
9.	5	Study & trial on Francis turbine & plotting of operating characteristics.	4
10.	5	Study & trial on Kaplan turbine.	4
11.	6	Study & trial on centrifugal pump to plot operating characteristics.	4
<b>Total</b>			<b>32</b>

## SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN:

Unit No.	Unit Title	Teaching Hours	Distribution of Marks			
			R Level	U Level	A Level	Total
1	Fluid properties, Pressure and its measurement		6	5	5	16
2	Basic Equations of Fluid Flow		4	4	4	12
3	Flow through pipes		4	4	4	12
4	Impact of Jet		4	6	6	16
5	Water Turbines		4	4	4	12
6	Centrifugal and Reciprocating pump		4	4	4	12
<b>TOTAL</b>			<b>26</b>	<b>27</b>	<b>27</b>	<b>80</b>

### TEACHING METHODOLOGY:

Chalk-Board, Discussions, Charts, Models.

Skills to be developed:

i) **Intellectual Skills:**

- Interpret manometer readings.
- Compare different pressure measuring devices and flow measuring devices.
- Analyze the performance of pumps and turbines.

ii) Motor skills:

- Measuring the discharge through various devices.
- Priming and starting of centrifugal pump.

**SPECIAL INSTRUCTIONAL STRATEGIES (if any)**

- v. Show video/animation film to demonstrate the working principles, constructional features, testing and maintenance of different types of electronic and magnetic instruments.
- vi. Arrange a visit to nearby small scale manufacturing unit and make a report of tools and equipments used.
- vii. Use Flash/Animations to explain the working of different instruments.
- viii. Give Mini projects to students.

**SUGGESTED LEARNING RESOURCES**

I) **REFERENCE BOOKS:**

SR. NO.	AUTHOR	TITLE	PUBLISHER
1	Dr. P.N. Modi Dr. S.M. Seth	Hydraulics & Fluid Mechanics	Standard Book House, New Delhi.
2	R.K Bansal	Fluid Mechanics & Hydraulic Machines	Laxmi Publications, New Delhi.
3	R.S. Khurmi	Hydraulics & Hydraulic Machines	Standard Book House, New Delhi.

**Mapping matrix of CO's, PO's and PSO's:**

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PSO2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	3	2	1	1	1	0	1	3	1	1
CO2	2	2	2	1	1	0	1	2	2	1
CO3	2	2	1	0	1	1	1	2	1	1
CO4	1	3	2	0	1	1	0	1	3	1
CO5	1	1	2	1	1	1	0	2	1	0

**3: High 2: Moderate and 1:Low Relationship**

## CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1

### DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

**COURSE: SOLID MODELING**

**COURSE CODE: R18ME3209**

**COURSE CATEGORY: CORE**

**CREDIT: 4**

#### **Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
02	02	-	--	--	50	--	50	100

#### **Rationale:**

Mechanical, Plastic, Automobile and allied Industries need to build model based applications which are being developed using “Solid Modeling Software” This course deals with concepts of solid modeling to enhance solid modeling skills of diploma students. This course will enable the students to inculcate solid modeling and additive manufacturing concepts and methodology to solve engineering problems. Today 3D models are used in wide variety of engineering fields. Three dimensional computer graphics are widely used for product design, assembly design etc. As a diploma engineer he should have the knowledge of solid modeling software to visualize the machine components & assembly like automobile, machine tools, material handling systems and earth movers etc. 3D Printing technology could revolutionize and re-shape the world. Advances in 3D printing technology can significantly change and improve the way we manufacture products and produce goods worldwide. 3D Printing can revolutionize the learning experience by helping students interact with the subject matter. Affordable 3D printers in institute may be used for a variety of applications which can aid students in finding their field of interest easier and faster.

#### **Course Outcomes:**

- 1) Develop 2D drawing in sketcher workbench.
- 2) Develop solid models in modeling workbench.
- 3) Create assembly in assembly workbench.
- 4) Generate drawings of assembly in drafting workbench.
- 5) Understand 3D printer /Additive manufacturing technology.

**Course Details:**

UNIT	NAME OF THE TOPICS	LEARNING OUTCOMES	HOURS
UNIT NO.1 2D Environment	<p><b>1.1 Introduction to Solid Modeling:</b> Needs, benefits, and applications of solid modeling.</p> <p><b>1.2 Introduction System &amp; Software:</b> Hardware requirements, different CAD Software. Software selection requirements and its criteria, sketcher tool bars and prime setting.</p> <p><b>1.3 Drawing Tool:</b> Line, Rectangle, Circle, Arc, Ellipse, Spline, etc.</p> <p><b>1.4 Editing Tool:</b> Trim, Extend, Erase, Mirror, etc.</p> <p><b>1.5 Modify Tool:</b> Chamfer, Fillet, Copy, Move, etc.</p> <p><b>1.6 Constraints:</b> Need, types of constrains, applying constrains.</p> <p><b>1.7 Drawing Template:</b> Prepare drawing template consisting of Name plate boundary lines and projection symbol.</p>	<ol style="list-style-type: none"> <li>Understand concept of modeling.</li> <li>State need, benefit and applications of solid modeling in design.</li> <li>Know the hardware requirement, list of different CAD software and its selection criteria.</li> <li>Understand various tool bars.</li> <li>Use of different tool to draw 2D sketch.</li> <li>Draw custom based template format.</li> </ol>	4
UNIT NO.2 3D Environment	<p><b>2.1 Introduction to 3D Environment:</b> Start 3D environment, various 3D tools its use, and prime setting.</p> <p><b>2.2 Produce 3D Component:</b> Extrude, pocket, Hole, Revolve, Rib, Sweep, Swept blend, Pattern, etc.</p> <p><b>2.3 Produce 3D Component by Reference plane:</b> Create reference plane and its use, creating 3D by reference plane.</p> <p><b>2.4 Part Modify &amp; Editing Tools:</b> Specification tree, use of specification tree, Chamfer, Round, Copy, Move, Draft, etc.</p>	<ol style="list-style-type: none"> <li>Understand various tool bars in 3D environment.</li> <li>Use of various 3D environment tools.</li> <li>Create 3D part using various commands.</li> <li>Create 3D part using reference plane.</li> <li>Use of modify and editing tools.</li> </ol>	8
UNIT NO.3 Assembly Environment	<p><b>3.1 Introduction to Assembly Environment:</b> Start assembly environment, various assembly tools and its use.</p> <p><b>3.2 Constraints Used in Assembly:</b> Types of</p>	<ol style="list-style-type: none"> <li>Understand various assembly constraints.</li> <li>Prepare assembly by applying various constrain.</li> <li>Explode the assembly.</li> </ol>	8

	constraints, various constraints tools and its applications. <b>3.3 Exploded View:</b> tools used for exploding the assembly, explode the assembly.		
<b>UNIT NO.4 Drawing Environment</b>	<b>4.1 Introduction to Drawing Environment:</b> Start drawing environment, various drawing environment tools and its use. <b>4.2 Produce Production Drawing:</b> Various drawing tools and its applications. Content in production drawing.	1. Understand various tools in drawing environment. 2. Generate production drawing using various tool of drawing environment.	<b>6</b>
<b>UNIT NO.5 Plotting of Drawing</b>	<b>5.1</b> Printer selection, paper size, orientation. Page set up and other settings. <b>5.2</b> Printing.	1. Use different settings for plotting. 2. Use printer to plot drawing on A3 or A4 size sheet.	<b>2</b>
<b>UNIT NO.6 3D Printer Technology/ Rapid prototyping machine.</b>	<b>6.1 Introduction to Additive Manufacturing:</b> Concept, main areas of use, advantages and limitations, rapid prototyping. <b>6.2 File format:</b> STL (Stereo Lithography). <b>6.3 3D printer software:</b> part import, orientation, processing and printing settings.	1. Describe the process of Additive manufacturing. 2. Study construction and working of 3D printer / Rapid prototyping machine. 3. Describe materials use for 3D printer / Rapid prototyping machine.	<b>4</b>
<b>Total</b>			<b>32</b>

#### SUGGESTED EXERCISES/PRACTICALS:

<b>Sr. No.</b>	<b>Unit No.</b>	<b>Practical Exercises (Outcomes' in Psychomotor Domain)</b>	<b>Hrs. Required</b>
1.	1	Plan & prepare drawing template consisting information of production drawing. (Conventionally).	02
2.	1, 5	Draw and print one simple 2D geometries using sketcher commands.	02
3.	1, 5	Draw and print one complex 2D geometries using sketcher commands	02
4.	1, 5	Draw and print the one simple 3D part using 3D modeling commands.	02
5.	2	Develop solid models of individual components of Bench vice /Drill Jig/Screw Jack/Tool Post / anyone assembly consisting of at least five parts. (Problem I )	02

6.	2	Develop solid models of individual components of Bench vice /Drill Jig/Screw Jack/Tool Post / anyone assembly consisting of at least five parts .(Problem I continued)	02
7.	2	Develop solid models of individual components of Bench vice /Drill Jig/Screw Jack/Tool Post / anyone assembly consisting of at least five parts. (Problem I continued)	02
8.	2	Develop solid models of individual components of Bench vice /Drill Jig/Screw Jack/Tool Post / anyone assembly consisting of at least five parts. (Problem I continued)	02
9.	3	Assembly of the developed components in practical 5 to 8 using assembly environment. (Problem II)	02
10	3	Assembly of the developed components in practical 5 to 8 using assembly environment. (Problem II continued)	02
11	3	Assembly of the developed components in practical 5 to 8 using assembly environment. (Problem II continued)	02
12	4, 5	Draw and print the production drawings consisting of all the individual components of assembly & full assembly developed in practical 5 to 11 (Problem III)	02
13	4, 5	Draw and print the production drawings consisting of all the individual components of assembly & full assembly developed in practical 5 to 11 (Problem III continued)	02
14	4, 5	Draw and print the production drawings consisting of all the individual components of assembly & full assembly developed in practical 5 to 11 (Problem III continued)	02
15	6	Print one simple components using 3D printer/Rapid prototyping machine/Visit (Problem IV)	02
16	6	Print one simple components using 3D printer/Rapid prototyping machine/Visit (Problem IV continued)	02
<b>Total</b>			<b>32</b>

#### **MAJOR EQUIPMENT/INSTRUMENT REQUIRED:**

SR.NO.	EQUIPMENT NAME WITH BROAD SPECIFICATIONS	EXP.SR.NO.
1	Hardware: Personal computer 20 Nos, (i3/ i5 or higher), RAM minimum 4 GB; A3 / A4 size printer / plotter (1 Nos). Display-wide Screen preferably (1 Nos). Projector (1 Nos).	For all Experiments
2	Operating system: Windows 10 or higher. 20 Nos.	
3	Software: Any parametric solid modeling software. 20 Nos.	
4	3D Printer / Rapid prototyping Machine. 1Nos.	15 &16
5	Wooden models.40 Nos.	4, 15 &16

#### **TEACHING METHODOLOGY:**

Chalk-Board, Discussions, Charts, Models.PPT, Projector etc

### **Skills to be developed:**

- i) **Intellectual Skills :**
  - Design approach.
  - Interpretation of drawing.
  - Use of Command dialogue box.
- ii) **Motor Skills :**
  - Graphical Presentation.
  - Use printer and plotter.
  - Set 3D printer parameters.

### **SUGGESTED LEARNING RESOURCES:**

#### **J) REFERENCE BOOKS:**

<b>Sr. No.</b>	<b>Author</b>	<b>Title</b>	<b>Publisher / Edition</b>
1	Sham Tickoo	Autodesk 3D Max.	Softcover, Cadcam Technologies
2	Sham Tickoo , Deepak Maini	NX 4 for Designers	Softcover, Cadcam Technologies
3	Sham Tickoo , Deepak Maini	Solid Edge V19 for Designers	Softcover, Cadcam Technologies
4	Sham Tickoo	CATIA V5R17 for Designers	Softcover, Cadcam Technologies
5	Sham Tickoo	Pro/Engineer Wildfire for Designers	Softcover, Cadcam Technologies
6	Sham Tickoo	Solid Works For Designers Release 2006	Softcover, Cadcam Technologies
7	Sham Tickoo	Autodesk Inventor for Designers: Release 10	Softcover, Cadcam Technologies
		Various advance 3D Modeling software manuals	

### **MAPPING MATRIX OF CO's, PO's & PSO's:**

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PS2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	1	1	1	2	0	1	2	1	1	2
CO2	1	1	1	2	0	1	2	2	1	2
CO3	1	1	1	2	0	1	2	1	1	2
CO4	1	0	0	1	0	1	2	1	1	2
CO5	1	2	1	2	1	1	2	1	1	2

**3: High 2: Moderate and 1: Low Relationship**

**DIPLOMA PROGRAMME: MECHANICAL ENGINEERING**

**COURSE: PRODUCTION TECHNOLOGY**

**COURSE CODE: R18ME4206**

**COURSE CATEGORY: CORE**

**CREDIT: 07**

**Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
3	4	3	80	20	25	-	50	175

**Rationale:**

Diploma engineers comes across various types of manufacturing processes like milling ,grinding, broaching, sawing and non chip forming processes . He /she during working in industry it is required to select, operate and control the appropriate processes for specific applications. He /she are also required to know about various cutting tools, improvements in manufacturing processes. This is a core technology subject. The diploma engineers should know how the raw material gets converted into finished goods using manufacturing processes. Hence it is required to understanding of basic manufacturing processes, machines, tools and equipments. With sound knowledge of this subject, the diploma technician will be able to handle and control practical situations more effectively and confidently in industry.

**CO1:** Illustrate and relates the basic principles of grinding processes and surface coating operations.

**CO2:** Explain and relates the basics of press tool and press working operations.

**CO3:** Explain /illustrate various types of nontraditional manufacturing processes and gear cutting processes. Also, select appropriate one according to application.

**CO4:** Illustrate /explain basic principles of working of machine tools such as milling and press tools.

**CO5:** Explain basic principles of jigs, fixtures and broaching tools

**Course Details:**

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS
<b>UNIT NO.I</b>  <b>Milling Machine</b>	<p>1.1 Introduction, classification specification of milling machine, basic parts of column &amp; knee type milling machine &amp; their functions, milling operations like plain milling, side milling, straddle milling, gang milling, face milling - slot milling, slitting. Up milling &amp; down milling, cutting parameters.</p> <p>1.2 Work holding and cutter holder devices, accessories and attachments.</p> <p>1.3 Introduction and working principle of universal dividing head, indexing, different methods of indexing (simple, compound, differential), numerical based on indexing</p>	<p>1. Explain the working principle of milling machine.</p> <p>2. Describe various operations to be performed on milling machine.</p> <p>3. Distinguish between up and down milling concepts.</p> <p>4. Calculate gear teeth by using various indexing methods.</p>	<b>8</b>	<b>12</b>
<b>UNIT NO.II</b>  <b>Gear Manufacturing</b>	<p>2.1 Gear tooth elements, types of gear, methods of manufacturing form tooth processes as milling &amp; broaching. Generating processes as gear planning, shaping &amp; hobbling. Working principles of gear shaping, gear shaping cutters.</p> <p>2.2 Introduction of gear hobbing, hobbing cutters, Working principles of gear hobbing. Gear finishing processes – gear shaving, grinding &amp; lapping.</p>	<p>1. Explain the working principle of milling machine.</p> <p>2. Describe various operations to be performed on milling machine.</p> <p>3. Distinguish between up and down milling concepts.</p> <p>4. Calculate gear teeth by using various indexing methods.</p>	<b>6</b>	<b>12</b>

<b>UNIT NO.III</b>  <b>Grinding Processes and Surface Finishing Operations.</b>	<p><b>3.1 Grinding Processes:</b></p> <p>Basic principle of the grinding processes, Kinds of grinding machines(centre less, surface ,internal, external) ,grinding wheel, Abrasives, Grit grade, Structure of grinding wheel, Wheel shapes ,wheel mounting, selection and specifications of grinding wheel, Wheel glazing, Loading of grinding, wheel Dressing.</p> <p><b>3.2 Surface Finishing Operations:</b></p> <p>Introduction, description, advantages, limitations, applications of traditional finishing processes such as Honing, Lapping, Super finishing process, Buffing, Polishing.</p>	<ol style="list-style-type: none"> <li>1. Classify grinding machines.</li> <li>2. Discuss the nomenclature and various types of abrasive and bonding materials used in grinding wheels.</li> <li>3. Describe the grinding wheel nomenclature.</li> <li>4. Illustrate with sketches the constructional features of cylindrical, centre less and surface grinding machines.</li> <li>5. Distinguish between cylindrical, centres less and surface grinding.</li> <li>6. List different grinding wheels based on application.</li> <li>7. Explain principles of various surface finishing operations like Honing Lapping, Super finishing process, Buffing, Polishing.</li> <li>8. Discuss the applications of the above processes.</li> </ol>	10	16
<b>UNIT NO.IV</b>  <b>Non conventional machining methods &amp; surface coating operations</b>	<p><b>4.1 Non Conventional Machining Methods:</b></p> <p>Need and importance classification of non conventional machining Methods Working principles, advantages, disadvantages, application of following non-conventional processes: - USM, AJM, EDM, wire cut EDM, ECM, EBM, LBM.</p> <p><b>4.2 Surface Coating Operations:</b></p> <p>Introduction to various surface coating operations like Electro Plating, Anodizing and Electro-Less Plating, Coating on Abrasive grain, Application of Surface Coating.</p>	<ol style="list-style-type: none"> <li>1. Explain the need for NTM processes.</li> <li>2. Discuss the principle of working of NTM processes.</li> <li>3. Describe in detail the methods such as ultrasonic machining, abrasive jet machining, electro discharge machining, electro chemical machining, electron beam machining, laser beam machining.</li> <li>4. Discuss applications of NTM methods.</li> <li>5. Explain the advantages and disadvantages of NTM.</li> <li>6. Describe the surface coating methods such as Electro Plating, Anodizing and Electro-Less Plating.</li> <li>7. Discuss applications of various above surface coating operations.</li> </ol>	7	12

<b>UNIT NO.V</b>  <b>Press and Press Working Processes</b>	<p>5.1 Introduction, classification and types of press, press parts and their functions.</p> <p>Tools and accessories, introduction to power press.</p> <p>Press operations such as shearing, punching, blanking, trimming, and lancing.</p> <p>5.2 Perforating, notching, bending, drawing operations. Types of dies (compound, combination, progressive), construction and Working. Types of blanks ,Layout development for different shapes of sheet metal blank ,Introduction to Die ,Cutting operation, cutting action in punch &amp; die, die clearance, Types of die construction, Die design fundamentals. Die materials.</p>	<ol style="list-style-type: none"> <li>1. Illustrate with sketches the constructional features of power press.</li> <li>2. Classify the press.</li> <li>3. Illustrate the various operations that can be carried out on the press tool.</li> <li>4. Illustrate with sketches the constructional features of various types of dies such as compound, combination, and progressive.</li> <li>5. Illustrate with example the Layout development for different shapes of sheet metal blank.</li> <li>6. Explain the concept of die clearance.</li> </ol>	10	16
<b>UNIT NO.VI</b>  <b>A] Broaching And Sawing Machines</b> <b>B] Jigs And Fixtures</b>	<p><b>A] Broaching And Sawing Machines :</b></p> <p><b>1.1 Broaching machines:</b> Geometry of broach, pull and push broaches, different shapes produced by broaching. advantages &amp; limitations of broaching</p> <p><b>1.2 Sawing machines:</b> Classification types, selection of saws.</p> <p><b>B] Jigs And Fixtures :</b> Definition , types and advantages of jigs and fixtures, different types of locators, different types of clamping devices, various types of jigs , 3-2-1 principle of location.</p>	<ol style="list-style-type: none"> <li>1. Classify broaching machines</li> <li>2. Illustrate with sketches the constructional features of broaching machines.</li> <li>3. Distinguish between pull broach and push broach</li> <li>4. Classify saws.</li> <li>5. Illustrate with sketches the constructional features of sawing machines such as band saw machine and power hacksaw machine.</li> <li>6. Distinguish between jigs and fixtures.</li> <li>7. Illustrate with sketches the 3-2-1 principle of location.</li> <li>8. Illustrate with sketches the constructional features of various jigs such as template jig, plate jig, diameter jigs.</li> <li>9. Illustrate with sketches the constructional features of</li> </ol>	7	12

		various clamping devices. 10. Illustrate with sketches the constructional features of various locating devices.		
--	--	--	--	--

### SUGGESTED EXERCISES/PRACTICALS:

S. No.	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
1.	I	Prepare one job on lathe containing the operations like plain turning, chamfering, drilling, boring, internal thread cutting.	22
3.	II	Prepare one job on milling Machine and lathe machines by operations like plain turning, drilling, and simple indexing.	22
4.	III	One Job on lathe and surface grinding machine by operations like plain turning and surface grinding.	20
<b>Total</b>			<b>64</b>

Unit No.	Unit Title	Teaching Hours	Distribution of Marks			
			R Level	U Level	A Level	Total
1.	Milling Machine	08	4	4	4	12
2.	Gear Manufacturing	06	4	4	4	12
3.	Grinding Processes And Surface Finishing Operations	10	4	4	8	16
4.	Non Conventional Machining Methods & Surface Coating Operations	06	2	4	6	12
5.	Press And Press Working Processes	11	4	4	8	16
6.	A] Broaching And Sawing Machines B] Jigs And Fixtures	07	3	3	6	12
<b>TOTAL</b>		<b>48</b>	<b>21</b>	<b>23</b>	<b>36</b>	<b>80</b>

### MAJOR EQUIPMENT/INSTRUMENT REQUIRED:

Sr. No.	Equipment Name With Broad Specifications	Exp. Sr. No.
1.	Center Lathe Machines	All Practical
2.	Horizontal Milling Machine	03
3.	Surface Grinding Machine	04

### TEACHING METHODOLOGY:

Chalk-Board, Discussions, Charts, Models.

**I) Intellectual Skills:**

- Different manufacturing methods of metal matrix composites
- Advance micro machining methods.
- Advances in metal forming processes.
- Maintenance of workshop equipments and tools
- Different surface coating techniques.
- Advances in jigs and fixtures.

**II) Motor Skills:**

- Presentation Skills
- Use of multi media

**SUGGESTED LEARNING RESOURCES****K) REFERENCE BOOKS:**

Sr. No.	Title of Book	Author	Publication
3.	Elements of workshop Technology–Volume I & II	S. K. Hajra Chaudhary, Bose, Roy	Media Promoters and Publishers Limited
4.	Workshop Technology, Vol. – I &II	Raghuvanshi B. S.	Dhanpat Rai, Delhi.
5.	Production Technology	R. K. Jain	Khanna Publishers, New Delhi.
6.	Manufacturing Technology, Vol - I & II	P. C. Sharma	S. Chand Publication

**L) REFERENCE WEBSITE:**

- a) <http://nptel.ac.in>
- b) [www.egr.msu.edu/~pkwon/me478](http://www.egr.msu.edu/~pkwon/me478)
- c) [www.basicmechanicalengineering.com/lathe-machine-operations-basic-turning-operations/](http://www.basicmechanicalengineering.com/lathe-machine-operations-basic-turning-operations/)
- d) [www.planomillers.com/drilling-machine.html](http://www.planomillers.com/drilling-machine.html)
- e) [www.jsw.co.jp/en/products/injection\\_molding/](http://www.jsw.co.jp/en/products/injection_molding/)
- f) <https://www.opm.gov/fedclass/fws3869.pdf>

### Mapping matrix of CO's, PO's and PSO's:

CO's	PO1 Basic knowledge Discipline specific Knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PSO2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	3	1	1	1	0	0	1	3	1	1
CO2	3	1	1	1	0	0	0	3	1	1
CO3	2	1	1	01	1	1	1	2	2	1
CO4	2	2	2	1	1	0	1	2	1	1
CO5	2	2	2	1	1	0	1	2	1	1

**3: High 2: Moderate and 1: Low Relationship**

## **CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1**

---

### **DIPLOMA PROGRAMME: MECHANICAL ENGINEERING**

**COURSE: MEASUREMENT AND CONTROL**

**COURSECODE: R18ME4207**

**COURSE CATEGORY: APPLIED**

**CREDIT:05**

---

#### **Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
3	2	3	80	20	-	-	25	125

#### **Rationale:**

The art of measurement plays an important role in all branches of engineering. With advances in technology, measurement techniques have also taken rapid strides, with many types of instrumentation devices, innovations, refinements. The course aims at making a Mechanical Engineering student familiar with the principles of instrumentation, transducers & measurement of non-electrical parameters like temperature, pressure, flow, speed, force and torque, vibration, humidity for engineering applications.

#### **Course Outcomes:**

1. Use appropriate instrument for measuring displacement.
2. Use appropriate instrument for measuring force and torque.
3. Use appropriate pressure and temperature measuring instruments.
4. Use suitable instrument for measurement of flow.
5. Select suitable instrument for measurement of vibration and strain.
6. Select appropriate instrument for speed, sound and humidity measurement.

#### **Course Details:**

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS
<b>UNIT NO.1 Introduction and significance of Measurement</b>	<p>1.1 Types of measurement, classification of instruments Static terms and characteristics- Range and Span, Accuracy and Precision, Reliability, Calibration, Hysteresis and Dead zone, Drift, Sensitivity, Threshold and Resolution, Repeatability and Reproducibility, Linearity.</p> <p>1.2 Dynamic characteristics- Speed of response, Fidelity and Dynamic errors, Overshoot.</p> <p>1.3 Measurement of error- Classification of errors, environmental errors, signal transmission errors, observation errors, operational errors.</p> <p>1.4 Transducers:Classification of transducers, active and passive, contact non-contact,mechanicalelectrical, analog, digital.</p>	<p>1. Understand Terminology related to measurement.</p> <p>2. Identify the specified characteristics of the given instrument in the figure.</p> <p>3. Identify the error in the given instrument based on the given data.</p> <p>4. Classify transducers based on the given application.</p> <p>5. Describe with sketches, the working of the non-contact type transducer for the given situation.</p>	<b>09</b>	<b>12</b>
<b>UNIT NO.2 Displacement ,Force and Torque Measurement</b>	<p>2.1 Displacement Measurement: Specification, selection &amp; application of displacement transducer. Capacitive transducer, Potentiometer, LVDT, RVDT,</p> <p>2.2 Force Measurement system- Characteristic of force measurement. Creep curve for force transducer.</p> <p>2.3 Force and load sensors- Types of load cell, load cell applications, construction and working of Quartz force sensor, force rings.</p> <p>2.4 Torque Measurement- Inline and reaction Torque measurement.</p> <p>2.5 Torque sensors-Construction and working of slip ring, Rotary transformer, Infrared</p>	<p>1. Select the displacement measuring sensor for the relevant applications. with justification</p> <p>2. Select the relevant force measuring sensors for measuring sensors for measurement of pressure in the given situation with justification.</p> <p>3. Select the relevant dynamometer for measuring the given torque with justification.</p> <p>4. Describe with sketches the procedure for measurement of displacement .force and torque using the given device.</p>	<b>09</b>	<b>16</b>

	<p>sensor, FM Transmitter.</p> <p>2.6 Dynamometers- construction and working of Transmission dynamometer, absorption dynamometer, Eddy current Dynamometer.</p>			
<b>UNIT NO.3</b> <b>Pressure and Temperature measurement</b>	<p>Pressure Measurement:</p> <p>3.1 Low pressure gauges- McLeod Gauge, Thermal conductivity gauge, Ionization gauge, Thermocouple vacuum gauge, Pirani gauge. High Pressure gauge-Diaphragm, Bellows, Bourdon tube, Electrical resistance type, photoelectric pressure transducers, piezoelectric type</p> <p>3.2 Non-electrical methods- Bimetal, Liquid in glass thermometer and Pressure thermometer.</p> <p>3.3 Electrical methods- RTD, Platinum resistance thermometer, Thermistor, Thermoelectric methods - elements of thermocouple, Seebeck series, law of intermediate temperature, law of intermediate metals, thermos emf measurement.</p> <p>3.4 Pyrometers-working and principle of radiation and optical.</p>	<p>5. Select the pressure gauge for measurement of pressure in the given situation with justification.</p> <p>6. Choose the relevant instruments to measure temperature of the given system with justification.</p> <p>7. Select the relevant pyrometer for given application with justification.</p> <p>8. Describe with sketches the procedure for measurement of temperature and pressure using the given device.</p>	<b>07</b>	<b>12</b>
<b>UNIT NO.4</b> <b>Flow measurements</b>	<p>4.1 Types of flow meter, selection criteria for flow meter, classification</p> <p>4.2 Flow meters-application and construction of Orifice, venture tube, Pitot tube, Dall tube.</p> <p>4.3 Variable area Meter- Construction, working and principle of Rotameter, anemometer</p> <p>4.4 Positive displacement Flow meter-construction, advantages and disadvantages</p>	<p>1. Identify the flowmeter for the given situation with justification mentioning the salient features.</p> <p>2. Select the relevant flowmeter to measure flow in the given system with justification.</p> <p>3. Describe with sketches the procedure for measurement of flow using the given ultrasonic flowmeter.</p>	<b>06</b>	<b>12</b>

	<p>of Coriolis flow meter, oscillating piston flow meter, Rotating vane flow meter.</p> <p>4.5 Ultrasonic flow meter- application and construction of Doppler and transit time ultrasonic flow meter.</p>			
<b>UNIT NO.5</b> <b>Vibration and Strain Measurement</b>	<p>5.1 Concept of natural frequency, free body diagram and spring mass system.</p> <p>5.2 Vibration measurement element principle and working of velocity pickup, Accelerometer, Inductive pick up, Capacitive pick up, Stroboscope.</p> <p>5.3 Introduction to FFT Analyzer, working and application.</p> <p>5.4 Types of strain gauges- bonded and unbounded, gauge factor, strain gauge selection criteria.</p> <p>5.5 Methods of strain measurement axial, bending, Torsional.</p> <p>5.6 Construction of foil, semiconductor and wire wound strain gauge.</p>	<ol style="list-style-type: none"> <li>1. Select the relevant sensor for vibration measurement in the given situation with justification.</li> <li>2. Describe with sketches the use of FFT analyzer for measuring the vibration in the given situation.</li> <li>3. Identify the relevant strain gauges for measuring strain in the given situation with justification.</li> <li>4. Describe with sketches the procedure for measurement of strain in the given system using strain gauge.</li> </ol>	<b>08</b>	<b>12</b>

<b>UNIT NO.6</b> <b>Miscellaneous Measurement</b> <b>Sound ,speed and humidity measurements</b>	<p>6.1 Sound measurement, principle of electrodynamic microphone and carbon microphone.</p> <p>6.2 Speed measurement- working and principle of eddy current generation type tachometer, incremental and absolute type, Mechanical Tachometers, Revolution counter and timer, Slipping clutch Tachometer, Electrical tachometer. Contactless electrical tachometer</p> <p>6.3 Humidity measurement- working principle of hair hygrometer, sling psychrometer</p> <p>6.4 Thermal conductivity measurement.</p>	<ol style="list-style-type: none"> <li>Identifying the relevant sound measuring device in the given situation with justification mentioning the salient features.</li> <li>Describe with sketches the use speed measuring instrument in the given situation.</li> <li>Select the relevant instrument for measuring humidity in the given situation with justification.</li> <li>Describe with sketches the procedure for measurement of humidity using the given device.</li> <li>Describe with sketches the procedure for measurement of humidity Using the given device.</li> </ol>	<b>09</b>	<b>16</b>
---	--	---	-----------	-----------

### SUGGESTED EXERCISES/PRACTICALS:

<b>S. No.</b>	<b>Unit No.</b>	<b>Practical Exercises (Outcomes' in Psychomotor Domain)</b>	<b>Approx. Hrs. Required</b>
<b>1.</b>	<b>I</b>	Identify and select the contact and non-contact transducers.	<b>02</b>
<b>2.</b>	<b>I</b>	Use inductive transducer (LVDT) to measure displacement in given sample.	<b>02</b>
<b>3.</b>	<b>I</b>	Record Liquid Level Measurement by using Capacitive Transducer system.	<b>02</b>
<b>4.</b>	<b>II</b>	Use Load cell to measure force on the given system.	<b>02</b>
<b>5.</b>	<b>III</b>	Use Bourdons pressure gauge to measure pressure in a given system.	<b>02</b>
<b>6.</b>	<b>III</b>	Use liquid in glass Thermometer and Thermocouple to measure temperature	<b>02</b>
<b>7.</b>	<b>IV</b>	Use Rotameter to measure flow	<b>02</b>
<b>8.</b>	<b>V</b>	Use Stroboscope to measure speed of rotating shaft.	<b>02</b>
<b>9.</b>	<b>V</b>	Use Inductive Pick up to measure speed of rotating machine	<b>02</b>

<b>10.</b>	<b>V</b>	Use of FFT analyzer to measure vibration of given machine	<b>02</b>
<b>11.</b>	<b>V</b>	Use strain gauge to measure strain induced on a member.	<b>02</b>
<b>12.</b>	<b>VI</b>	Use Sling Psychrometer to measure air properties.	<b>02</b>
<b>13.</b>	<b>VI</b>	Measure sound level of a given system using sound meter.	<b>02</b>
<b>Mini-project.</b>			
<b>14</b>	<b>VI</b>	Study of an actual control system for one suitable application (boiler) arranging industrial visit at sugar factory / paper mill / textiles / food processing industry.	<b>04</b>
<b>15</b>	I,VI	Visit various departments/laboratories in own institute and understand how the measurement devices are fitted on machines/equipments, the procedure of measurement and calibration.	<b>02</b>
<b>Total</b>			<b>32</b>

#### SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

<b>Unit No.</b>	<b>Unit Title</b>	<b>Teaching Hours</b>	<b>Distribution of Marks</b>			
			<b>R Level</b>	<b>U Level</b>	<b>A Level</b>	<b>Total</b>
I	Introduction to Measurement	06	02	04	06	12
II	Force and Torque Measurement	10	02	04	10	16
III	Pressure and Temperature Measurement	08	02	04	06	12
IV	Flow Measurement	08	02	04	06	12
V	Vibration and Strain Measurement	08	02	04	06	12
Vi	Miscellaneous Measurement	08	02	06	08	16
<b>Total</b>		<b>48</b>	<b>12</b>	<b>26</b>	<b>42</b>	<b>80</b>

#### MAJOR EQUIPMENT/INSTRUMENT REQUIRED:

<b>SR. NO.</b>	<b>EQUIPMENT NAME WITH BROAD SPECIFICATIONS</b>	<b>EXP. SR. NO.</b>
1.	LVDT coil with ferromagnetic core coupled to micrometer Range-+/- 10mm 230 V AC 50 Hz.	<b>1</b>
2.	Bourdon tube pressure and Vacuum gauge Range-0-4kg/cm <sup>2</sup> , 0-760mmHg.	<b>3</b>
3.	Temperature thermocouple,temperature controlled dry block heater,temperature sensors – Mercury in glass thermometer,RTD,Thermister and thermocouple, Range-50-100°C	<b>3</b>
4.	Flow measurement by Rotameter- acrylic body rotameter with Range-10 to 100 lPh,automatic digital timer, calibrated scale on measuring Jar, submersible pump with sump tank.	<b>4</b>
5.	Digital strain gauge setup,strain gauge Bridge-350 Ohm,Gauge factor 2.1,Excitation voltage 5 V DC @ 30 mA,Linearity 0.1%, accuracy 0.1%	<b>5</b>
6.	Infrared temperature sensor(non contact) Range: -20 to +450°C, resolution : 0.1°C, accuracy :+/-2% of reading, power 9VDC battery, display : LCD with back light.	<b>3</b>

7.	Speed measurement by using 1] magnetic pick up 2] inductive pick up 3] stroboscope, trainer kit consist of non contact type speed measuring transducer with disc mounted on motor shaft. Speed of motor variable by pot meter from 30 to 1500 RPM. LED stroboscope is 230 VAC, range up to 9999 rpm, accuracy 1%, automatic range select. power : 230VAC ,50Hz	6
8.	Level Measurement by capacitive probes, acrylic tank of 200mm height along with capacitive level sensor- Teflon coated and corrosion resistance stainless steel probe for water application, submersible pump, control valve,pvc piping,power-230VAC,50Hz	1
9.	Vane anemometer (0.01-45m/sec.), Range: 0.01-45m/sec.),EU-m/s, feet/minute,knots,km/hr,mph, Air temperature-0 to 45 C, Display power : 09 VDC Battery,Size Vane Probe : 251x72x30mm	6
10.	Humidity Measurement Set Up: Humidity Chamber Range- 20 to 95%RH,Size :1Cubic Feet APPx., Front hinge door, With glass and lock , direct reading capacitive sensor based digital humidity indicator, power 1.5V battery, Range - 10-95%RH, requires water 500mL for humidification.	6

### **TEACHING METHODOLOGY:**

Chalk Board, Discussions, Power Point Presentations, Visits, Charts.

#### **i) Intellectual Skills:**

1. Analyze the result of calibration of thermister.
2. Interpret calibration curve of a rotameter.
3. Evaluate the stress induced in a strain gauge.
4. Verify the characteristics of photo transister and photo diode.

#### **ii) Motor Skills:**

1. Handle various instruments.
2. Test and calibration curve of a rotameter.
3. Measure various parameter using instruments.

### **SUGGESTED LEARNING RESOURCES**

#### **M) REFERENCE BOOKS:**

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Dr. D.S. Kumar	Mechanical Measurements & Control	Metropolitan Publications, New Delhi
2	B C Nakra / K K Chaudhary	Instrumentation Measurement and Analysis	McGraw Hill Education
3	E.O. Dobelin	Measurement Systems	Tata McGraw Hill Publications,
4	R.K. Jain	Mechanical & Industrial Measurements	Khanna Publications, New Delhi
5	A.K. Swanky	Mechanical Measurements &Instrumentation.	Dhanpat Rai &Sons, New Delhi

## Mapping matrix of CO's, PO's and PSO'S

### **3: High 2: Moderate and 1: Low Relationship**

CO's											
		PO1 Basic knowledge Discipline specific Knowledge		PO2 Problem analysis		PO3 Design/ development of solutions		PO4 Engineering Tools, Experimentation and testing		PO5 Engineering practices for society, sustainability & environment	
CO1	2	1	2	2	2						
CO2	2	1	2	2	1	1	1	1	1	1	1
CO3	2	1	2	2	1	1	1	1	1	1	1
CO4	2	1	2	2	1	1	1	1	1	1	1
CO5	2	1	2	2	1	1	1	1	1	1	1
CO6	2	1	2	2	1	1	3	1	1	1	1
						PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.			PSO2 Communicating effectively to work as a team member or a leader with professional ethics.		PSO3 Pursuing higher studies and engaging in lifelong learning.

# CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1

## **DIPLOMA PROGRAMME: CIVIL/MECH./ELECT./COMP./E&TC. ENGINEERING**

**COURSE : BUSINESS COMMUNICATION  
COURSE CATEGORY : FOUNDATION**

**COURSE CODE: R18SC1708  
CREDIT : 03**

### **Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
1	2	-	-	-	-	25	25	50

### **Rationale:**

Communication is life blood of any business. To be able to communicate effectively is considered one of the foremost employability skills. Fluency and correct pronunciation makes a world of difference in any business situation like meetings, conferences, seminars, presentations etc. Along with that, a business professional has to be proficient in written communication. Hence in this curriculum, speaking and writing skills are emphasized to help the students in interviews, presentations, and other oral as well as written communication situations.

### **Course Outcomes:**

1. Give presentation using ICT.
2. Face a mock interview.
3. Write business letters for given formal situations
4. Draft notice, memorandum, and circular in given formal situations.
5. Draft reports on given formal situations.

### **Course Details:**

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS
1	<b>Presentation Skills</b> 1.1 Need and importance 1.2 Effective presentation – guidelines for effective presentation 1.3 Use of positive Body language for effective presentation 1.4 Guidelines to prepare an effective Power Point Presentation	1a. Use different types of verbal and non-verbal communication during a presentation.	02	--
2	<b>Interview Techniques</b> 2.1 Preparation stage: Preparing for an interview, pre-interview research. 2.2 Factors affecting performance during the interview: stress, self-awareness, presence of mind. 2.3 Post-interview follow-up	2a. Face a mock interview using appropriate communication skills	02	--
3	<b>Business Correspondence-Part-I</b> 3.1 Letter of Enquiry 3.2 Letter of Order 3.3 Letter of Complaint	3a. Draft formal business letters in given situations	04	--

4	<b>Business Correspondence-Part II</b> 4.1 Letter of Job Application 4.2 Letter of Resignation 4.3 Joining letter 4.4 Leave application	4a. Draft formal letters related to employment in given situations.	<b>04</b>	--
5	<b>Office Drafting</b> 5.1 Notice 5.2 Circular 5.3 Memo 5.4 Email writing	5a. Draft notice, memo, circular in given situations	<b>02</b>	--
6	<b>Report Writing</b> 6.1 Visit report 6.2 Accident report 6.3 Progress report	6a. Draft Visit, accident, and progress report in given situations	<b>02</b>	--

### SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

**Not applicable**

### SUGGESTED EXERCISES/PRACTICALS

Sl. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. Required
1	II	Face a mock Interview	04
2	I	Talk about different jobs and types of work	02
3	I	Talk about your hobbies and enquire about those of other people	02
4	I	Enquire about people's programmes, plans and booking facilities	02
5	IV	Draft a letter of Job Application with resume	02
6	III	Draft a request letter for everyday institute activities	02
7	V	Draft a Circular/ Notice on a given situation	02
8	VI	Email a Visit Report/ Accident Report to given email addresses.	02
9	I	Preparation of PPT /report on micro-project	04
10	I	Presentations on micro-project using ICT	06
<b>Total</b>			<b>28</b>

### SUGGESTED STUDENT ACTIVITIES

1. Summarize the contents of a famous book/books.[fiction/nonfiction]
2. Write a report on various formal events in your college.
3. Identify a good business leader, study his presentations and prepare a report on it..

### SPECIAL INSTRUCTIONAL STRATEGIES

1. Show video/animation, film to improve business communication

### SUGGESTED LEARNING RESOURCES

#### A) Books

Sl. No.	Title of Book	Author	Publication
1	Communication Skills	MSBTE	MSBTE, Mumbai
2	Effective Communication Skills	M Ashraf Rizvi	Tata McGraw-Hill

3	Communication Skills	Sanjay Kumar and Pushp Lata	Oxford University Press
4	Personality Development and Soft Skills	Barun K. Mitra	Oxford University Press
5	Kumar's Group Discussions and Interviews	Dr. B. R. Kishore , D. S. Paul	Vee Kumar Publications Private Limited, New Delhi-110008.
6	PowerPoint Presentations that Sell	Adam B. Cooper	McGraw Hill Professionals.
7	Business Communication	R. C. Bhatia	Ane Books India, New Delhi.
8	Developing Communication Skills	Krishna Mohan, Meera Banerji	Macmillan India Ltd., New Delhi.
9	300+ Successful Business Letters For Associates	Alan Bond and Nancy Schuman	BARON'S
10	The McGraw Hill Handbook of More Business Letters		McGraw Hill

## B) Major Equipment/ Instrument with Broad Specifications

Linguaphone language laboratory software

## C) Software/Learning Websites

- a. British council – [LearnEnglish website](http://learnenglish.britishcouncil.org/en/) – <http://learnenglish.britishcouncil.org/en/>
- b. British council – [LearnEnglish website](http://learnenglish.britishcouncil.org/en/study-break) – fun and games – <http://learnenglish.britishcouncil.org/en/study-break>
- c. British council – [LearnEnglish website](http://learnenglish.britishcouncil.org/en/business-and-work) – business and work – <http://learnenglish.britishcouncil.org/en/business-and-work>
- d. <http://www.talkenglish.com>
- e. [www.wordsworthelt.com](http://www.wordsworthelt.com)
- f. [www.notesdesk.com](http://www.notesdesk.com)
- g. <http://totalcommunicator.com/>
- h. [www.speaking-tips.com](http://www.speaking-tips.com)
- i. [www.skillstudio.co.uk](http://www.skillstudio.co.uk)
- j. [www.mindtools.com](http://www.mindtools.com)
- k. [www.storynory.com](http://www.storynory.com)

### Mapping matrix of PO's and CO's:

Course Name: Business Communication Course code: R18CE5103	PO 1 Basic and discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/development of solutions	PO 4 Engineering Tools, experimentation and testing	PO 5 The engineer ing practice s for society, sustainability and environment	PO 6 Project management	PO 7 Lifelong learning	PSO 1	PSO 2	PSO3
CO1- Give presentation using ICT	3	0	0	0	0	1	1	0	0	2
CO2- Face a mock interview	3	0	0	0	0	1	1	0	0	2
CO3- Write business letters for given formal situations	2	0	0	0	0	1	1	0	0	2
CO4- Draft notice, circular and memorandum in given formal situations	2	0	0	0	0	1	1	0	0	2
CO5- Draft reports on given formal situations	2	0	0	0	0	1	1	0	0	2

Rating scale '3' for high, '2' for medium, '1' for low '0' for no correlation

# CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1

---

## **DIPLOMA PROGRAMME: MECHANICAL ENGINEERING**

**COURSE: INDUSTRIAL ORGANIZATION AND MANAGEMENT**      **COURSE CODE: R18ME2203**  
**COURSE CATEGORY: ALLIED**                                    **CREDIT: 03**

---

### **Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
3	-	3	80	20	--	--	--	100

### **Rationale:**

Engineer has to work in Industry with man and machines and material as resources. Therefore, managerial skills and abilities are essential for enhancing their employability and career growth. This course is therefore designed to provide the basic concepts in business organization & management. This course is classified under human sciences and is intended to teach students about structure of organization and its management, types of organization, principles of management and process, Management and functioning of various departments, Industrial safety & Industrial Acts.

### **Course Outcomes:**

1. Overview of business and understand business organization and management processes.
2. Know types of business organization structures, organizational principles, departmentation and types of ownerships.
3. Identify different human resources and its management. Know different acts, wages, and incentives, safety measures for execution in Industry.
4. Understand financial resources and its management.
5. Identify different sources of material and its storage management.
6. Understand marketing management & use project management techniques.

### **Course Details:**

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS
<b>UNIT NO.1 Business Organization &amp; Management Processes</b>	<b>1.1 Types of business:</b> Service industry, manufacturing industry, trading industry. <b>1.2 Industrial sectors:</b> Types and features of engineering industry, process industry, textile, chemical, agriculture, information	1. Lists different business trends of Industry. 2. Explain characteristics, nature of each business with suitable example. 3. Explain various industrial sectors with its product nature. 4. Describe nature of smart manufacturing as emerging trends in business Industry.	<b>07</b>	<b>12</b>

	<p>technology, banking, insurance, retail, hospitality, automobiles, paper, cement .petro chemical, sugar, steel and healthcare etc.</p> <p><b>1.3 Emerging trends in business:</b> Industry 4.0 revolution and Smart Manufacturing, globalization and its effect.</p> <p><b>1.4 Management:</b> Concept, definitions, levels, administrator &amp; management, scientific management.</p> <p><b>1.5 Principles of management:</b> 14 principles of Henry Fayol.</p> <p><b>1.6 Functions of management:</b> Planning, organizing, staffing, directing and controlling.</p>	<p>5. Justify globalization and its effect on Indian market.</p> <p>6. Define the Management term and list different level of management.</p> <p>7. Explain role of the different level of management.</p> <p>8. Differentiate between management &amp; administration.</p> <p>9. Compare between conventional and scientific management.</p> <p>10. Enlist and describe Henry Fayol 14 principles of management.</p> <p>11. State and explain functions of management with suitable example.</p>		
<b>UNIT NO.2</b>  <b>Organization al Management</b>	<p><b>2.1 Organization:</b> Definition, steps in organization formation .</p> <p><b>2.2 Types of organization structure:</b> Line, staff, line and staff.</p> <p><b>2.3 Departmentation:</b> Formed by product, by functions &amp; by process.</p> <p><b>2.4 Principles of organization:</b> Authority and responsibility, centralization and decentralization of authority, span of control, balance, stability and flexibility, communication.</p> <p><b>2.5 Forms of ownership:</b> Proprietorship, partnership, Joint stock (private Ltd, public Ltd), co-operative society, Government sector- Govt. dept, public corporation, public company.</p>	<p>1. Define the term organization.</p> <p>2. Explain the steps in organization formations.</p> <p>3. Describe different types of organization with respect to its nature, characteristics etc.</p> <p>4. Differentiate between line &amp; staff types of organization.</p> <p>5. Explain the concept of departmentation.</p> <p>6. State and explain different types of departments.</p> <p>7. Describe various principles of organization with suitable example.</p> <p>8. Classify different forms of ownership with diagram.</p> <p>9. Explain different forms of ownerships with respect to its nature, characteristics,</p> <p>10. advantages, limitations.</p>	<b>07</b>	<b>12</b>
<b>UNIT NO.3</b>  <b>Human</b>	<p><b>3.1 Personnel management:</b> Definition, functions, man power planning, source of</p>	<p>1. Define the personnel management.</p> <p>2. State the functions of personnel management in</p>	<b>10</b>	<b>16</b>

<b>Resource and Management</b>	<p>employment, recruitment &amp; selection procedure, employee testing methods, training methods, qualities and duties of supervisor. Morale-advantages, methods to improve morale. Motivations-definition and need, types.</p> <p><b>3.2. Wages:</b> Definition, types, characteristics of good wages, wage payment plan &amp; types.</p> <p><b>3.3. Incentives:</b> Definition, types, incentive plans.</p> <p><b>3.4. Legislative Acts:</b> Needs, factory act, employee compensation act, industrial dispute act, minimum wages acts.</p> <p><b>3.5. Industrial accidents &amp; safety:</b> Causes of accidents, types, effects of accidents, preventive measures, safety procedure &amp; programme.</p>	<p>organization.</p> <ol style="list-style-type: none"> <li>3. Describe men power planning for different department.</li> <li>4. Write different source of employment.</li> <li>5. Explain recruitment and selection procedure for employee.</li> <li>6. State and describe various testing &amp; training methods of employee.</li> <li>7. Justify qualities and duties of supervisor.</li> <li>8. Write advantages of morale.</li> <li>9. State methods for improvement of morale.</li> <li>10. Explain various types of motivations.</li> <li>11. Describe characteristics of good wage plan and its types.</li> <li>12. Write various types of incentive plans.</li> <li>13. Explain various industrial acts.</li> <li>14. Write causes, effect, types of industrial accidents.</li> <li>15. Explain preventive measure, safety procedure &amp; programme.</li> </ol>		
<b>UNIT NO.4</b>  <b>Financial Management</b>	<p><b>4.1. Financial Management:</b> Definition, objectives, functions.</p> <p><b>4.2. Capital Generation:</b> Types of capital, sources of raising capital.</p> <p><b>4.3. Budgets:</b> Types of budgets-production, sales, cash, labour, material and financial budget.</p> <p><b>4.4. Accounts:</b> Types of account- profit &amp; loss account, balance sheet, financial ratios. Terminology –Book keeping &amp; accounting, journal, ledger, liability and assets etc.</p> <p><b>4.5. Taxes:</b> Types of taxes, meaning and example of excise, service tax, income tax, value added tax, custom duty, goods service tax (GST).</p>	<ol style="list-style-type: none"> <li>1. Define term 'Financial management.</li> <li>2. State and explain objectives and functions of financial management.</li> <li>3. Differentiate between fixed capital and working capitals.</li> <li>4. State and explain various source of raising the finance.</li> <li>5. Describe different types of budgets.</li> <li>6. Enlist various types of accounts with example.</li> <li>7. Justify profit &amp; loss accounts with sample balance sheet.</li> <li>8. State and explain various financial ratios and its purposes in company.</li> <li>9. Explain the terminology used in account.</li> <li>10. Classify the various taxes, explain the meaning</li> </ol>	<b>10</b>	<b>16</b>

		of each taxes used in business.		
<b>UNIT NO.5</b>  <b>Material Management</b>	<p><b>5.1. Inventory Management:</b> Inventory-concept, classification, functions, objectives of inventory managements.</p> <p><b>5.2. ABC analysis:</b> Concept and necessity, graphical representation, advantages and limitations.</p> <p><b>5.3. Economic order quantity:</b> Concept EOQ, graphical representation, determination of EOQ, buffer stock, advantages and limitations, numerical.</p> <p><b>5.4. Purchasing:</b> Objectives, functions of purchase department, purchasing procedure.</p> <p><b>5.5. Industry4.0 Techniques of Material Management:</b> Technology used in Smart Manufacturing(SM) for material management – material resource planning (MRP) module ,enterprise resource planning (ERP)module, internet of thing (IoT) and digital transformations (DT),and its advantages.</p>	<ol style="list-style-type: none"> <li>Explain the concept inventory.</li> <li>Classify and state various functions of inventory.</li> <li>List various objectives of inventory management.</li> <li>Describe concept and need of ABC analysis.</li> <li>Show the graphical representation of ABC analysis.</li> <li>Write advantages and limitations of ABC analysis.</li> <li>Explain concept of EOQ with graphical representation.</li> <li>Define buffer stock.</li> <li>State advantages and limitations of EOQ.</li> <li>Solve simple numerical based on EOQ calculation.</li> <li>Describe objectives &amp; functions along with purchasing procedure.</li> <li>State and explain Industry 4.0 techniques of material management.</li> <li>Justify use of internet of things (IoT) &amp; digital transformation (DT) with its advantages.</li> </ol>	<b>07</b>	<b>12</b>
<b>UNIT NO.6</b>  <b>Sales/ Marketing Management &amp; Project Management</b>	<p><b>6.1. Sales Management:</b> Sales-definition, functions &amp;duties of sales managers.</p> <p><b>6.2. Marketing Management:</b> Marketing-definition, functions. Marketing management-definition and functions.</p> <p>Market research- definition, objectives and scope. Market concept, types.</p> <p><b>6.3. Advertising:</b> Definition, agency and types.</p> <p><b>6.4. Project Management:</b> Network analysis- Definition,</p>	<ol style="list-style-type: none"> <li>Define sales; also write functions &amp; duties of sales managers.</li> <li>Define marketing. State the functions of marketing.</li> <li>Define marketing management. State the functions of marketing management.</li> <li>Define market research. State its objectives and scope.</li> <li>List &amp; explain various types of markets.</li> <li>Define advertising; also state its agency and types.</li> <li>Define network analysis</li> </ol>	<b>07</b>	<b>12</b>

	<p>list of network analysis technique, objectives and advantages.</p> <p>Terminology in network analysis- events, activity, path, network diagram, critical path, duration, dummy activity, construction of network diagram for project.</p> <p><b>6.5. CPM:</b> Concept, characteristic, applications and simple numerical.</p> <p><b>6.6. PERT:</b> Concept, characteristics, applications, simple numerical on PERT.</p>	<p>&amp;and its various techniques.</p> <ol style="list-style-type: none"> <li>8. Write objective and advantages of network analysis.</li> <li>9. Explain various terminology used in network analysis.</li> <li>10. Draw network diagram and show events, activity, critical path, duration, dummy activity.</li> <li>11. Explain concept of CPM. State its important characteristics and applications. Solve numerical on CPM.</li> <li>12. Explain concept of PERT. State its important characteristics and applications. Solve numerical on PERT.</li> </ol> <p>Compare CPM and PERT.</p>		
<b>TOTAL</b>			<b>48</b>	<b>80</b>

#### Specification table for question paper design:

Unit No.	Unit Title	Teaching Hours	Distribution of Marks			
			R Level	U Level	A Level	Total
1	Business Organization &Management Processes	07	4	4	4	12
2	Organizational Management	07	4	4	4	12
3	Human Resource and Management	10	4	8	4	16
4	Financial Management	10	4	8	4	16
5	Material Management	07	4	4	4	12
6	Sales/ Marketing Management & Project Management	07	4	4	4	12
<b>TOTAL</b>		<b>48</b>	<b>24</b>	<b>32</b>	<b>24</b>	<b>80</b>

#### Teaching Methodology:

Chalk Board, Discussions, Power Point Presentations, Videos, Visits, Charts.

#### i) Intellectual Skills:

- Understand functions and managerial skills required for various departments.
- Understand the principles of management and role of management in organization.
- Apply different project management techniques in industry.

## Suggested Learning Resources:

### Reference Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Dr. O.P. Khanna	Industrial Engineering & Management.	Dhanpat Rai & Sons.
2	J. R. Batliboi	First Steps in Book Keeping.	
3	Dr. B. C. Punmia and K. Khandelwal	Project Planning and Control with CPM and PERT.	Laxmi Publication.

### Mapping Matrix of CO's, PO's and PSO's:

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Lifelong learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PS2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	1	1	0	0	1	2	2	0	2	2
CO2	1	1	0	0	1	2	3	0	2	2
CO3	1	0	0	0	1	2	3	1	1	1
CO4	2	0	0	0	1	2	3	1	1	1
CO5	2	1	0	0	1	2	3	1	1	1
CO6	1	2	0	0	1	3	3	2	2	2

**3: High 2: Moderate and 1: Low Relationship**

# CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1

## DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

**COURSE : POWER ENGINEERING**

**COURSE CODE: R18ME4201**

**COURSE CATEGORY: APPLIED**

**CREDIT: 06**

### Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
4	2	3	80	20	25	-	25	150

### Rationale:

Diploma engineers work in different areas of operation like production, maintenance, power generation, etc. In all these areas he/she comes across energy conversion processes and related devices. Mainly energy conversion takes place in the form of conversion of heat energy to other form of energies. It is therefore essential that knowledge and familiarization with basic Laws, various related devices like I.C. Engines, steam power cycles, Gas Turbines, Air Compressor is necessary.

### Course Outcomes:

The student will be able to:

- 1) Evaluate the performance of Air Compressor.
- 2) Understand Basic refrigeration (VCR) cycle and calculate its COP
- 3) Describe construction, working and application of gas turbine cycle.
- 4) Interpret fuel supply system, ignition System, and cooling system of I. C engine.
- 5) Calculate the effectiveness of I.C. engine cycles and prepare heat balance sheet.

### Course Details:

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS
UNIT NO.1 <b>Air Compressors</b>	<b>1.1</b> Introduction. <b>1.2</b> Uses of compressed air, Classification of air compressors, Definition of Compression ratio, Compressor capacity, Free Air Delivered, Swept	1. State various Terminology used in The Compressor.  2. Explain the working	10	12

	<p>volume.</p> <p><b>1.3</b> Reciprocating air compressor -Construction and working of single stage and two stage compressor , Efficiency- Volumetric , Isothermal &amp; Mechanical (only simple numerical). Advantages of multi staging.</p> <p><b>1.4</b> Rotary Compressor- Construction and working of screw, lobe, centrifugal compressors (No numerical). Comparison and applications of reciprocating and rotary compressors.</p> <p><b>1.5</b> Methods of energy saving in air compressors.</p>	<p>principle of Reciprocating and Rotary Compressor.</p> <p>3. Calculate the Volumetric, Mechanical, and Isothermal efficiency of Reciprocating Air compressor.</p>		
<b>UNIT NO.2</b>  <b>Refrigeration and Air- Conditioning</b>	<p><b>2.1</b> Refrigeration : Applications of refrigeration, Ton of Refrigeration, coefficient of performance. Vapour compression refrigeration system: Layout, functions of important components, representation on p-h and T-S diagrams, COP calculation. Effect of superheating and subcooling on COP of VCR system. Simple numerical on VCR cycle with dry compression only.</p> <p><b>2.2</b> Psychrometry: Application of air conditioning, Properties of moist air-DBT, WBT, DPT, Specific humidity and relative humidity, Dalton's law of partial pressure. Introduction to psychrometric chart and finding properties from the chart.</p>	<p>1. Describe the components and application of vapors compression system.</p> <p>2. Describe psychometric properties and find their values from psychometric chart.</p>	<b>13</b>	<b>16</b>
<b>UNIT NO.3</b>  <b>Gas Turbine and Jet Propulsion</b>	<p><b>3.1</b> Classification and applications of gas turbine.</p> <p><b>3.2</b> Constant volume and constant pressure gas Turbines. Closed cycle and open cycle gas turbines and</p>	<p>1. Classify the Gas turbine</p> <p>2. Differentiate Between closed cycle and open cycle gas turbine</p>	<b>09</b>	<b>12</b>

	<p>Their comparison.</p> <p><b>3.3</b> Methods to improve thermal efficiency of gas turbine- Regeneration, inter-cooling, reheating using T- Ø diagram (no analytical treatment).</p> <p><b>3.4</b> Jet Propulsion - Principles of turbojet, turbo propeller, Ram jet.</p> <p><b>3.5</b> Rocket Propulsion - Solid propellants and liquid propellants, Components of liquid propellant rocket engine.</p>	<p>3. Describe method to improve thermal efficiency of gas turbine.</p> <p>4. Explain the jet propulsion Gas turbine</p>		
<b>UNIT NO.4</b>  <b>I. C. Engine Fundamentals</b>	<p><b>4.1</b> Introduction: Heat Engine and classification of heat engine, Classification of I.C. engine, Basic components of I.C. engine.</p> <p>Four-stroke diesel engine and two-stroke diesel engine –principle and working</p> <p>Four-stroke petrol engine and two-stroke petrol engine –principle and working</p> <p>,Valve timing diagram for four stroke petrol and diesel engine ,Comparison of four stroke and two stroke engines. Comparison of compression ignition and spark ignition engines</p> <p><b>4.2</b> Air standard cycles:</p> <p>Otto cycle, Diesel cycle, Dual cycle, calculations of properties at salient points and air standard efficiency, Comparison of Otto, Diesel and Dual cycle.</p>	<p>1. Identify The Different components of IC engine.</p> <p>2. Compare four stroke engine with Two stroke IC Engine And CI engine with SI engine</p> <p>3. Calculate the Air Standard Efficiency of Otto and Diesel Cycle.</p>	<b>13</b>	<b>16</b>
<b>UNIT NO.5</b>  <b>Fuel system ,Cooling and Ignition Systems in I.C. Engines</b>	<p><b>5.1</b> Spark ignition engines:</p> <p>Definition of carburetion, air-fuel mixtures, air-fuel mixture requirements at different loads and speeds.</p> <p>Simple carburetor: construction, working and limitations.</p> <p>Ignition systems: Battery ignition,</p>	<p>1.Explain the working principle of simple Carburetor.</p> <p>2. State the requirement of air fuel mixture at various operating condition</p>	<b>09</b>	<b>12</b>

	<p>magneto ignition, electronic ignition system.</p> <p><b>5.2</b> Compression ignition engines:Fuel injection system: Functions of injection system, components of fuel systems. Individual pump system &amp; Common rail system, Description and working of fuel pump, Principles of injectors and atomizers. Knocking in engine Introduction to MPFI system.</p> <p><b>5.3</b> Engine cooling:Air cooling system, Liquid cooling system, Radiator in cooling system.</p>	<p>3. Explain the cooling System in IC engine.</p>		
<b>UNIT NO.6</b> <b>Performance and Testing of I.C. Engines</b>	<p><b>6.1</b> Performance parameters of I.C. engine: Indicated power, brake power, mean effective pressure, specific fuel consumption, indicated thermal efficiency, brake thermal efficiency, mechanical efficiency, and volumetric efficiency. Methods to determine friction power: Willan's line method, Morse test and Motoring testHeat balance sheet for an I.C. engine</p> <p><b>6.2</b> Pollution control: Pollutants in exhaust gases in Petrol and Diesel Engine, un-burnt hydrocarbon and its effect on environment and exhaust gas analyzers for petrol and diesel engine. Broad provisions in Bharat Stage III &amp; IV standards.</p>	<p>1. Prepare the Heat Balance Sheet of IC engine.</p> <p>2. Calculate the friction power by Morse test.</p> <p>3. Know the Different pollutant come out from the IC engine and its effects on environment.</p> <p>4. Know the Bharat stage III and Bharat Stage IV standards.</p>	<b>10</b>	<b>12</b>

## SUGGESTED EXERCISES/PRACTICALS:

<b>S. No.</b>	<b>Unit No.</b>	<b>Practical Exercises (Outcomes' in Psychomotor Domain)</b>	<b>Approx. Hrs. Required</b>
1	1	Identify functional components of two stage reciprocating air compressor with intercooler and explain their purposes.	2
2	1	Perform a trial on two stage reciprocating air compressor with intercooler and evaluate performance parameters.	4
3	2	Trial on Vapour compression Refrigeration System to Determine its C.O.P.	4
4	4	Identify various important components of two stroke and four stroke cycle petrol engine with their functions.	2
5	4	Identify various components of four stroke cycle diesel engine and its fuel injection system.	4
6.	5	Draw a neat sketch of simple carburetor and explain modifications required to satisfy different load requirements.	2
7.	6	Perform a trial on four stroke cycle petrol engine to evaluate performance parameters with different load.	4
8.	6	Perform a trial on Multi cylinder Petrol/ Gas engine for determination of friction power (Morse Test).	4
9.	5	Know and understand the components of pressure and splash lubrication system	2
10	6	Perform trial on diesel engine to determine various efficiencies, SFC and Heat balance sheet.	4
<b>Total</b>			32

<b>Unit No.</b>	<b>Unit Title</b>	<b>Teaching Hours</b>	<b>Distribution of Marks</b>			
			<b>R Level</b>	<b>U Level</b>	<b>A Level</b>	<b>Total</b>
1	Air Compressors.	10	4	04	4	12
2	Refrigeration and Air- Conditioning	13	4	4	8	16
3	Gas Turbine and Jet Propulsion.	09	2	6	4	12
4	I. C. Engine Fundamentals.	13	4	6	6	16
5	Fuel system, Cooling and Ignition Systems in I.C. Engines.	09	4	4	4	12
6	Performance and Testing of I.C. Engines.	10	2	4	6	12
	<b>TOTAL</b>	<b>64</b>	<b>20</b>	<b>28</b>	<b>32</b>	<b>80</b>

## MAJOR EQUIPMENT/INSTRUMENT REQUIRED:

<b>Sr. No.</b>	<b>Equipment Name with Broad Specifications</b>	<b>Exp. Sr. No.</b>
1	Two Stage Reciprocating Air Compressors.	ALL Practicals.
2	Vapour compression Refrigeration test rig	
3	Four stroke cycle Diesel engine	
4	Multi cylinder Four stroke cycle Petrol engine	
5	Model of Two stroke and four stroke engine	

**TEACHING METHODOLOGY:**

Chalk-Board, Discussions, Charts, Models.

**i) Intellectual Skills :**

- Understand functions , working of various devices like I.C .Engines,Gas Turbines etc.
- Identifying various energy conservation points in air compressor unit.

**ii) Motor Skills :**

- Testing of Air Compressor and I.C.Engine performance for different efficiencies.
- Measurement of pressure, temperature, energy meter reading for Air Compressor.
- Measurement of load, speed ,fuel consumption etc for I.C.Engines

**SUGGESTED LEARNING RESOURCES:****D) REFERENCE BOOKS:****Books:**

SR.NO	AUTHOR	TITLE	PUBLISHER
1	Prof. R. C. Patel & C. J. Karamchandani	Elements of heat engines Volume -- I, II, III	Acharya Publications, Vadodara.
2	R.K. Rajput	Thermal Engineering	Laxmi Publications, Delhi
3	M.L. Mathur& R.P. Sharma	Internal Combustion Engines	Dhanpat Rai & Sons, New Delhi.
4	V. Ganeshan	Internal Combustion Engines	Tata McGraw Hill Publishing House, New Delhi.
5	Dr. V. P. Vasandani& Dr. D. S. Kumar	Heat Engineering	Metropolitan Book House, New Delhi.
6	R. S. Khurmi	Thermal Engineering	S. Chand Publications, New Delhi.
7	V. M. Domkundwar	Course in Thermal Engg.	Dhanpat Rai & Co.
8	P.L.Ballaney	Thermal Engineering	Khanna Publishers.
9	R. K. Jain	Automobile Engineering	Tata McGraw Hill.

### Mapping matrix of CO's, PO's and PSO's:

CO's											
		PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PSO2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	2	2	1	1	1	-	-	1	3	1	1
CO2	2	2	1	1	1	-	1	-	3	1	1
CO3	2	1	-	-	1	1	0	2	2	1	1
CO4	1	2	2	2	1	1	1	2	2	2	1
CO5	2	2	2	3	1	1	1	2	2	2	1

**3: High Relationship, 2: Medium Relationship, 1: Low Relationship**

# CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1

## DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

COURSE : INDUSTRIAL HYDRAULICS AND PNEUMATICS

COURSE CODE: R18ME4202

COURSE CATEGORY: APPLIED

CREDIT: 05

### Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
3	2	3	80	20	25	-	25	150

### Rationale:

Hydraulic and pneumatic controls are widely used in industry due to versatility, compactness and ease for automation. Course aims at making a diploma technician to understand principles, construction and working of various elements in Hydraulic & Pneumatic control systems. At the end of the course, the students will be able to read and interpret the drawings showing different hydraulic and pneumatic circuits and also become familiar with operation, troubleshooting and maintenance of Hydraulic and Pneumatic systems.

### Course Outcomes:

- Understand the importance of fluid selection, contamination and filter in hydraulic system
- Recognize and comprehend the use of fluid power components like pumps, direction control valves, pressure control valves and flow control valves
- Recognize and comprehend the use of pneumatic circuit components
- Prepare and interpret simple hydraulic/pneumatic circuit, with significant role of each component.

### Course Details:

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS
UNIT NO.1	<b>1.1 Fluid Power Systems:</b> Principles of fluid systems, comparison with conventional systems, comparison of hydraulic and pneumatic transmission. Symbols & Components of fluid power systems and pneumatic systems.	1. Understand and restate desirable properties of hydraulic fluids. 2. Understand the various filter locations and write their respective functions. 3. Report the causes and ill effects of contamination of oil and write the suitable remedies.	8	12

	<p><b>1.2 Hydraulic fluids:</b> Types of hydraulic fluids, properties of fluids, selection of fluids, effects of temperature and pressure on hydraulic fluids. Additives,</p> <p><b>1.3 Filters:</b> position of filters and filter rating. Seals, sealing materials, types of pipes, hoses. Fluid conditioning through filters, strainers, sources of contamination and contamination control.</p> <p><b>1.4 Accumulators:</b> Classification, details of bladder type accumulator, Applications of accumulators.</p>	<p>4. Classify accumulators and appreciate its use in important applications.</p>		
<b>UNIT NO.2</b>	<p><b>2.1 Hydraulic Pumps –</b> Classification, principle of working and constructional details of Gear pump, Gerotor pump, Vane pump, Radial piston pump, Axial piston pump, Bent axis pump. Selection of pump for power transmission. Elementary power and efficiency calculations.</p> <p><b>2.2 Hydraulic Actuators:</b> Types and construction of actuators, linear and rotary actuators, hydraulic motors, tandem cylinder, telescopic cylinder, end cushioning of cylinder, mounting of cylinder.</p>	<p>1. Classify hydraulic pumps.</p> <p>2. Calculate efficiency of the pumps.</p> <p>3. Classify hydraulic actuators and state their use in specific applications.</p> <p>4. Understand the working of various direction control valves.</p>	<b>7</b>	<b>12</b>
<b>UNIT NO.3</b>	<p><b>3.1 Pressure Control Valves:</b> Principles of pressure control valves, direct operated and pilot operated pressure relief valve, pressure reducing valve, sequence valve, counter balance valve, unloading valve: construction and working.</p> <p><b>3.2 Study of simple hydraulic circuits with linear, regeneration and sequence circuits, study of two pump</b></p>	<p>1. Understand the working of various pressure control valves and describe them.</p> <p>2. Select components and Prepare hydraulic circuit for given purpose/application.</p> <p>3. Prepare and read the circuit i.e. identifies the fluid flow path for different DCV positions.</p>	<b>9</b>	<b>16</b>

	unloading circuit, circuit using counterbalance valve, cylinder synchronization circuits, automatic reciprocating circuit,			
<b>UNIT NO.4</b>	<p><b>4.1 Direction control valve:</b> Check valve, pilot operated check valve, two way two position, four way two position / three position valves, open centre, close centre, tandem centre, float centered, manually operated, solenoid operated, pilot operated direction control valve.</p> <p><b>4.2 Flow Control Valves:</b> Principles of flow control valve, pressure compensated, and temperature compensated, flow control valve.</p> <p><b>4.3 Speed control circuits-</b> Meter in circuit, meter out circuit, bleed off circuit. Circuit for hydraulic shaper and milling machine and grinding machine.</p>	<ol style="list-style-type: none"> <li>Understand the working of various direction and flow control valves and describe them.</li> <li>Select components and Prepare hydraulic circuit for given purpose/application.</li> <li>Prepare and read the circuit i.e. identifies the fluid flow path for different DCV positions.</li> </ol>	<b>9</b>	<b>16</b>
<b>UNIT NO.5</b>	<p><b>5.1 Principles of Pneumatics:</b> Schematic diagram of compressed air system and air treatment.</p> <p><b>5.2 Basics of pneumatic systems-</b> FRL unit, constructional details of air filter, regulator and lubricator.</p> <p><b>5.3 Constructional details and significance of shuttle valve, dual pressure valve, and quick exhaust valve and time delay valve.</b></p>	<ol style="list-style-type: none"> <li>Identify the important components in pneumatic circuit.</li> <li>Appreciate the use of the FRL unit in pneumatic circuit.</li> <li>Describe the working specialized valve used in pneumatics.</li> </ol>	<b>8</b>	<b>12</b>
<b>UNIT NO.6</b>	<p><b>6.1 Basic pneumatic circuits:</b> direct and indirect actuation of single and double acting cylinder, Automatic actuation of double acting cylinder, Logic OR and AND gate circuit, Pneumatic</p>	<ol style="list-style-type: none"> <li>Select components and Prepare pneumatic circuit for given purpose/application.</li> <li>Read the circuit i.e. identifies the fluid flow path for different DCV</li> </ol>	<b>7</b>	<b>12</b>

	circuit using time delay valve and quick exhaust valve. <b>6.2</b> Maintenance, troubleshooting and safety precautions of hydraulic circuits.	positions.		
--	--	------------	--	--

### SUGGESTED EXERCISES/PRACTICALS (Any 8):

S. No.	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
1.	II	Classify positive displacement pumps. Sketch various Hydraulic pumps and describe them.	04
2.	II	Study of direction control valve and circuits using direction control valve and pilot operated check valve.	04
3.	III	Sketch sectional views of pressure control valves and draw relevant circuits.	04
4.	III	Understand principles of flow control valves and draw circuits using flow control valve.	04
5.	I	Classify Accumulator, write applications with relevant circuits and understand charging procedure of it.	04
6.	I	Draw a neat sketch of hydraulic power unit and accessories.	02
7.	V	Study of direction control valve in pneumatic circuits and circuits using manual and pilot operated valve.	04
8.	V,VI	Sketch symbol and sectional views of shuttle valve, Quick Exhaust Valve, Dual Pressure Valve, Time Delay Valve and related circuits. Build circuits using components and verify the behavior.	04
9.	V	Draw simple hydraulic systems used in practice such as shaping, milling, copy turning, dumper, fork lift, etc	04
10.	VI	Study of troubleshooting procedures of various hydraulic and pneumatic circuits.	02
11.	-	Draw Standardized graphical (ISO / JIC) symbols.	04
<b>Total</b>			<b>32</b>

### SPECIFICATION TABLE

Unit No.	Unit Title	Teaching Hours	Distribution of Marks			
			R Level	U Level	A Level	Total
I	Fluid power: Introduction, Hydraulic fluids, filters, and contamination.	8	4	4	4	12
II	Hydraulic pumps and Actuators	7	4	4	4	12
III	Pressure control valves and hydraulic circuit using pressure control valve	9	4	4	8	16
IV	Direction Control Valve, Flow control valve	9	4	4	8	16

	and hydraulic circuits using them					
V	Principles of pneumatics	8	4	4	4	12
VI	Pneumatic circuits	7	3	3	6	12
	<b>TOTAL</b>	<b>48</b>	<b>23</b>	<b>23</b>	<b>34</b>	<b>80</b>

### TEACHING METHODOLOGY:

Chalk Board, Discussions, Power Point Presentations, Transparencies, Visits, Charts.

#### i) Intellectual Skills:

- Interpreted simple hydraulic & pneumatic circuits.
- Identify the different components in hydraulic & pneumatic circuits.
- Diagnose the faults & suggest remedies in hydraulic & pneumatic circuits

#### ii) Motor Skills:

- Build pneumatic circuits using symbols.
- Connect different components as per given drawing.

### SUGGESTED LEARNING RESOURCES

#### E) REFERENCE BOOKS:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	S.R. Mujumdar	Oil Hydraulic Systems (Principles and Maintenance)	Tata McGraw Hill Publications, New Delhi.
2	S.R. Mujumdar	Pneumatic Systems	Tata McGraw Hill Publications, New Delhi.
3	Vickers	Industrial Hydraulic Manual	Vickers India.
4	Anthony Esposito	Fluid Power with Applications	Pearson Education Inc
5	J.J. Pippenger & Hicks	Industrial Hydraulics	McGraw Hill Publications.
6	M.J. Pinches and J.G. Ashby	Power Hydraulics	Prentice Hall Publications.
7	Festo	Basic Pneumatic Manual	Festo Controls

### Mapping matrix of CO's, PO's and PSO's:

CO's		PO's							PSO's		
		PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PSO2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	2	2	1	1	0	1	0	1	3	1	0
CO2	2	2	2	1	1	0	0	0	2	1	1
CO3	2	1	1	0	0	0	0	0	3	1	0
CO4	2	2	2	1	1	1	1	1	3	2	1

**3: High 2: Moderate and 1:Low Relationship**

# CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1

## DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

**COURSE: DESIGN OF MACHINE ELEMENTS**

**COURSE CODE: R18 ME4203**

**COURSE CATEGORY: APPLIED**

**CREDIT: 06**

### Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
4	2	3	80	20	-	25	25	150

### Rationale:

The Diploma Engineers in practical field come across the situations involving design and drafting of machine components and assemblies incorporating various aspects of design such as strength, rigidity, functional design, ergonomic considerations, economy etc. This course aims at providing exposure to a student in the design considerations of various mechanical components.

### Course Outcomes:

1. Understand the basic design principles and apply them to determine dimensions of simple machine parts.
2. Design the shaft based on strength and rigidity basis for various loading conditions.
3. Determine the dimensions of key and design the coupling for given application.
4. Design spring for given application.
5. Design the power screw for given loading condition.
6. Understand significance of bearing and basic principles of load-life relationship and mountings.

### Course Details:

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS
UNIT NO. 1	<b>Introduction:</b> 1.1 Machine Design procedure, General considerations in Machine Design 1.2 Designation of materials as per B.I.S., Stress concentration:	1. List design parameters. 2. Apply basic concepts of design in regular life. 3. Determine the various compositions in a	12	16

	<p>meaning, causes and remedies.</p> <p>1.3 Finding maximum shear stress and principal normal stress analytically and graphically (Mohr's circle), Theories of elastic failures, Preferred Numbers.</p> <p>1.4 Use of Design Data Book for standard design parameters</p> <p>1.5 Aesthetic and ergonomic considerations in design.</p> <p>Design of simple machine parts subjected to direct tension, compression</p>	<p>material.</p> <p>4. Use of Handbook for design of machine elements.</p>		
<b>UNIT NO. 2</b>	<p><b>Design of Shafts</b></p> <p>2.1 Types of shafts, materials, Standard shafts available, Forces resulting Torsion. Design as per A.S.M.E. code</p> <p>2.2 Design of Shafts (hollow and solid) on the basis of rigidity and strength, Line shafts supported between bearings carrying one or two pulleys in between or one overhung pulley.</p>	<p>1. Design a various types of joint.</p> <p>2. Calculate dimensions of various lever/link.</p>	<b>10</b>	<b>12</b>
<b>UNIT NO. 3</b>	<p><b>Design of Keys and Couplings</b></p> <p>3.1 Types of Keys and their applications, Design of Keys (Rectangular and Square keys.)</p> <p>3.3 Design of Couplings – Muff or Box coupling, Protected flanged coupling, Bushed Pin Type of Flexible Coupling.</p>	<p>1. Explain the design procedures for types of keys.</p> <p>2. State the types of couplings and explain the design procedures for types of couplings.</p>	<b>10</b>	<b>12</b>
<b>UNIT NO. 4</b>	<p><b>Design of Springs</b></p> <p>4.1 Classification, Application and Function of Springs, Material selection &amp; Specification of Springs, Spring terminology. Wahl's Correction factor.</p> <p>4.2 Design of Helical Compression and Tension Spring for I.C. Engine Valves, Weighing Balance, Railway Buffers--- for gradually applied loads.</p> <p>4.3 Semi elliptical Leaf springs: Construction &amp; applications.</p>	<p>1. Explain the classification of different types of springs.</p> <p>2. Explain the design procedure for helical springs.</p> <p>3. State the different applications of springs.</p>	<b>10</b>	<b>12</b>
<b>UNIT NO. 5</b>	<p><b>Design of Power Screws:</b></p> <p>5.1 Types of thread profiles used in power screws, merits and demerits, Torque required to overcome thread friction while raising and lowering</p>	<p>1. State the Merits and Demerits of various types of thread profiles.</p> <p>2. State applications of fasteners.</p>	<b>12</b>	<b>16</b>

	<p>the load.</p> <p>5.2 Design of Power Screw with consideration of Maximum Principal Stress &amp; Shear Stress theory.</p> <p>5.3 Condition for self-locking and overhauling, efficiency of screw thread, Torque required to overcome collar friction, overall efficiency.</p> <p>5.4 Design of Screw Jack, Screw Press, C clamp, Toggle jack.</p>	<p>3. Explain the design procedure for power screw.</p> <p>4. Derive the condition for self locking and overhauling of screw threads.</p>		
<b>UNIT NO. 6</b>	<p><b>Bearings:</b></p> <p>6.1 Classification of bearings, comparison, advantages and disadvantages of sliding contact bearing and rolling contact bearings.</p> <p>6.2 Static and Dynamic load ratings, bearing life, Average life. Load-life relationship. Selection of ball bearings and roller bearings from manufacturers' catalogue.</p> <p>6.3 Bearing Mountings &amp; lubrication.</p>	<p>1. Explain the design procedure for bolted and welded joints.</p> <p>2. Explain the various stresses induced in screwed fastenings.</p> <p>3. Classify and select the suitable bearings according to applications.</p>	<b>10</b>	<b>12</b>

### SUGGESTED EXERCISES/PRACTICALS:

<b>S. No.</b>	<b>Unit No.</b>	<b>Practical Exercises (Outcomes' in Psychomotor Domain)</b>	<b>Approx. Hrs. Required</b>
1.	1	Assignment on aesthetic and ergonomic considerations in design and design for manufacturing	2
2.	2	Design of shaft subjected to combined bending and twisting moments in both axes involving inclined loads (belt tensions)	4
3.	5	Design of C-clamp (power screw and section design)	4
4.	4	Design of springs for practical application	4
5.	6	Study of various arrangements of bearing mountings	2
<b>Total</b>			<b>16</b>

<b>Sr. No.</b>	<b>Unit No.</b>	<b>DESIGN PROJECTS</b>	<b>Approx. Hrs. Required</b>
1.	3	Design and draw bushed pin type flexible Coupling	8
2.	5	Design and draw Screw Jack	8
<b>Total</b>			<b>16</b>

The design project consist of half imperial sheets involving assembly drawing with overall dimensions, bill of material and details of individual components with dimensional tolerances, geometrical tolerances, surface finish symbols etc. so as to make it a working drawing. A design report giving all necessary calculations of the design of components along with the sketches shall be submitted in a separate file.

### **SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN:**

<b>Unit No.</b>	<b>Unit Title</b>	<b>Teaching Hours</b>	<b>Distribution of Marks</b>			
			<b>R Level</b>	<b>U Level</b>	<b>A Level</b>	<b>Total</b>
1	Introduction	12	6	6	4	16
2	Design of Shafts	10	3	3	6	12
3	Design of Keys and Couplings	10	3	3	6	12
4	Design of Springs (Tension & Compression)	10	4	4	4	12
5	Design of Power Screws	12	4	6	6	16
6	Bearings	10	4	4	4	12
<b>Total</b>		<b>64</b>	<b>24</b>	<b>26</b>	<b>30</b>	<b>80</b>

### **MAJOR EQUIPMENT/ INSTRUMENT REQUIRED:**

<b>Sr. No.</b>	<b>Equipment Name With Broad Specifications</b>	<b>Exp. Sr. No.</b>
1	Mini drafter	All
2	Solid models	3,4

### **TEACHING METHODOLOGY:**

Chalk-Board, Discussions, Charts, Models, PPT.

#### **i) Intellectual Skills:**

- Apply and use the basic knowledge of earlier courses like mechanical engineering materials, strength of materials and theory of machines.
- Understand types of failures of machine components and decide the design criteria and Equations.
- Understand the concept of standardization and selecting standard components.

#### **ii) Motor Skills:**

- Draw the components assembly as per the designed dimensions.
- Use of various IS codes (standards) to select standard sizes of components.

## SUGGESTED LEARNING RESOURCES

### REFERENCE BOOKS:

SR. NO.	AUTHOR	TITLE	PUBLISHER
1	V. B. Bhandari	Introduction to Machine Design	Tata McGraw Hill Pub. Ltd.
2	P. V. Mandke	Text Book of Machine Design	Nirali Prakashan, Pune.
3	R. S. Khurmi	Text Book of Machine Design	S. Chand & Co. Ltd., New Delhi
4	G.E. Dieter	Engineering Design: A Materials and Processing Approach	Tata McGraw Hill Pub. Ltd.
5	--	Design Data Book	PSG College of Technology, Coimbatore.

### Mapping matrix of CO's, PO's and PSO's:

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PS2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
C01	3	0	2	0	0	1	1	3	0	1
C02	2	1	2	0	1	0	1	2	1	1
C03	2	1	2	0	1	1	1	2	1	1
C04	2	2	2	1	1	0	1	2	1	1
C05	2	2	2	1	1	0	1	2	1	1
C06	1	1	1	1	1	1	1	2	1	1

**3: High 2: Moderate and 1: Low Relationship.**

**DIPLOMA PROGRAMME: MECHANICAL ENGINEERING**

**COURSE: INDUSTRIAL ENGINEERING, ESTIMATING & COSTING**

**COURSE CODE: R18ME4204**

**COURSE CATEGORY: Applied**

**CREDIT: 05**

**Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
3	2	3	80	20	-	-	25	125

**Rationale:**

Diploma Technician is mainly operating in a particular type of production system in which he has to understand & operate the production system. Diploma Technician should have sound knowledge of operational & theoretical aspects of Production system like Productivity, Product design, Different cost & cost estimation, Plant layout, Material handling, Process planning, Time & motion study, Jigs & fixtures, Inventory control. Proper understanding & exposure to these aspects will improve the skills & proficiencies of Diploma Technician while dealing & operating with the production systems.

**Course Outcomes:**

1. Estimate machining time and depreciation cost of product.
2. Justify present and proposed method of doing work with principles of motion economy.
3. Estimate standard time of the job.
4. Estimate cost of product and Break Even Quantity & Economic Order Quantity.
5. Prepare process sheet for given component.
6. Suggest changes in plant layout and Plant Maintenance.

**Course Details:**

UNIT	NAME OF THE TOPIC (with Details)	LEARNING OUTCOME	HOURS	MARKS
<b>UNIT NO. 1</b> <b>Estimation, Depreciation, Calculation of Machining Time</b>	<p><b>1.1 Estimation :</b> Objective of cost estimation, functions of estimating department, Functions of estimator.</p> <p><b>1.2 Calculation of Machining Time</b> for operations such as lathe work, Milling, operations on shaping or planning and grinding machines. To estimate fabricated and sheet metal jobs.</p> <p><b>1.3 Depreciation &amp; Obsolescence:</b> Definition, classification of depreciation, methods of calculating such as straight line method and reducing installment method (Numericals on both methods). Concept of Obsolescence.</p>	1.Explain the terminology of Estimating, need, scope & importance of Estimating in industries. 2.Calculate Machining Time considering all parameters. 3.Explain the terminology depreciation & Obsolescence. 4.Calculate depreciation by different methods.	<b>10</b>	<b>16</b>
<b>UNIT NO.2</b> <b>Productivity and Work Study</b>	<p><b>2.1 Productivity and Work Study:</b> Meaning of productivity, three basic ways to increase productivity. concept, basic work content, and excess work content, causes of excess work content, management techniques to reduce work content.</p> <p><b>2.2</b> Introduction to work study, method study and work measurement.</p> <p><b>2.3 Method Study:</b> Definition of method study, steps in method study, process chart symbols and conventions. Process charts: OPC, FPC, MAC, Two handed process chart, flow diagram and string diagram. Critical examination for improving a</p>	1.Explain the terms productivity, work study, method study, basic work content, and excess work content. 2.Explain basic steps in Method study and prepare various process charts and diagrams related to it. 3.Concept of principles of motion economy.	<b>08</b>	<b>12</b>

	<p>process, governing considerations for critical examination (primary and secondary questions), check list of purpose, person, sequence, place and means. Therbligs and SIMO chart.</p> <p><b>2.4 Principles of Motion</b></p> <p><b>Economy:</b></p> <p>Rules concerning use of human body, rules concerning arrangement of work place and rules concerning tools and equipment, design of work place layout.</p>			
<b>UNIT NO.3</b>  <b>Work Measurement &amp;</b>  <b>Performance Rating</b>	<p><b>3.1 Work Measurement :</b> Work measurement concept, work measurement techniques: time study, P.M.T.S., analytical estimating., <b>P.M.T.S.:</b> definition, basic manual motions, brief description of Reach, Move, Turn, Grasp, Position, Disengage, and Release load.</p> <p><b>3.2 Analytical Estimating:</b> definition, salient features, and procedure in brief. <b>Time Study:</b> Time study procedure, cumulative timing and snap back timing method. Breaking the task into elements, types of elements, why to break a task into elements? Allowances: definition, Need, Types. Definition of observed time, normal time and standard time.</p> <p><b>3.3 Performance Rating &amp; Incentives:</b> Standard time computation (problems to find standard time), Standard data: definition and types of standard data. Concept of Incentives, group incentives,</p>	<p>1.Explain term work measurement and techniques related to it. 2.Explain procedure and various concepts of Time study. 3.Explain term allowances Need, Types. 4.Explain concept of Performance Rating, Incentives and types of incentives.</p>	<b>08</b>	<b>12</b>

	Halsey incentive plan.			
<b>UNIT NO.4</b>  <b>Costing, Break Even Analysis, Economic Order Quantity</b>	<p><b>4.1 Costing:</b> Introduction to costing, types of cost: fixed and variable cost, material and labour cost, Expenses: direct and indirect expenses. Components of cost, types of overheads: factory, administrative or office, selling &amp; distribution overheads. Selling price. Advantages of efficient costing.</p> <p><b>4.2 Break Even Analysis :</b> Break even point, margin of safety, angle of incidence, determination of break even point, application of break even point, problems to find break even point. Make or Buy decision, criteria for make or buy decision.</p> <p><b>4.3 Economic Order Quantity</b> and Economic manufacturing (lot) quantity. Simple problems</p>	<ol style="list-style-type: none"> <li>1. Explain the terminology of Costing,</li> <li>2. Compare costing and Estimating, cost elements, Overheads, selling price.</li> <li>3. Explain Break Even Analysis and various terminologies.</li> <li>4. Explain term Economic Order Quantity, and solve numerical related it.</li> </ol>	<b>08</b>	<b>16</b>
<b>UNIT NO.5</b>  <b>Production planning and control</b>	<p><b>5.1 Production, Planning and Control :</b> Definition and objectives of production, planning and control, functions of production planning and control. Concept, necessity and importance of production planning (men, machine and material), routing, scheduling, dispatching, follow up, corrective action, and estimation as functions of production planning and control.</p> <p><b>5.2 Process Engineering and Process Planning :</b> Scope and procedure of process planning. Operation planning and sequence of operation planning, preparation of process planning sheet for a simple component. Factors</p>	<ol style="list-style-type: none"> <li>1. Explain concept, functions and importance's of production, planning and control.</li> <li>2. Explain concept, Scope, procedure, sequence of process planning. Operation planning.</li> <li>3. Prepare process planning sheet and Gantt chart.</li> </ol>	<b>08</b>	<b>12</b>

	affecting process planning. Gantt chart.			
<b>UNIT NO.6</b>  <b>Plant layout and plant maintenance</b>	<p><b>6.1 Plant Layout:</b> Objectives of plant layout, symptoms of good and bad layout. Types of layout: Description, advantages, limitations and applications of product layout, process layout, fixed position layout and combination layout.</p> <p><b>6.2 Plant Maintenance:</b> Definition and importance of maintenance. Types of maintenance. Description, advantages, limitations and applications of Preventive maintenance, Breakdown maintenance and Scheduled maintenance. Predictive maintenance and condition monitoring.</p>	<ol style="list-style-type: none"> <li>1. Explain Objectives of plant layout, symptoms of good and bad layout.</li> <li>2. Explain types, advantages, limitations and applications of plant layout.</li> <li>3. Explain concept, types, advantages, limitations and applications of Plant Maintenance.</li> </ol>	<b>06</b>	<b>12</b>

### SUGGESTED EXERCISES/PRACTICALS:

<b>Sr. No.</b>	<b>Unit No.</b>	<b>Practical Exercises/Assignments(Any 8) (Outcomes' in Psychomotor Domain)</b>	<b>Approx. Hrs. Required</b>
1.	2	Prepare O.P.C. and F.P.C. for existing and proposed method.	4
2.	2	Prepare M.A.C. and two handed process chart for existing and proposed method.	4
	2	Understand critical examination procedure in method study.	4
3.	2	Apply principle of motion economy and design of work place layout.	4
4.		Understand Production, Planning and Control	4
5.	3	Calculate standard time of job by different timing methods.	4
6.	1	Calculate machining time for a job.	4
7.	1	Calculate depreciation fund by straight line method and reducing installment method.	4
8.	6	Draw and compare different plant layouts.	4
9.	4	Understand Economical Order Quantity and Break Even Analysis.	4

<b>10.</b>	2	Prepare O.P.C. and F.P.C. for existing and proposed method.	4
<b>Total</b>			<b>32</b>

### SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN:

<b>Unit No.</b>	<b>Unit Title</b>	<b>Teaching Hours</b>	<b>Distribution of Marks</b>			
			<b>R Level</b>	<b>U Level</b>	<b>A Level</b>	<b>Total</b>
1	<b>Estimation, Depreciation, Calculation of Machining Time</b>	10	02	06	08	16
2	<b>Productivity and Work Study</b>	08	02	06	04	12
3	<b>Work Measurement &amp; Performance Rating</b>	08	04	04	04	12
4	<b>Costing, Break Even Analysis, Economic Order Quantity</b>	08	04	06	06	16
5	<b>Production planning and control</b>	08	04	04	04	12
6	<b>Plant layout and plant maintenance</b>	06	02	06	04	12
<b>TOTAL</b>		<b>48</b>	<b>18</b>	<b>32</b>	<b>30</b>	<b>80</b>

### TEACHING METHODOLOGY:

Chalk Board, Discussions, Power Point Presentations, Visits, Charts.

#### i) Intellectual Skills :

- Selection of appropriate method of manufacturing.
- Understand the concept of performance rating.
- Know the objectives of estimation and costing.
- Identify machining time and cost of a product.

#### ii) Motor Skills:

- Enhance presentation skills through case studies.
- Prepare graphical layout of an organisation/department/section.
- Calculation of standard time for completion of a job.

### SUGGESTED LEARNING RESOURCES

#### F) REFERENCE BOOKS:

<b>SR. NO.</b>	<b>AUTHOR</b>	<b>TITLE</b>	<b>PUBLISHER</b>
1.	L.C. Jhamb	Work Study and Ergonomics	Everest Publishing House, 1990.
2.	T.R. Banga and S.C.Sharma	Mechanical Estimating and Costing	Khanna Publishers, 1997.

3.	Samuel Eilon	Elements Of Production And Control	Universal Publishing Corporation Bombay, 2001.
4.	International Labour Office, Geneva	Introduction To Work Study	1981.
5.	K.G.Lockyer	Factory And Production Management	The English Language Book Society and Pitman Publishing, 1978.
6.	O.P. Khanna	Industrial Engineering And Management	Dhanpat Rai and Sons, 1992.

### Mapping matrix of CO's, PO's and PSO's:

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PS2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	2	0	0	1	0	2	1	2	0	3
CO2	2	2	2	1	1	3	2	1	2	1
CO3	0	1	1	2	1	2	2	0	2	2
CO4	1	0	0	1	0	2	1	1	0	3
CO5	2	0	0	2	0	1	2	0	1	3
CO6	0	1	2	2	1	2	1	0	2	1

**3: High Relationship, 2: Medium Relationship, 1: Low Relationship**

# CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1

## DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

**COURSE: METROLOGY & QUALITY CONTROL**

**COURSE CODE: R18ME4205**

**COURSE CATEGORY: APPLIED**

**CREDIT: 06**

### Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
4	2	3	80	20	25	-	25	150

### Rationale:

Mechanical engineering diploma holders often come across different measuring instruments. He/She should be able to select the proper instrument for the measurement of the machined component based on its tolerances. He/She should be able to use these measuring instruments to measure various quality characteristics. Also he/he should be able to analyze the data (reading taken) by the instruments from statistical quality control point of view.

### Course Outcomes:

5. Contribute quality system for certification of ISO/QS.
6. Draw the trends using graphical and statistical parameters for data.
7. Select appropriate sampling plan for decision making.
8. Estimate limits, fits and tolerances for given drawings.
9. Measure /monitor quality parameters using instruments for given components.

### Course Details:

UNIT	NAME OF THE TOPIC (with Details)	LEARNING OUTCOME	HOURS	MARKS
UNIT NO.1	<b>1.1 Elements of quality:</b> Meaning of quality, quality of design, quality of conformance, quality of performance, Availability, Reliability, Maintainability, Customer service.  <b>1.2 Economics of quality-</b> cost and value of	1. Explain elements of quality control. 2. Differentiate between traditional approach & TQM approach. 3. State various types of cost	12	16

	<p>quality. Elements of quality costs: Failure cost, appraisal cost, prevention cost. Effect of quality of conformance and design on quality cost. Optimum quality of design.</p> <p><b>1.3</b> Difference between inspection and quality control. Inspection planning, planning of quality through trial lots. Quality policies. Quality assurance. Vendor rating &amp; Vendor quality rating. Importance of quality mindedness. Quality circle, Quality audit.</p> <p><b>1.4 ISO 9000 series-</b> concept, importance and Implication. Concept of total quality management, difference between Traditional approach and TQM approach Product certification and Quality system certification.</p>	<p>associated with quality.</p> <p>4. Explain quality planning &amp; importance of quality mindedness.</p> <p>5. Explain ISO certification Concept &amp; its fundamentals.</p>		
<b>UNIT NO.2</b>	<p><b>2.1 Elementary Study of Statistics:</b> Arithmetic mean, median, mode, range, standard deviation, frequency distribution, pictorial representation of Statistical data, normal distribution curve. (Numerical on statistics).</p> <p><b>2.2 Statistical Quality Control: Process</b> capability study, process capability of machine, statistical limits, different possibilities, rejection areas, capable and incapable process. Control charts: inherent and assignable sources of variation, control charts by variables- X and R chart; control charts by Attributes- p, np, c charts (Numerical on Control Charts).</p>	<p>1. Calculate Arithmetic mean, median, mode, range, standard Deviation, frequency distribution.</p> <p>2. Representation of statistical data &amp; normal distribution curve.</p> <p>3. Explain various process charts used in statistical quality controls.</p>	<b>10</b>	<b>12</b>
<b>UNIT NO.3</b>	<p><b>3.1 Acceptance Sampling-</b> Operating characteristic curve, its important Characteristics. AQL, process average, RQL (LTPD), producer's risk, consumer's risk, AOQ, AOQL. Advantages and disadvantages of sampling, Types of sampling plans: Single, double and multiple sampling Plans. (No numerical).</p> <p><b>3.2 Limits, Fits and Gauges:</b> Terminology, designation of hole and shaft, grades of</p>	<p>1. Explain various terms &amp; types of acceptance sampling select appropriate fits, tolerances &amp; gauges for specific components.</p> <p>2. Describe Taylor's principle for gauge design.</p> <p>3. Design of plug gauge, ring gauge and snap</p>	<b>10</b>	<b>12</b>

	<p>tolerance and fundamental deviation. Clearance, interference and transition fits, guide for selection of fits, interchangeability and selective assembly, push fit, press fit, shrink fit. Limit gauges, plug gauges, ring Gauges, and snap gauges, adjustable snap gauge (Numerical on finding the limits of hole &amp; shaft).</p> <p><b>3.3</b> Taylor's principle of gauge design, gauge maker's tolerance and wear allowance. Design of plug gauge, ring gauge and snap gauge.</p>	<p>gauge.</p>		
<b>UNIT NO.4</b>	<p><b>4.1 Metrology:</b></p> <p>Definition of metrology, need of inspection in industries, precision, accuracy, sensitivity, readability, calibration, reproducibility, Traceability, magnification. Sources of error: - Systematic errors, random errors, precautions while using an instrument for getting higher precision and accuracy, selection of instruments.</p> <p><b>4.2 Measuring Instruments:</b> Zero error concept of instruments, Study and use of different types of Vernier calipers and micrometers, Vernier height Gauge and depth gauge. Standards: - line standard, end standard, wavelength standard. Slip gauges and length bars. (Numerical on setting of slip gauge).</p>	<ol style="list-style-type: none"> <li>1. Explain metrology terms &amp; different types of error.</li> <li>2. Describe construction &amp; working of Vernier calipers, micrometers, Vernier height gauge and depth gauge.</li> <li>3. Calculation by setting of slip gauges.</li> </ol>	<b>10</b>	<b>12</b>
<b>UNIT NO.5</b>	<p><b>5.1 Comparators:</b> Definition, advantages, limitations and uses of comparators such as Electrical, optical, Sigma comparator and Pneumatic comparator</p> <p><b>5.2 Dial Indicators:</b> Requirement of good dial indicator, working mechanism, Advantages, limitations and uses of dial indicator. Precautions while using dial indicator.</p> <p><b>5.3 Angular Measurement:</b> Instruments for angular measurement, Working &amp; use of Vernier bevel protractor, sine bar, spirit level, angle gauges (Numerical on</p>	<ol style="list-style-type: none"> <li>1. Explain construction &amp; working of comparators &amp; state its types.</li> <li>2. Describe construction &amp; working mechanisms of dial indicators.</li> <li>3. Measure &amp; calculate angles by angular measurement instruments.</li> <li>4. Explain straightness, flatness, squareness, parallelism and circularity.</li> <li>5. Explain alignment test on</li> </ol>	<b>12</b>	<b>16</b>

	<p>setting of angle gauges). Principle of working of autocollimator and angle dekkor.</p> <p><b>5.4 Geometric Features:</b> Definition of straightness, flatness, squareness, parallelism and circularity. <b>Straightness:</b> straightness testing using Straight edge, spirit level or autocollimator. <b>Flatness:</b> Measuring flatness by dial indicator, Autocollimator and Optical flat.</p> <p><b>Squareness:</b> squareness testing with dial indicator, autocollimator.</p> <p><b>Parallelism Testing:</b> - Between two axes, two planes, axis to a plane, trajectory and plane, trajectory to an axis, two trajectories.</p> <p><b>Circularity and Roundness:</b></p> <p>Types of irregularities such as ovality, lobing and irregularities of no specific form. Roundness testing by dial indicator.</p> <p><b>5.5 Alignment testing</b> on machine tools.</p>	lathe Machine.		
<b>UNIT NO.6</b>	<p><b>6.1 Measurement of Surface Texture:</b> Primary texture, secondary texture, sampling length, lay, measurement of surface finish, Tomlinson surface meter, Taylor Hobson Talysurf, Ra, Rmax, Rz values. Symbols for designating surface roughness on drawings.</p> <p><b>6.2 Metrology of Screw Threads:</b> Screw thread terminology, errors in threads, pitch errors, measurement of effective diameter using two wire And three wire methods. Thread gauges.</p> <p><b>6.3 Measurement and Testing of Gears:</b> Terminology of gears, analytical and functional inspection, rolling test, Gear tooth Vernier caliper Measurement of tooth thickness (Chordal thickness method).</p> <p><b>6.4 Measuring Machines:</b> - Working of</p>	<ol style="list-style-type: none"> <li>1. Explain various terms regarding surface texture.</li> <li>2. Draw Symbols for designating surface roughness.</li> <li>3. Describe screw thread terminology &amp; errors.</li> <li>4. Calculate effective diameter by two wire &amp; three wire method.</li> <li>5. Calculate tooth thickness by using gear tooth Vernier caliper.</li> </ol>	<b>10</b>	<b>12</b>

	Optical profile projector, CMM (Coordinate Measuring Machine):- Its features and applications.		
--	--	--	--

### SUGGESTED EXERCISES/PRACTICALS:

Sr. No.	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
1.	IV	To measure physical dimensions of given component using vernier caliper, vernier height gauge and depth gauge in combination of non-precision instruments.	02
2.	IV	To measure physical dimensions of given component using inside and outside micrometer, extension rod type micrometer in combination of non-precision instruments.	02
3.	IV	To build the dimension using slip gauges and identify the errors of vernier caliper and micrometer using slip gauges.	02
4.	IV	To verify acceptance or rejection of given components using limit gauges.	02
5.	IV,V	To compare dimensions of component with standard slip gauge using dial indicator.	02
6.	IV	To compare inner/outer diameter of the given component with standard gauge using pneumatic comparator.	02
7.	V	To measure unknown angle of the given component using vernier bevel protractor, sine bar and angle gauges.	04
8.	V	Use of autocollimator and angle dekkor to check straightness and inclination of the surface.	02
9.	V	To compare flatness of the surface using optical flats.	02
10.	V	To conduct alignment test on lathe / drilling machine.	04
11.	VI	To measure the screw thread elements using screw pitch gauge, screw thread micrometer and floating carriage micrometer.	02
12.	VI	Measure the gear (or screw) elements using gear tooth vernier caliper and profile projector.	02
13.	II	Draw the frequency histogram, frequency polygon, normal distribution curve and Ogive curve for given samples and find mean, mode, median, standard deviation, variance and range.	02
14.	II	To draw and interpret the control limit for variable measurement (X and R chart). Or (P and C chart).	02
<b>Total</b>			<b>32</b>

## SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN:

Unit No.	Unit Title	Teaching Hours	Distribution of Marks			
			R Level	U Level	A Level	Total
1	Quality control	12	4	8	4	16
2	Statistical quality control	10	2	6	4	12
3	Acceptance sampling and limits, fits & tolerances	10	2	6	4	12
4	Metrology	10	2	4	6	12
5	Comparators	12	4	6	6	16
6	Measurement of surface texture, screw thread & gears	10	2	6	4	12
<b>TOTAL</b>		<b>64</b>	<b>16</b>	<b>36</b>	<b>28</b>	<b>80</b>

### MAJOR EQUIPMENT/INSTRUMENT REQUIRED:

SR.NO.	EQUIPMENT NAME WITH BROAD SPECIFICATIONS	EXP.SR.NO.
1.	Vernier Caliper 0-200mm, Micrometer 0-25mm & 25-50mm, Vernier Height Gauge 0-300mm, Vernier Depth Gauge 0-200mm	1 and 2
2.	Slip Gauge box	3
3.	Limit Gauges- Plug gauge, Ring Gauge, Snap gauge	4
4.	Dial Indicator with magnetic stand	5
5.	Pneumatic Comparator (Dial Type)	6
6.	Vernier Bevel Protractor, Sine Bar and Angle Gauge set	7
7.	Autocollimator, Angle Dekkor.	8
8.	Optical Flat with monochromatic light source.	9
9.	Screw pitches gauge, Screw thread micrometer and Floating carriage micrometer.	11
10.	Gear tooth vernier caliper and Optical profile projector.	12

### TEACHING METHODOLOGY:

Chalk Board, Discussions, Power Point Presentations, Visits, Charts.

#### I. Intellectual Skills:

- Select correct instrument for particular measurement.
- Identify different parts of instruments.
- Interpret the data into readings.

- Understand concept, working principle and parts of various instruments.
- Reading of scales of various instruments considering errors.

## **II. Motor Skills:**

- Handling various instruments.
- Setting of instruments with accessories.
- Measure various parameters and comparing with standards.

## **SUGGESTED LEARNING RESOURCES:**

### **G) REFERENCE BOOKS:**

<b>Sr.No.</b>	<b>Title of Book</b>	<b>Author</b>	<b>Publication</b>
<b>1</b>	Engineering Metrology	R. K. Jain	Khanna Publisher.
<b>2</b>	Engineering Metrology	I.C.Gupta	Dhanpat Rai publication
<b>3</b>	Metrology & Quality Control	S.N Mahajan, S.C. Shilawant, N.M. Ambadekar, R.A. Tamboli	NIRALI PUBLICATION
<b>4</b>	Metrology & Quality Control	A.B. Auti	Tech-Max Publication
<b>5</b>	Metrology & Quality Control	R.P.Arora.	Tech-Max Publication
<b>6</b>	Metrology & Quality Control	S.R.Chintakindi, S.S.Ganpule	Technova Publication
<b>7</b>	Metrology & Quality Control	M.S. Mahajan, D.S.Chaudhari	New Vrinda Publication
<b>8</b>	Text Book Of Metrology	M.Mahajan	Dhanpat Rai publication
<b>9</b>	Metrology & Measurement	Anand K. Bewoor, Vinay A. Kulkarni	TMH
<b>10</b>	Metrology & Quality Control	S.G.Tillu, L.G. Navale, V.R.Sable, S.R.Chintakindi	Nirali Publication
<b>11</b>	Metrology & Quality Control	S.S.Kuber	Nirali Publication
<b>12</b>	Metrology(Lab Manual)	R.Bahl, M.Adithan	TTTI

## SOFTWARE/LEARNING WEBSITES:

1. <https://www.youtube.com/watch?v=ySRN3yuZUT0>
2. [https://www.youtube.com/watch?v=2-cm\\_ocn9p4](https://www.youtube.com/watch?v=2-cm_ocn9p4)
3. <https://www.youtube.com/watch?v=Hi7NUJdznc0>
4. <https://www.youtube.com/watch?v=owiuBoVooY4>
5. <https://www.youtube.com/watch?v=50qt5k1IqwI>
6. <https://www.youtube.com/watch?v=WlcA1iJH1iE>
7. <https://www.youtube.com/watch?v=wqc5cG9npwo>

## Mapping matrix of CO's, PO's and PSO's:

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PSO2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	1	0	1	2	1	1	2	0	2	3
CO2	2	2	1	0	0	0	2	2	0	2
CO3	1	1	0	2	0	1	1	0	2	1
CO4	2	0	1	0	0	0	2	1	0	1
CO5	2	2	1	3	0	1	3	1	1	2

## 3: High 2: Moderate and 1: Low Relationship

# CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1

## DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

COURSE: ADVANCED MANUFACTURING TECHNOLOGY COURSE CODE: R18ME4208

COURSE CATEGORY: APPLIED

CREDIT: 06

### Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
4	2	3	80	20	50	-	25	175

### Rationale:

Diploma Engineers need to acquire the knowledge of CAD, CAM, CIM, GT, FMS, SM, Automation and Robotics after getting conversant with conventional manufacturing technology. With advent of technology there are many improvements & many advances in manufacturing technology. As a part of these, conventional machine tools and technology have undergone metamorphic changes in their construction, working & control by incorporating CNC, CAD, CAM, CIM, GT, FMS, SM, and Automation &Robotics. Diploma engineers being in direct contact with manufacturing should possess understanding of advances in manufacturing areas & related emerging trends and technology. To make their working prominent in field it is necessary to give these basic inputs about their advances. To cope up with the upcoming emerging industrial demands, the Technical Institutes are to be tuned to educate and train their students to meet the upcoming requirements of the industrial revolution.

### Course Outcomes:

1. Compare conventional product cycle and CAD/CAM/CIM product cycle.
2. Understand construction and working of CNC machine.
3. Develop, verify, simulate and execute CNC program.
4. Adopt safety practices while working on CNC machines.
5. Develop the mindset for advanced trends in manufacturing technology like (FMS, SM, Automation, and Robotics).

**Course Details:**

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS
<b>UNIT NO.1</b> <b>CAD/CAM /CIM</b>	<p><b>1.1 Traditional product cycle:</b>  <b>Marketing-</b>Market survey, recognition of customer needs.  <b>R&amp;D-</b> Product concept, reverse engineering, prototype.  <b>Design-</b>Design, analysis, optimization &amp; evaluation of design.  <b>Manufacturing-</b>Process planning, tool design and procurement, material procurement, production planning, production control and quality control.  <b>Sales-</b>sales analysis and comparison with competitors. Advantages and disadvantages of traditional product cycle.</p> <p><b>1.2 CAD/CAM/CIM product cycle:</b>  Advantages and disadvantages.  <b>Marketing-</b> Customer relationship management (CRM)  <b>R&amp;D-Rapid</b>  prototyping(RPT),software design for manufacturing(DFM),software design for assembly(DFA)  <b>Design-</b>Computer aided design (CAD), Computer aided Engineering (CAE).  <b>Manufacturing-</b> Computer aided processes planning (CAPP), Computer aided manufacturing (CAM) Computer aided quality control (CAQC), programmable logic control (PLC), automatic storage and retrieval system (ASRS).</p> <p><b>1.3 Application of computer in design:</b>  <b>Synthesis:</b> Geometric modeling by CAD software. Software's.  <b>Analysis and optimization:</b> Structural, thermal, stress-strain, kinematic, dynamitic, vibration, fluid flow analysis etc. software's.  <b>Evaluation-</b>Performance of product, quality and reliability etc.  <b>Presentation-</b>Drawing, part list, material specification etc Advantages and disadvantages of CAD/CAM product</p>	1. Define the traditional product cycle. 2. List the various department involved in product cycle. 3. Explain working of various depart in traditional product cycle. 4. Define CAD/CAM/CIM product cycle. 5. State advantages and disadvantages of CAD/CAM/CIM. 6. Explain working of various departments in CAD/CAM/CIM product cycle. 7. Describe meaning of synthesis for design process. 8. Explain use of computer and CAD software to analysis and optimize the part. 9. State use of computer and CAD software to evaluate part. 10. Describe use of computer and CAD software for drawing presentation. 11. Explain use of computer and CAD software in manufacturing. 12. State the elements of CIM. 13. Draw diagram of	<b>09</b>	<b>12</b>

	<p>cycle.</p> <p><b>1.4 Applications of computers in manufacturing:</b> CNC, CAM.</p> <p><b>1.5 Monitoring and control applications:</b> CIM &amp; Smart Manufacturing.</p> <p><b>1.6 Computer Integrated Manufacturing (CIM):</b> Elements of CIM.</p>	<p>CIM and show all elements of it.</p> <p>14. Describe elements of CIM.</p>		
<b>UNIT NO.2</b> <b>CNC Machines</b>	<p><b>2.1 Current manufacturing needs:</b> Production rate, quality, accuracy, repeatability, accuracy, flexibility. Advantages, limitations and applications.</p> <p><b>2.2 Main Components of CNC Machine:</b> Program, machine control unit and machine tool.</p> <p><b>2.3 Constructional elements of CNC:</b>  <b>Machine structure-</b> Bed, slide ways, column and tables.  <b>Spindle drives-</b> Stepper motor, servo motor &amp; hydraulic motor.  <b>Movement's actuators-</b> re-circulating ball screw, linear motion bearings.  <b>Feedback elements-</b> Positional and velocity feed backs.  <b>Automatic tool changer-</b> Tool magazine, turret head.  <b>Pallet changer-</b> Linear and rotary pallet changer.  <b>Miscellaneous elements-</b> Lubrication system, coolant and swarf removal system. Use of hydraulic and pneumatic system for tool holding and pallet changing.</p> <p><b>2.4 Tooling for CNC machine:</b> Concept and need, CNC tool planning.  <b>Types of CNC cutting tools-</b> For turning, milling &amp; drilling CNC machines, types of indexable inserts with its geometry.  <b>Tool holding device-</b> Construction, working &amp; hydraulic tool holding system.</p>	<p>1.Explain current needs of manufacturing technology.</p> <p>2.List main components of CNC machine.</p> <p>3.Explain constructional elements of CNC machine and its functions.</p> <p>4.Classify and study the different constructional elements of CNC machine with respect to, need working, location, characteristics, purpose and importance in CNC machine.</p> <p>5.Explain the meaning of tooling in CNC machine.</p> <p>6.Explain tooling of different CNC machine like lathe, milling, drilling etc.</p>	<b>09</b>	<b>12</b>

<b>UNIT NO.3</b> <b>CNC Programming</b>	<p><b>3.1 Working of CNC machine:</b> Lathe and milling.</p> <p><b>3.2 Classification of CNC:</b> Point-to-point, continuous path, straight path, absolute and incremental co-ordinate system, open loop and closed loop control system.</p> <p><b>3.3 Fundamentals of CNC programming:</b> Program, programming &amp; programmer, stepwise procedure for programming, terminology used for program in word address format (WAF).</p> <p><b>3.4 CNC lathe programming:</b> Machine specifications, Axis identification and nomenclature using right hand rule, basic lathe operations. Calculations of cutting parameters. Concept of machine zero, work zero and reference point. G &amp; M codes. To write program for given components.</p> <p><b>3.5 CNC milling part programming:</b> CNC machine specifications, Types of CNC milling machines. Axis identification and nomenclature using right hand rule. Basic milling operations, calculations of cutting parameters, concept of machine zero, work zero and reference point. G &amp; M codes, tool length compensation, cutter radius compensations. To write programmers for given components.</p> <p><b>3.6 Concept :</b> Canned cycles and subroutine, advantages</p>	1. Explain working of CNC lathe and milling machine. 2. Classification of CNC machines. 3. Understand the fundamentals of CNC programming. 4. Develop, verify and execute the part program on CNC lathe for given component. 5. Develop, verify and execute the part program on CNC milling for given component. 6. Understand the concept of canned and subroutine.	<b>14</b>	<b>16</b>
<b>UNIT NO.4</b> <b>Automation</b>	<p><b>4.1 Automation:</b> Define, need of automation, high and low cost automation, examples of automations.</p> <p><b>4.2 Elements of automation:</b> Power source, control unit and feedback control.</p> <p><b>4.3 Types of automations:</b> Fixed (Hard) automation, programmable automations and Flexible automations (Soft). Comparison of types of automations.</p> <p><b>4.4 Strategies in automation:</b> Simplification, specializations of operations, multiple operations, integration of work stations, increased flexibility, automated material handling storage system, on line inspection, on line monitoring, processes control and optimization, control of plant operations</p>	1.Define the automation and its needs in modern industry. 2.Explain different types of automations and describe each with respect to its characteristics. Differentiate between types of automation. 3.Understand the kind of strategies to be considered while designing automation in	<b>09</b>	<b>12</b>

	and computer integrated manufacturing (CIM),advantages, limitations and industrial applications of automation.	industry.		
<b>UNIT NO.5</b> <b>GT,FMS &amp; SM</b>	<p><b>5.1 Group Technology:</b> Concept, basis for developing part families, part classification and coding with example, concept of cellular manufacturing. Advantages and limitations.</p> <p><b>5.2 Flexible Manufacturing System:</b> Introduction, concept, definition and need, sub systems of FMS, comparing with other manufacturing approaches.</p> <p><b>5.3 Major elements of FMS:</b> Workstations, material handling and storage system, computer control system and human resource.</p> <p><b>5.4 Classification based on flexibility:</b> Dedicated FMS, random order FMS.</p> <p><b>5.5 Classification based on types of layouts:</b> Inline layout types, rotary layout, rectangular layout, loop layout type ladder layout type.</p> <p><b>5.6 FMS:</b> Applications, advantages and disadvantages of FMS.</p> <p><b>5.7 Introduction to Smart Manufacturing(SM):</b> Concept, definitions, evolutions.</p> <p><b>5.8 Elements of SM:</b> Internet of things, digital transformation, artificial intelligent, cloud computing &amp; big data</p>	<ol style="list-style-type: none"> <li>Understand the concept of group technology and its benefits.</li> <li>Understand concept of FMS need and compare it with other manufacturing processes.</li> <li>Study of major elements of FMS.</li> <li>Classify the FMS based on flexibility and based on types of layout.</li> <li>Knowing the applications, benefits, advantages and disadvantages of FMS.</li> <li>Define the SM.</li> <li>State evolution of SM.</li> <li>Explain elements of SM.</li> </ol>	<b>09</b>	<b>12</b>
<b>UNIT NO.6</b> <b>Robotics</b>	<p><b>6.1 Introduction:</b> definition of robot and robotics, advantages disadvantages.</p> <p><b>6.2 Basic components of robot:</b> Manipulator, end effectors, actuators, sensors, controller, processor and software.</p> <p><b>6.3 Robot joints:</b> Linear, orthogonal, rotational, twisting and revolving.</p> <p><b>6.4 Degree of freedom of robot:</b> Vertical, radial, rotational traverse, wrist pitch, wrist yaw wrist roll.</p> <p><b>6.5 Actuators:</b> Mechanical, hydraulic, pneumatic and electric.</p> <p><b>6.6 End effectors:</b> Grippers and types.</p> <p><b>6.7 Robot sensors:</b> classification of sensors.</p> <p><b>6.8 Basic configuration of robot:</b> Cartesian, cylindrical, polar(spherical)</p> <p><b>6.9 Applications of robot:</b> Loading unloading, material handling, processing</p>	<ol style="list-style-type: none"> <li>Define the robot and robotics. Also state advantages and disadvantages of robot.</li> <li>Explain basic components of robot with suitable diagram.</li> <li>Show different joints in robot with neat sketch.</li> <li>Describe degree of freedom of robot with diagram.</li> <li>List different actuators used in robot and explain it with suitable diagram.</li> <li>Explain types of grippers used in</li> </ol>	<b>14</b>	<b>16</b>

	operations, assembly and inspection.	robot with diagram. 7. Classify the sensors used in robot and explain in brief. 8. With the help of diagram, explain configurations of robot. 9. State various industrial applications of robot.		
<b>TOTAL</b>			<b>64</b>	<b>80</b>

### Suggested Exercises/Practical's:

Sr. No.	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
1.	1, 2 & 3	<b>CNC Lathe:-</b> -To show main components, constructional elements, specifications, tooling, types of tools, tool turret, and tool holders of CNC lathe machine, axis identification, working of CNC lathe. Simple demo of program and its execution.	02
2.	1, 2 & 3	<b>CNC Milling:-</b> -To show main components, constructional elements, specifications, tooling, types of tools, tool magazine, and tool holders of CNC milling machine, axis identification, working of CNC. Simple demo of program and its execution.	02
3.	1, 2 & 3	<b>CNC Lathe:-</b> -To develop program for CNC lathe for facing and step turning operations using G00, G01 and M codes, testing it by simulation software , machine set up, work and tool setting before machining, setting of work zero, machine zero and reference point, execution of program actually on machine.(Job 1)	02
4	1, 2 & 3	<b>CNC Lathe:-</b> -To develop program for CNC lathe for facing and step turning operations using G00, G01 and M codes, testing it by simulation software , machine set up, work and tool setting before machining, setting of work zero, machine zero and reference point, execution of program actually on machine.(Job 1 continue)	02
5	1,2&3	<b>CNC Milling:</b> - To develop program for CNC milling for slot operations using G00, G01 and M codes, testing it by simulation software, machine set up, work and tool setting before machining, setting of work zero, machine zero and reference point, execution of program actually on machine.(Job 2)	02
6	1, 2 & 3	<b>CNC Milling:</b> - To develop program for CNC milling for slot operations using G00, G01 and M codes, testing it by simulation software, machine set up, work and tool setting before machining, setting of work zero, machine zero and reference point, execution of program actually on machine. (Job 2 continue)	02

7	1, 2 & 3	<b>CNC Lathe:-</b> Develop program for CNC lathe for circular interpolation function clockwise operations using G02 and M codes, testing it by simulation software, machine set up, work and tool setting before machining, setting of work zero, machine zero and reference point, execution of program actually on machine.(Job 3)	02
8	1, 2 & 3	<b>CNC Lathe:-</b> Develop program for CNC lathe for circular interpolation function clockwise operations using G02 and M codes, testing it by simulation software, machine set up, work and tool setting before machining, setting of work zero, machine zero and reference point, execution of program actually on machine(Job 3 continue)	02
9	1, 2 & 3	<b>CNC Milling:-</b> Develop program for CNC milling for circular interpolation function clockwise operations using G02 and M codes, testing it by simulation software, machine set up, work and tool setting before machining, setting of work zero, machine zero and reference point, execution of program actually on machine. (Job 4)	02
10	1, 2 & 3	<b>CNC Milling:-</b> Develop program for CNC milling for circular interpolation function clockwise operations using G02 and M codes, testing it by simulation software, machine set up, work and tool setting before machining, setting of work zero, machine zero and reference point, execution of program actually on machine. (Job 4 continue)	02
11	1, 2 & 3	<b>CNC Lathe:-</b> Develop program for CNC lathe for circular interpolation function counter clockwise operations using G03 and M codes, testing it by simulation software, machine set up, work and tool setting before machining, setting of work zero, machine zero and reference point, execution of program actually on machine. (Job 5)	02
12	1, 2 & 3	<b>CNC Lathe:-</b> Develop program for CNC lathe for circular interpolation function counter clockwise operations using G03 and M codes, testing it by simulation software, machine set up, work and tool setting before machining, setting of work zero, machine zero and reference point, execution of program actually on machine. (Job 5 continue)	02
13	1, 2 & 3	<b>CNC Milling:-</b> Develop program for CNC milling for circular interpolation function counter clockwise operations using G03 and M codes, testing it by simulation software, machine set up, work and tool setting before machining, setting of work zero, machine zero and reference point, execution of program actually on machine. (Job 6)	02

14	1, 2 & 3	CNC Milling:- Develop program for CNC milling for circular interpolation function counter clockwise operations using G03 and M codes, testing it by simulation software, machine set up, work and tool setting before machining, setting of work zero, machine zero and reference point, execution of program actually on machine. (Job 6 continue)	02
15	4, 5 & 6	Show different videos on GT, FMS & SM, identify work stations, conveyer, material handling system, AGV etc.	02
16	4, 5 & 6	Show different videos on automation and robotics, SM, identify and study the different automation system and industrial robots etc.	02
<b>TOTAL</b>			<b>32</b>

#### Suggested Specification Table For Question Paper Design:

Unit No.	Unit Title	Teaching Hours	Distribution of Marks			
			R Level	U Level	A Level	Total
1	CAD/CAM/CIM	09	4	4	4	12
2	CNC Machines	09	4	4	4	12
3	CNC programming	14	4	4	8	16
4	Automation	09	4	4	4	12
5	GT ,FMS &SM	09	4	4	4	12
6	Robotics	14	4	8	4	16
<b>TOTAL</b>		<b>64</b>	<b>15</b>	<b>23</b>	<b>42</b>	<b>80</b>

#### Major Equipment/Instrument Required:

Sr. No.	Equipment Name With Broad Specifications	Exp. Sr. No.
01	CNC Trainer LATHE. CUTVIEWER,FATEK PLC CONTROLLER	
02	CNC MILL TRAINER- CUTVIEWER,FATEK PLC CONTROLLER	All Practical's 1 to 14

#### Teaching Methodology:

Chalk Board, Discussions, Power Point Presentations, Videos, Visits, Charts.

##### i) Intellectual Skills:

- Understand the construction and working of CNC machine.
- Understand the fundamentals of CNC programming.
- Develop the CNC part program for lathe and milling machine.
- Develop the mindset for modern trends in manufacturing technology like (FMS,CIM,SM, Automation, and Robotics).

##### ii) Motor Skills:

- Feed the program to control unit and check the program by simulations.
- Operate CNC Lathe and Milling machine.

- Loading and execution of the program on machine.
- Measurement of part and compare with drawing.

### Suggested Learning Resources:

#### Reference Books:

SR. NO.	AUTHOR	TITLE	PUBLISHER
1	Groover M.P. & Zimmers E.W.	Computer Aided Design and Manufacturing	Prentice Hall of India
2	Ibrahim Zeid	CAD/CAM Theory and Practice	Tata McGraw Hill Publishing Co., New Delhi
3	Radhakrishna P. & Subramanyam	CAD/CAM/CIM	Wiley Easteen Ltd
4	Mickell P. Groover	Automation, Production System & CIM	Prentice Hall (I) Pvt. Ltd., New Delhi
5	Mickell P. Groover, Emory W Zimmers Jr	CAD / CAM	Prentice Hall (I) Pvt. Ltd., New Delhi
6	S. R. Deb	Robotics Technology & Flexible Automation	Tata McGraw Hill Pub. Co. Ltd., New Delhi

### Mapping Matrix of CO's, PO's and PSO'S:

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Lifelong learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PSO2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
	CO1	1	0	0	0	1	1	2	1	1
CO2	1	1	0	2	1	1	2	1	1	2
CO3	2	2	2	3	1	1	2	1	1	2
CO4	1	0	0	1	2	1	2	1	1	2
CO5	1	0	0	1	1	1	1	1	1	2

**3: High 2: Moderate and 1: Low Relationship**

**DIPLOMA PROGRAMME: MECHANICAL ENGINEERING**

**COURSE: INDUSTRIAL TRAINING**

**COURSE CODE: R18ME4209**

**COURSE CATEGORY: APPLIED**

**CREDITS: 6<sup>^</sup>**

---

**Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
-	<b>6<sup>^</sup></b>	-	-	-	-	<b>75</b>	<b>75</b>	<b>150</b>

(<sup>^</sup>) Six week industrial training is compulsory after fourth semester (i.e May to June). Though 6 credits are allocated for Industrial Training it is only for awarding marks. As far as teaching load/time table preparation is considered, each faculty would be assigned with one batch of students (equivalent to practical batch size) for guiding the preparation of industrial training report and its evaluation. For this purpose 1 hour (or two hours on working Saturdays) teaching load would be considered.

**Note:**

- During summer break after fourth semester (i.e between fourth and fifth semester), institute/ department will ensure mandatory placement of students for six weeks industrial training. Preferably, the industry where students would be placed should be large or medium scale, however if such industries are not available, then students can also be placed in small or very small industries but it should be relevant to the branch/ discipline. This training would be evaluated during fifth semester.
- Students should prepare report of training, which will be evaluated during fifth semester.

**DIPLOMA PROGRAMME: MECHANICAL ENGINEERING**

**COURSE: PROJECT WORK**

**COURSE CODE: R18ME4210**

**COURSE CATEGORY: APPLIED**

**CREDITS: 4**

**Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
-	<b>4</b>	-	-	-	-	<b>50</b>	<b>100</b>	<b>150</b>

**Rationale:**

The project work should enable the students to integrate the theoretical and practical concepts studied into useful applications. The work should enable students to exhibit their ability to work in a team, develop planning of execution skills and perform analyzing and trouble shooting in successful completion of project. The project report should be a neatly documented record of the principle, applications, detailed and assembly drawings, process sheets, costing and the scope for future development.

**Course Outcomes:**

1. Co-relate theory with practical aspects.
2. Develop and manufacture new/modified equipments.
3. Acquire skills to identify the problem and to take step towards seeking the solution.
4. Record the work systematically and prepare report.

**Term Work:**

Term work shall consist of fabrication of working models, machines, prototypes based on new ideas, experimental set-ups, material handling devices, measurement and control of parameters, jigs and fixtures, renovation of machines, low cost automation application, energy saving devices, recycling of waste, innovative mechanisms, pollution control equipments, equipment operating on non-conventional energy, biotechnology etc.

**SUGGESTED PROJECT WORK AREAS:**

1. Fabrication of small machine / devices/ test rigs/ material handling devices/ jig & fixtures/demonstration models, etc.
2. Design & fabrication of mechanisms, machines, devices, etc.
3. Development of computer program for designing and / or drawing of machine components, Simulation of movement & operation, 3D modeling, pick & place robots.

4. Industry sponsored projects: Project related with solving the problems identified by Industry should be selected. (One person from industry is expected to work as co-guide along with guide from institution).
5. Literature survey based projects: Project related with collection, tabulation, classification, analysis & presentation of the information. Topic selected must be related with latest technological developments in mechanical field, and preferably beyond curriculum.
6. Modification in the existing machinery / equipment for improved performance.
7. Maintenance based projects.
8. Industrial engineering based project: Project based on work study, method study, methods improvement, leading to productivity improvement.
9. Low cost automation projects.
10. Innovative/ Creative projects involving generation of new ideas and converting it into a model, gadget.
11. Market survey based projects.
12. Project based on use of appropriate technology particularly benefiting rural society or economically weaker section.
13. Equivalent level project can be selected from other than the area specified above.

Above work is to be taken up in groups. Each group shall not have more than four (4) students.

#### **Guidelines for Preparation of Project Report:**

1. Project report shall consist of about 40 to 60 pages.
2. Project Report shall be typed / printed on A-4 size paper with 12 font size (Times New Roman) and 1.5 line spacing.
3. Each project group shall prepare  $(N+1)$  copies of the reports,  $(N)$  being the number of students in the group.
4. Figures and tables will be on separate pages and attached at respective places.
5. Front cover shall have the format as shown below with proper spacing.

A PROJECT REPORT ON
(TITLE)
SUBMITTED BY
NAMES & EN.NOs.
UNDER THE GUIDANCE OF

6. The Title Sheet shall be the first sheet and shall contain following with proper spacing.

A PROJECT REPORT ON
(TITLE)
SUBMITTED BY
NAMES & EN.NOs.
UNDER THE GUIDANCE OF

7. The Project Approval Sheet shall follow the title sheet and shall be as shown below with proper spacing.

This is to certify that the project entitled _____ submitted by _____, Enrollment No. _____ for the partial fulfillment for the award of DIPLOMA IN MECHANICAL ENGINEERING of CUSROW WADIA INSTITUTE OF TECHNOLOGY, PUNE, 411001 for academic year 20__-20__ is approved.
---

8. The sequence of the text of the project report shall be as under :

- a) Acknowledgement
- b) Abstract
- c) Index page showing content of text, with page numbers
- d) List of figures (if any)
- e) List of tables (if any)
- f) Introduction, Project Specifications.
- g) Design procedure (if any).
- h) Component drawings with proper dimensioning, machining symbols and tolerances along with the Process Sheets.
- i) Assembly Procedure with difficulties faced.
- j) Test results.
- k) Costing.
- l) Conclusions and scope for future improvements.
- m) References shall be mentioned at the end, followed by appendices (if any).

9. All part drawings and assembly drawing in TWO views shall be prepared using any CAD software.

10. Preferably actual photographs/ video clips showing actual progress of project work be added at the appropriate places in the report.

### **Learning Resources:**

Standard specification tables, websites, etc.

### **Mapping Matrix of CO's, PO's and PSO's**

CO's	PO1 Basic knowledge Discipline specific knowledgee	PO2 Problem analysis	PO3 Design/ development	PO4 Engineering Tools,	PO5 Engineering practices for society,	PO6 Project	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and	PSO2 Communicating effectively to work as a team member or a	PSO3 Pursuing higher studies and engaging
CO1	2	2	1	2	2	2	2	2	1	2
CO2	2	2	2	2	2	2	2	1	1	2
CO3	1	1	1	2	1	1	2	1	2	2
CO4	0	0	1	0	1	1	2	1	2	1
CO5	0	0	0	1	1	2	2	0	1	1

**3: High 2: Moderate and 1: Low Relationship**

# CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1

## DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

COURSE: AUTOMOBILE ENGINEERING

COURSE CODE: R18ME5202

COURSE CATEGORY: SPECIALISED

CREDIT: Credits: 06

### Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
4	2	3	80	20	-	50	50	200

### Rationale:

Automobile is one of the necessities of modern life. Development and progress of the world majority is based upon the development of modern automobiles. Diploma Engineer should know principle of working, construction and various systems of automobile vehicles of different types and sizes. Now a day's many advances in automobile technology have been made like Automatic transmission, Control System, Ignition System, Electrical system, Alternate fuels, Electronics control System etc. A Diploma Engineer should be conversant with these modern developments and trends.

### Course Outcomes:

- Understand Layout of Automobile System & Different Types of Engines.
- Identify Various Components of Transmission System.
- Select the Appropriate Braking, Suspension & Steering System.
- Know the Different Types of Electrical & Electronic System in Automobile.

### Course Details:

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS
UNIT NO.1 <b>Introduction to Automobiles</b>	<b>1.1</b> Classification of automobile vehicles, types of automobile vehicles. Two and four wheeler chassis layout of an automobile vehicle, automobile body types, Layout of vehicle	1. Draw vehicle layouts. 2. Draw chassis layouts. 3. Explain the concept of aerodynamic shape of vehicle.	10	12

	<p>such as front engine rear wheel drive, front engine front wheel drive, rear engine rear wheel drive, four wheels drive etc. their advantages, comparisons. Aerodynamic body shapes &amp; advantages, transfer box.</p> <p><b>1.2</b> Types of automobile power plants such as petrol engine, diesel engine, gas operated (LPG, CNG), electric power plants, hybrid vehicles, alternate fuels.</p>			
<b>UNIT NO.2</b>  <b>Transmission Systems</b>	<p><b>2.1</b> Need and Requirements of transmission system. Its components and their functions, tractive effort, total resistance, stabilized speed</p> <p><b>2.2 Clutch-</b> Function and purpose of clutch, Requirement of good clutch types and construction of clutches as coil spring type and diaphragm type, Electromagnetic clutch.</p> <p><b>2.3Gear box-</b> constant mesh and synchromesh gear boxes, Epicyclic gear box their construction and operation. Overdrive, transfer case, Need of gearbox, Torque convertor.</p> <p><b>2.4</b> Propeller shaft types and construction, functions of universal and slip Joints.</p> <p><b>2.5Differential -</b> need, construction and working, differential action and Operation, front axle its types &amp; stub axle.</p> <p><b>2.6Axe</b> – Hotchkiss and torque tube drives, Rear- full floating axle, semi Floating</p>	<ol style="list-style-type: none"> <li>1. Describe transmission system of automobiles and their components.</li> <li>2. Explain construction and working of gear box clutch, differential, and Axle.</li> </ol>	<b>12</b>	<b>16</b>

	and three quarter floating axle. Front axle.			
<b>UNIT NO.3 Control Systems</b>	<p><b>3.1 Steering System:</b> Purpose of steering system, construction and working of - recirculating ball type and rack and pinion, &amp; Steering mechanism. Wheel Geometry- caster, camber, king pin inclination, Toe In and Toe Out. Power steering (introductory).</p> <p><b>3.2 Braking System:</b> Need of braking system, types of automotive braking systems for two and four wheeler vehicles – mechanical, hydraulic and air operated.</p> <p>Hydraulic braking systems: Layout &amp; components of hydraulic braking systems ,Construction and working of master cylinder and wheel cylinder, Drum braking system, Disc Braking Systems, Air braking system: layout and working.</p>	1.Explain different components of steering System. 2.Describe steering geometry and requirements. 3.Explain the braking system of automobile. 4.Differentiate between disc brakes and drum brakes.	<b>10</b>	<b>12</b>
<b>UNIT NO.4 Suspension Systems, Wheels and Tyres</b>	<p><b>4.1</b> Necessity and Classification of Suspension System, Front and rear suspension system construction and working of Wishbone type, Mac Pherson type, Trailing link type, coiled springs, leaf spring and Shock absorbers, hydraulic damper &amp; air suspension system.</p> <p><b>4.2</b> Wheel construction, alloy wheel, wheel alignment and balancing, type of tyres, tyre construction, tread design.</p>	1. Explain necessity of Suspension system. 2. Describe components of suspension system. 3. Explain different types of wheels & tyres.	<b>10</b>	<b>12</b>
<b>UNIT NO.5 Electrical</b>	<b>5.1 Battery:</b> Automotive battery construction and operation, battery capacity,	1. Describe battery constructional details with sketch.	<b>10</b>	<b>12</b>

<b>Systems</b>	<p>Battery ratings, Battery tests  <b>Charging System :</b> Need of charging system,          Construction and operation of charging system,          Alternator principle construction and working of cut off relay, battery maintenance.</p> <p><b>5.2 Starting System:</b> Need of starting system, layout, construction of starting motor, Bendix drive.</p> <p><b>5.3 Lighting System:</b> Layout of lighting system of two wheeler and four wheeler, Wiring harness, cable color codings.</p> <p><b>5.4 Ignition System and their Components</b> Battery, magneto, electronic ignition system &amp; their comparison.</p>	<ol style="list-style-type: none"> <li>2. Explain charging system.</li> <li>3. Explain the starting and ignition system.</li> <li>4. Differentiate the different colour used for wiring System</li> </ol>		
<b>UNIT NO.6</b>  <b>Advanced control systems &amp; Vehicle Performance</b>	<p>Electronic Control system, block diagram,</p> <p>Sensors, Types, Principle of operation, Electronic Control Unit, Actuators, types, Electronic Stability Programme, Need, Component, Principle of working, Traction Control System, component, working.</p> <p>Vehicle performance parameters, road resistance, traction and tractive effort, power requirement for propulsion, road performance curves,</p> <p>Stability of vehicles. SAE vehicle axis system, vehicle body moments,</p>	<ol style="list-style-type: none"> <li>1. Explain concept of Electronic stability program.</li> <li>2. Differentiate between different type of sensor</li> <li>3. Explain the Traction control system</li> <li>4. Describe the various resistance to the Vehicle motion</li> </ol>	<b>12</b>	<b>16</b>

## SUGGESTED EXERCISES/PRACTICALS:

<b>S. No.</b>	<b>Unit No.</b>	<b>Practical Exercises (Outcomes' in Psychomotor Domain)</b>	<b>Appro. Hrs. Required</b>
1.	1	Study of scenario of Automobile manufacturers in India-Two or four wheeler vehicles.	2
2.	3	Dismantle and assemble single plate-coil and diaphragm type clutch, sketch and state the functions of important component in brief.	4
3.	2	Dismantle and assemble synchromesh gear box, sketch and state the functions of important component in brief.	6
4.	2	Dismantle and assemble differential, sketch and state the functions of important component in brief.	4
5.	6	Dismantle brake system and observe various components of it, sketch and state the functions of important component in brief.	4
6.	2	Study and observe various steering systems of automobile vehicle and make a systematic record.	4
7.	2	Observe and draw various suspension systems, describe their advantages and limitations.	4
8.	5	Inspection of battery like Ah rating, type of battery, no. of cells, vents, charge status by using hydrometer and voltmeter.	4
<b>Total</b>			<b>32</b>

## SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN:

<b>Unit No.</b>	<b>Unit Title</b>	<b>Teaching Hours</b>	<b>Distribution of Marks</b>			
			<b>R Level</b>	<b>U Level</b>	<b>A Level</b>	<b>Total</b>
1	Introduction to Automobiles	10	4	10	2	16
2	Transmission System	12	4	4	4	12
3	Control System	10	2	08	2	12
4	Suspension Systems, Wheels and Tyres	10	2	08	2	12
5	Electrical System	10	4	4	4	12
6	Advanced Control Systems & Vehicle Performance.	12	2	10	4	16
	<b>Total</b>	64	18	44	18	80

**TEACHING METHODOLOGY:**  
Chalk-Board, Discussions, Charts, Models.

**TERM WORK:**  
Skills to be developed:

**I) Intellectual Skills :**

- Apply and use the basic knowledge of earlier courses like mechanical engineering materials, strength of materials and theory of machines.
- Understand types of failures of machine components and decide the design criteria and Equations.
- Understand the concept of standardization and selecting standard components.

**II) Motor skills:**

- Draw the components assembly as per the designed dimensions.
- Use of various IS codes (standards) to select standard sizes of components.

**SUGGESTED LEARNING RESOURCES**

**H) REFERENCE BOOKS:**

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Dr. Kripal Singh	Automobile Engineering ( Vol. 1 & 2 )	Standard Publications, New Delhi.
2	H.M. Sethi	Automotive Technology	Tata McGraw Hill Publications, New Delhi.
3	Joseph Heither	Automobile Mechanics	Williesten Publications.
4	William Crouse	Automobile Mechanics	Tata McGraw Hill Publications, New Delhi.
5	M.L. Mathur& R.P. Sharma	Internal Combustion Engines	Dhanpat Rai & Sons, Delhi.
6	G.B. Narang	Automobile Engineering	Khanna Publications, New Delhi.
7	R.B.Gupta	Automobile Engineering	Satya Prakashan , New Delhi

### Mapping matrix of CO's, PO's and PSO's:

CO's		PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PSO2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	2	1	2	2	1	-	1	2	2	2	1
CO2	2	0	1	1	1	-	-	1	2	2	1
CO3	2	1	2	2	1	1	-	2	2	2	1
CO4	2	2	1	2	1	1	1	2	1	1	1

### **3: High 2: Moderate and 1: Low Relationship**

# CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1

## DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

COURSE: REFRIGERATION & AIR CONDITIONING COURSE CODE: R18ME5201

COURSE CATEGORY: SPECIALISED

CREDIT: 06

### Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
4	2	3	80	20	-	50	50	200

### Rationale:

Refrigeration and air conditioning and related devices find important position in application areas of Mechanical Engineering field. Various systems and devices like refrigeration systems, ice plants, process coolers, water coolers. Air conditioning systems are commonly used in practical areas. Diploma engineers are expected to operate and maintain these systems and devices. For this purpose it is necessary to incorporate basic concepts and areas of refrigeration and air conditioning. The knowledge of thermal engineering and power engineering is a prerequisite for this course

### Course Outcomes:

10. Write terminology associated with Refrigeration and Air Conditioning
11. Describe the principle and construction of refrigeration and air conditioning
12. Evaluate various psychrometric properties for psychrometric processes
13. Select various component of refrigeration and air-conditioning as per requirement
14. Calculate heat load for air conditioning systems

### Course Details:

UNIT	NAME OF THE TOPIC (with Details)	LEARNING OUTCOME	HOURS	MARKS
UNIT NO.1	<b>1.1 Introduction:</b> Definition of Refrigeration, Refrigeration and second law of thermodynamics, Applications of	6. Define Refrigeration and unit of refrigeration 7. State second law of thermodynamics. 8. Understand the principle	12	16

<b>Basics of Refrigeration, Carnot refrigeration and Air refrigeration cycle</b>	<p>Refrigeration, Unit of refrigeration (Ton of Refrigeration) and Coefficient of performance (COP), relative COP.</p> <p><b>1.2 Carnot refrigeration cycle:</b> Reversed Carnot cycle for refrigerator and heat pump, Comparison of heat engine, refrigerator and heat pump, Numerical approach based on reversed Carnot cycle.</p> <p><b>1.3 Air Refrigeration cycle:</b> Joule or reversed Brayton cycle or Bell Coleman cycle for gas refrigeration COP for Brayton refrigeration cycle. Numerical based on Bell Coleman cycle Advantages and Limitations of Air Refrigeration Cycle Simple air refrigeration system with evaporative cooling cycle for air craft refrigeration (layout and working only).</p>	<p>of refrigeration.</p> <p>9. Represent refrigeration cycle on P-V, and T-S diagram.</p> <p>10. Compare heat engine, Heat pump and Refrigerator.</p> <p>11. Calculate COP of given cycle.</p>		
<b>UNIT NO.2</b>  <b>Vapour compression and Vapour absorption cycle</b>	<p><b>2.1Simple vapour compression refrigeration(VCR) system:</b> Layout of components and representation of VCR cycle on p-V and T-s chart ( with dry compression and wet compression) Pressure –enthalpy chart and representation of VCR cycle on it .Analysis of VCR cycle numerical based on VCR cycle (dry as well as wet compression, no sub cooling) Effect of condenser and evaporator pressure on COP of VCR cycle using p-h chart Effect of sub cooling and superheating on COP of VCR cycle using p-h chart. Actual VCR diagram, introduction to multistage of VCR, its necessity and advantages</p>	<p>1. Draw components of VCR cycle.</p> <p>2. Represent VCR cycle on P-V, T-S and P-h chart.</p> <p>3. Describe Vapour absorption refrigeration system.</p> <p>4. Compare VCC and vapour absorption system.</p> <p>5. Calculate different parameters of vapor compression systems.</p>	<b>10</b>	<b>12</b>

	<p><b>2.2 Vapour absorption refrigeration system:</b>  Components and working of aqua- ammonia (simple &amp; practical) refrigeration system Desirable properties of refrigerant and absorbent pair used in vapour absorption system  Comparison between vapour absorption and vapour compression refrigeration systems.</p>			
<b>UNIT NO.3</b>  <b>Refrigerants and Refrigeration system Components</b>	<p><b>3.1 Refrigerants:</b>  Classification of refrigerants, desirable properties of a refrigerant ,Designation/nomenclature of refrigerantGlobal warning potential, Ozone layer potential and Montreal protocol, Properties of refrigerants Ammonia, R22 and R134a,environmentfriendly refrigerant R134a, R410a, R600a,R290,R32.(Theoretical only)Secondary refrigerants: Leakage detection and charging of refrigerant.</p> <p><b>3.2 Refrigeration system components:</b> Compressors: Construction and working of hermetically sealed compressor.  Condenser: Air cooled, water cooled and evaporative condensers.  Evaporator: Flooded chiller and Dry expansion chiller.  Expansion valve: Capillary tube and thermostatic expansion valve, High pressure cut-out and low pressure cut-out.</p>	<ol style="list-style-type: none"> <li>1. Explain properties and environmental effects of refrigerants.</li> <li>2. Identify refrigeration equipment's in view of classification, Construction and operation.</li> <li>3. List criterions of selection of equipment are for various refrigeration systems.</li> </ol>	<b>10</b>	<b>12</b>

<b>UNIT NO.4</b>  <b>Psychromery and Psychrometric processes</b>	<p><b>4.1 Introduction to Air Conditioning:</b> Definition of air conditioning, Applications of air conditioning.</p> <p><b>4.2 Psychrometry:</b> Composition of air, Dalton's law of partial pressuresDry bulb and wet bulb temperature, Adiabatic saturation and dew point temperatures, Humidity ratio, relative humidity, degree of saturation, enthalpy of moist air.Psychrometric chart (Numerical based on psychrometric properties with and without chart).</p> <p><b>4.3 Psychrometric processes:</b> Adiabatic mixing of air streams, Sensible cooling and sensible heatingApparatus dew point (ADP) &amp; Coil bypass factor, Humidification and dehumidification ( latent heating and latent cooling)Cooling and dehumidification &amp; cooling and humidificationHeating and humidification &amp; Heating and dehumidification(Numericals based on psychrometric processes using chart).</p>	<ol style="list-style-type: none"> <li>1. Define psychometric properties.</li> <li>2. Explain psychometric processes And Represent it on psychometric chart.</li> <li>3. Calculate Psychometric properties and capacity of coil using psychometric chart.</li> </ol>	<b>12</b>	<b>16</b>
<b>UNIT NO.5</b>  <b>Human Comfort, Cooling load and Air conditioning system</b>	<p><b>5.1 Human Comfort:</b> Thermodynamics of human body, Effectivetemperature and factors governing effective temperature ,Comfort chart and comfort conditions for winter and summer.</p> <p><b>5.2 Cooling Load Estimation:</b> Calculations of loads due to different sources like solar radiation, human beings, appliances, infiltration of air,</p>	<ol style="list-style-type: none"> <li>1. Explain thermodynamics of human body.</li> <li>2. List factor affecting human comfort.</li> <li>3. Calculate cooling load for different applications.</li> <li>4. Classify air conditioning system.</li> <li>5. Explain different air conditioning system.</li> </ol>	<b>10</b>	<b>12</b>

	etc.Sensible heat factor, Fresh supply and recirculated air quantities. Simple numerical on cooling load estimation. <b>5.3 Air conditioning systems:</b> Classification of air conditioning systemsCentral air conditioning system and unitary air conditioning system (window and split air conditioning)Summer, winter and year around air conditioning system.			
<b>UNIT NO.6</b>  <b>Air conditioning and application of Refrigeration and Air conditioning</b>	<b>6.1 Air Distribution system:</b> Principles of air distribution system in air conditioning, Air handling system: layout and functions of different components, Air distribution outlets: supply outlets, return outlets, grills, diffusers , Different arrangement of ducts & types of air distribution systems, Types of fans used in air condition system, Thermal insulation: functions, properties of insulating material and different types of insulating materials used. <b>6.2 Applications of refrigeration and air conditioning (construction and working):</b> Domestic refrigerator, Ice plant, Cold storage, Water coolers, Dessert coolers	1. Explain the various components of air distribution system. 2. List different insulating materials and its properties. 3. Explain applications of refrigeration and air conditioning systems.	<b>10</b>	<b>12</b>

#### SUGGESTED EXERCISES/PRACTICALS:

<b>Sr. No.</b>	<b>Unit No.</b>	<b>Practical Exercises (Outcomes' in Psychomotor Domain)</b>	<b>Approx. Hrs. Required</b>
1.	III	Handling, use & familiarization with refrigeration tools & accessories like tube cutter, tube bender, flaring tool, service valve, gauges, blow lamp, service cylinder.	<b>02</b>

2.	I, IV	Construction details, controls and working of vapour compression system for refrigerator, water cooler, window AC	<b>02</b>
3.	II	Perform trial on vapors compression test rig to determine refrigeration capacity, power required and COP	<b>02</b>
4.	VI	Perform trial on ICE plant test rig and determine power required and COP	<b>06</b>
5	III	Dismantling and assembly of hermetically sealed compressor.	<b>04</b>
6	II	Perform trial on vapors absorption test rig to determine COP	<b>02</b>
7	IV	Perform trial on air conditioning test rig to find capacity of system, power required and COP	<b>02</b>
8	IV	Perform trial on air conditioning test rig to understand humidification and dehumidification cycle with heating and cooling process.	<b>02</b>
9	IV, V, VI	Cooling load calculation for CAD/CAM Laboratory ,HOD cabin, Seminar Hall and select cooling capacity of air conditioner unit (any one)	<b>02</b>
10	II, III	<p>Visit to cold storage plant and write the visit report using following points</p> <ul style="list-style-type: none"> <li>• Organizational structure</li> <li>• Plant layout</li> <li>• Purpose of cold storage</li> <li>• Constructional details of various component</li> <li>• Use of refrigerant with scientific reason</li> <li>• Cooling load</li> <li>• Safety control devices</li> <li>• Constructional detail of AHU</li> <li>• Constructional details of ducting and insulation used</li> <li>• Parameter to be controlled</li> <li>• Troubleshooting and remedies</li> <li>• Economy associated with cold storage</li> </ul>	<b>02</b>
11	IV, V, VI	<p>Visit to Central AC plant and write visit report using following points</p> <ul style="list-style-type: none"> <li>• Layout</li> <li>• Constructional details of various component</li> <li>• Use of refrigerant with scientific reason</li> <li>• Cooling load</li> <li>• Safety control devices</li> <li>• Constructional detail of AHU</li> <li>• Constructional details of ducting and insulation used</li> <li>• Parameter to be controlled</li> <li>• Troubleshooting and remedies</li> <li>• Economy associated with AC plant.</li> </ul>	<b>02</b>

12	VI	Identify common problem occurred in following refrigeration system and their remedies <ul style="list-style-type: none"> <li>• Domestic refrigerator</li> <li>• Split /Window air conditioner</li> <li>• Water cooler</li> </ul>	<b>04</b>
<b>Total</b>			<b>32</b>

#### SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN:

<b>Unit No.</b>	<b>Unit Title</b>	<b>Teaching Hours</b>	<b>Distribution of Marks</b>			
			<b>R Level</b>	<b>U Level</b>	<b>A Level</b>	<b>Total</b>
1	Basics of Refrigeration, Carnot refrigeration and Air refrigeration cycle	12	6	6	4	16
2	Vapour compression and Vapour absorption cycle	10	4	4	4	12
3	Refrigerants and Refrigeration system Components	10	4	6	2	12
4	Psychromery and Psychrometric processes	12	6	6	4	16
5	Human Comfort, Cooling load and Air conditioning system	10	4	4	4	12
6	Air conditioning and application of Refrigeration and Air conditioning	10	4	4	4	12
<b>TOTAL</b>		<b>64</b>	<b>28</b>	<b>30</b>	<b>22</b>	<b>80</b>

#### MAJOR EQUIPMENT/INSTRUMENT REQUIRED:

<b>SR. NO.</b>	<b>EQUIPMENT NAME WITH BROAD SPECIFICATIONS</b>	<b>EXP. SR. NO.</b>
1	Refrigeration tools- Tube cutter, Spring bender, Flaring tools, Pressure gauge.	1
2	Godreg Refrigerator	2
3	Window air conditioner	2
4	Refrigeration-VCC Test Rig.	3
5	Ice-Plant Test Rig	4
6	Hermetically sealed compressor	5
7	Vapour absorption test Rig.	6
8	Air conditioner Test Rig.	7

#### TEACHING METHODOLOGY:

Chalk-Board, Discussions, Charts, Models.

##### i) Intellectual Skills:

- Reading of different charts & tables.
- Understanding of basic concepts, cycles & RAC systems.
- Comparison of different refrigeration cycles & systems.

## ii) Motor Skills:

- To handle components, devices & tools of systems.
- To measure or to record parameters using different gauges and meters.
- To prepare report of visit and tests on the test rigs.

## SUGGESTED LEARNING RESOURCES

### I) REFERENCE BOOKS:

AUTHOR	TITLE	PUBLISHER
C. P. Arora	Refrigeration & Air Conditioning	Tata McGraw Hill Publications, New Delhi.
Roy Dossat	Principles of refrigeration	Wiley Eastern Publication.
R.K. Rajput	A Textbook of Refrigeration & Air Conditioning	S.K. Kataria& Sons Publishers , New Delhi.
Manohar Prasad	Refrigeration & Air Conditioning	New Age International Publishers, New Delhi
V. M. Domkundwar	Refrigeration & Air Conditioning	Dhanpatrai Publications, New Delhi.
P. L. Ballaney	Refrigeration & Air Conditioning	Khanna Publications, New Delhi.

### Mapping matrix of CO's, PO's and PSO's:

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, & sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems. <small>PSO2</small>	Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	3	2	1	1	1	0	1	1	1	1
CO2	3	2	2	2	1	0	2	1	1	1
CO3	3	2	2	2	2	1	2	1	2	1
CO4	3	1	1	2	2	1	2	1	1	1
CO5	3	2	2	2	1	1	1	1	1	1

### 3: High 2: Moderate and 1:Low Relationship

**DIPLOMA PROGRAMME: MECHANICAL ENGINEERING**

**COURSE: WELDING TECHNOLOGY**

**COURSE CODE: R18ME5203**

**COURSE CATEGORY: SPECIALIZED**

**CREDIT: 06**

---

**Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
4	2	3	80	20	-	50	50	200

**Rationale:**

Fabrication technology has invaded virtually in every branch of manufacturing like bridges, ships, building construction, boilers, pressure vessels, pipe lines, automobiles, power plants, etc. With the wide spread applications, knowledge of the same has become essential for students who desires to take up career in fabrication.

**Course Outcomes:**

1. Suggest suitable method of welding.
2. Rectify welding defects.
3. Propose suitable inspection technique.
4. Conduct welding processes.

**Course Details:**

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS
UNIT NO.1	<b>1.1 Introduction to Fabrication Processes</b> – Riveting, Welding process, Classification of welding, surface and edge preparation.  <b>1.2 Safety recommendation in welding-</b> protection of welders, protection from welding rays, ventilation and health protection.	1. Define welding and riveting process. 2. Describe need of surface and edge preparation and Safety recommendation in welding process. 3. Explain oxy-acetylene gas welding process, advantages and disadvantages of it. 4. Suggest suitable	10	12

	<b>1.3 Gas Welding Processes-</b> Oxy-acetylene welding, principle of operation and types of welding flames, welding techniques-leftward and rightward, other fuel gas welding processes, their advantages and disadvantages.	particular applications for which gas welding is use.		
<b>UNIT NO.2</b>	<b>2.1 Arc Welding Processes-</b> Definition, principle, equipments, joint preparations, operation procedures of carbon arc welding, flux shielded metal arc welding, submerged arc welding, TIG and MIG welding, electro slag welding, electro gas welding, plasma arc welding, stud welding. Welding electrodes, shielding gases and mixtures.  <b>2.2 Resistance Welding Processes-</b> Definition, fundamentals, advantages and disadvantages. Applications of resistance welding- spot welding, seam welding, projection welding, resistance butt welding, flash butt welding.	1. Describe various arc welding and resistance welding processes. 2. Compare arc and resistance welding process and Welding, and Soldering process. 3. Explain various equipment used for arc welding, and resistance welding,. 4. Suggest suitable arc welding/ resistance welding process for particular applications.	<b>13</b>	<b>16</b>
<b>UNIT NO.3</b>	<b>3.1 Radiant Energy Welding-</b> Definition, principle, operational procedures of electron beam welding, laser beam welding.  <b>3.2 Thermo Chemical Welding-</b> Definition, principle, operational procedures of thermit welding, atomic hydrogen welding.  <b>3.3 Thermal Cutting of Metals-</b> Definition, types of cutting processes, principle of operation, advantages and	5. Describe Thermal cutting process, Radiant energy welding and Thermo-chemical Welding: it's advantages, disadvantages and applications. 6. Suggest suitable radiant energy welding / thermo-chemical welding process for particular applications. 7. Compare welding, braze welding and soldering.	<b>10</b>	<b>12</b>

	<p>disadvantages.</p> <p><b>3.4 Braze Welding and Soldering-</b> Definition, principle of operation, fluxes and fillers, advantages and disadvantages.</p>			
<b>UNIT NO.4</b>	<p><b>4.1 Welding of Cast Iron-</b> Welding characteristics, welding processes used for cast iron.</p> <p><b>4.2 Welding of Carbon Steels-</b> Welding of low carbon, medium carbon, high carbon steel.</p> <p><b>4.3 Welding of Alloy Steels-</b> Introduction to alloy steels, effect of alloying elements and welding of low alloy high strength steels.</p> <p><b>4.4 Welding of Stainless Steel-</b> Welding use for stainless steel.</p> <p><b>4.5 Welding of Aluminium and its Alloys-</b> Welding processes used for it.</p> <p><b>4.6 Welding of Dissimilar Metals-</b> concepts and metallurgical problems in dissimilar metals welding.</p>	<ol style="list-style-type: none"> <li>1. Describe various welding process for cast iron, carbon steel, alloy steel, stainless steel, aluminium and it's alloy and dissimilar metals.</li> <li>2. Describe composition and properties of cast iron, carbon steel, alloy steel, stainless steel, aluminium and it's alloy.</li> <li>3. Suggest suitable welding process for joining a cast iron/carbon steel/ alloy steel/ stainless steel/ aluminium and it's alloy / dissimilar metals for particular applications.</li> <li>4. Explain metallurgical problems in dissimilar metals welding.</li> </ol>	<b>13</b>	<b>16</b>
<b>UNIT NO.5</b>	<p><b>5.1 Weldability-</b> Definition and concept of weldability, effect of alloying elements on weldability.</p> <p><b>5.2 Welding Symbols-</b> Representing the welds, basic weld symbols, location of welds, dimensions of welds.</p> <p><b>5.3 Defects in Weld-</b> Crack distortion, incomplete penetration, porosity and blow holes, poor fusion, poor weld</p>	<ol style="list-style-type: none"> <li>1. Define a concept of weldability, defects in weld, welding distortion.</li> <li>2. Describe types of defects in weld, welding distortion and its causes and remedies.</li> <li>3. Draw and describe various weld symbols.</li> </ol>	<b>09</b>	<b>12</b>

	<p>bed appearance, its causes and remedies.</p> <p><b>5.4 Welding Distortion-</b> concept of distortion during welding, its causes and remedies.</p>			
<b>UNIT NO.6</b>	<p><b>6.1 Inspection of Welding-</b> Destructive testing, tensile test, bend test, impact test, hardness test.</p> <p><b>6.2 Non-Destructive Testing-</b> Visual inspection, leak inspection.</p> <p><b>6.3 Welding Jigs and Fixtures-</b> Welding jigs and fixtures concept with suitable example</p>	<ol style="list-style-type: none"> <li>Define concept of Welding jigs, and welding fixtures.</li> <li>Compare welding jigs and fixture.</li> <li>Compare destructive and non-destructive test for welding.</li> </ol>	<b>09</b>	<b>12</b>

#### SUGGESTED EXERCISES/PRACTICALS:

<b>Sr. No.</b>	<b>Unit No.</b>	<b>Practical Exercises/ Assignments (Outcomes' in Psychomotor Domain)</b>	<b>Approx. Hrs. Required</b>
1	1	Gas welding process.	2
2	2	Arc welding process.	2
3	2	Resistance arc welding process.	2
4	3	Thermo chemical welding, Radiant Energy Welding and Thermal cutting process.	4
5	5	Weld defects and welding symbols.	2
6	6	Destructive testing of welded joints.	2
7	6	Non-Destructive testing of welded joints.	4
8	4	Welding of Cast Iron, Carbon Steels, Alloy Steels, Stainless Steel,	4
9	4	Welding of Aluminum and its Alloys, Welding of Dissimilar Metals	2
10	5	Residual stresses, their causes and remedies.	2
11	5	Welding distortion, Welding jigs and fixture	2
12	6	Welding calculations	4
<b>Total</b>			<b>32</b>

## SPECIFICATION TABLE

Unit No.	Unit Title	Teaching Hours	Distribution of Marks			
			R Level	U Level	A Level	Total
1	Introduction to Fabrication Processes, recommendation in welding, Gas Welding Processes	10	4	6	2	12
2	Arc Welding Processes, Resistance Welding Processes	13	4	8	4	16
3	Radiant Energy Welding, Thermo Chemical Welding, Thermal Cutting of Metals, Braze Welding and Soldering	10	3	6	3	12
4	Welding of Cast Iron, Welding of Carbon Steels, Welding of Alloy Steels, Welding of Stainless Steel, Welding of Aluminium and its Alloys, Welding of Dissimilar Metals	13	4	8	4	16
5	Weldability, Welding Symbols Defects in Weld, Welding Distortion	09	3	6	3	12
6	Inspection of Welding, Non-Destructive Testing, Welding Jigs and Fixtures	09	3	6	3	12
<b>TOTAL</b>		<b>64</b>	<b>20</b>	<b>40</b>	<b>20</b>	<b>80</b>

### TEACHING METHODOLOGY:

Chalk-Board, Discussions, Charts, PPT

#### i) Intellectual Skills:

- Selection of suitable welding process.
- Reading of welding symbols and dimensions.
- Understanding of welding parameters.
- Enhance learning to learn skills.

#### ii) Motor Skills:

Preparation of power point presentation.

## SUGGESTED LEARNING RESOURCES

### J) REFERENCE BOOKS:

SR. NO.	AUTHOR	TITLE	PUBLISHER
1.	O. P. Khanna	A Text Book of Welding Technology	Dhanpat Rai Publications, New Delhi.

2.	S. V. Nadkarni	Modern Arc Welding Technology	Oxford and IBH Publications Co.
3.	Metal's Hand Book, Vol-6	Welding and Brazing	American Society of Metals
4.	Richard L. Little	Weld and Welding Technology	Tata McGraw Hill Publications, New Delhi.

### Mapping matrix of CO's, PO's and PSO'S:

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PSO2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	2	0	3	2	2	1	1	1	2	2
CO2	2	1	3	2	2	1	1	0	2	2
CO3	2	2	3	2	2	2	1	1	1	2
CO4	2	0	3	2	2	2	1	1	1	2

**3: High Relationship, 2: Medium Relationship, 1: Low Relationship**

# CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1

## DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

COURSE: PROJECT MANAGEMENT AND OPERATION RESEARCH COURSE CODE: R18ME5206

COURSE CATEGORY: SPECIALIZED

CREDIT: 06

### Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
4	2	3	80	20	-	50	50	200

### Rationale:

Diploma Technician handles different types of activities in industry. It is an added benefit to him/her if he/she has familiarity to basic idea of various tools of optimization, probability, statistics and simulation, as applicable in different scenarios in industry for better management of various resources. The course also helps to familiarize methods to develop project network and its execution.

### Course Outcomes:

1. Understand the concept of Project Management.
2. Apply methods of project management for developing project network to find optimum time duration of projects.
3. Understanding the concept of operation research to solve the technical problems in different fields.
4. Apply the various models of operation research such as assignment model, transportation model, Linear programming model, Decision Theory Model, Network Model and Sequencing Model.

### Course Details:

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS
UNIT NO.1	1.1 Introduction to Project Management, Brief history of project management, Role of a Project Manager.  1.2 Project Selection- Defining criteria, Project selection methods: 1-	1.1 Understand the concept of project management.	10	12

	<p>Sacred Cow, M-Comparative Benefit Model (CBM).</p> <p>1.3 Project Time Management, Project Quality Management, Project Cost Management, Project Risk Management. Ethics in engineering.</p>			
<b>UNIT NO.2</b>	Fulkerson's rule, concept and types of floats, nodes events, Drawing the Project network, finding the project duration by CPM and PERT, Introduction to crashing. (Numerical on CPM and PERT)	<p>2.1 Develop the project network.</p> <p>2.2 find the minimum tie duration for completing the project.</p>	<b>12</b>	<b>16</b>
<b>UNIT NO.3</b>	<p>3.1 History and development of OR, Applications, modeling in OR, OR models and their applications.</p> <p>3.2 Formulation of problem, Graphical solution, Simplex procedure for maximization and minimization, Duality concept. (Numerical on Graphical method and simplex problem for 8 to 10 marks)</p>	<p>3.1 Identify the need of operation research</p> <p>3.2 know the role of OR models in different fields of society.</p>	<b>12</b>	<b>16</b>
<b>UNIT NO.4</b>	<p><b>4.1 Transportation Model:</b></p> <ul style="list-style-type: none"> <li>• Mathematical formulation, methods to obtain initial basic feasible solution (NWCR and VAM) (IBFS).</li> <li>• Conditions for testing optimality, MODI method for testing optimality solution of balanced and unbalanced problems, Degeneracy and its resolution (Only theory).</li> </ul> <p><b>4.2 Assignment Model:</b></p> <ul style="list-style-type: none"> <li>• Mathematical statement, Methods to solve balanced and unbalanced assignment problems.</li> <li>• Maximization problems, finding the optimum solution to assignment model, Assignment with restrictions, Traveling salesman problem.</li> </ul>	<p>1.1 Know transportation model to obtain optimal solution to given transportation problem.</p> <p>1.2 Understand the assignment model to obtain optimum solution to given problem.</p>	<b>10</b>	<b>12</b>

UNIT NO.5	<p><b>5.1 Decision Theory:</b> Introduction, Pay off table, Decision making environments and criterions, Maximin or minmax principle, maximax or minimax principle, decision trees.</p> <p><b>5.2 Game theory:</b> Use of Minimax and Maximin Principle, Solution of Game with Saddle Point, Solution by Dominance, Solution by Graphical Method, m x n size game Problem.</p>	<p>5.1 Know the decision theory.</p> <p>5.2 Understand Game theory for optimum decision making.</p>	10	12
UNIT NO.6	<p><b>6.1 Replacement Analysis:</b> Replacement of Items that Deteriorate, Replacement of Items that Fail Suddenly.</p> <p><b>6.2 Sequencing Model:</b> Sequencing of n jobs and M &amp; 3 machines, M jobs and m machines.</p>	<p>6.1 Understand the concept of replacement Analysis</p> <p>6.2 Know the concept of Sequencing Model.</p>	10	12

### SUGGESTED EXERCISES/PRACTICALS:

Sr. No.	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Appro. Hrs. Required
1.	1	Assignment on Project management.	2
2.	2	Assignment on Project Management techniques (Numericals)	4
3.	3	Formulation of LPP and Graphical Solution.	4
4.	3	Assignment on Maximization and Minimization problems using Simplex method.	4
5.	4	Assignment on Transportation Problems.	4
6.	4	Assignment on Assignment problems.	4
7.	5	Assignment on Decision Theory or Game theory.	4
8.	6	Assignment on Replacement Analysis.	2
9.	6	Assignment on Sequencing Problems.	4
<b>Total</b>			<b>32</b>

### SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

UNIT NO.	UNIT TITLE	TEACHING HOURS	DISTRIBUTION THEORY MARKS			
			R LEVEL	U LEVEL	A LEVEL	TOTAL MARKS
1	Project Management	10	6	6	-	12
2	Project Management Techniques	12	4	4	8	16
3	Linear Programming Problems	12	4	4	8	16
4	Transportation and Assignment	10	2	4	6	12

	Model					
5	Decision Theory	10	2	4	6	12
6	Replacement Analysis and Sequencing Model	10	2	4	6	12
	<b>TOTAL</b>	<b>64</b>	<b>20</b>	<b>26</b>	<b>34</b>	<b>80</b>

### TEACHING METHODOLOGY:

Chalk-Board, Discussions, Charts, Models.

#### iii) Intellectual Skills :

- Understanding the different models of OR.
- Selecting the OR model for particular problem.
- Relating the given theory problem with specific OR model.

#### iv) Motor Skills :

- Use of engineering calculator for effective calculations

### SUGGESTED LEARNING RESOURCES:

#### K) REFERENCE BOOKS:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Vishwanath	Industrial Engineering and Management	Scitech Publication
2	Hira and Gupta	Operations Research	S.Chand and Co.
3	J. K. Sharma	Operations Research	McMillan India

### Mapping matrix of CO's, PO's and PSO's:

CO's	PO1 Basic knowledge Discipline specific Knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PSO2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	2	0	2	0	1	3	2	1	0	1
CO2	2	1	0	1	1	3	2	1	2	1
CO3	2	1	3	0	1	3	2	0	1	1
CO4	2	0	0	0	1	3	2	1	1	1

**3: High Relationship, 2: Medium Relationship, 1: Low Relationship**

**DIPLOMA PROGRAMME: MECHANICAL ENGINEERING**

**COURSE: TOOL ENGINEERING**

**COURSE CODE: R18ME5204**

**COURSE CATEGORY: SPECIALISED**

**CREDITS : 6**

**COURSE OUTCOME:**

**Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
4	2	3	80	20	-	50	50	200

**Course Objectives:**

1. Select tools and cutting fluid required for machining component
2. Know the types of jig and fixtures
3. Construct the sheet metal component
4. Identify suitable dies for Bending forming and drawing

**Rationale:**

Mechanical engineering diploma holders are dealing with various cutting tools, tool holding devices, different press tools, jigs, fixtures, dies etc. He/She should be able to select the proper press tool operation, sheet metal specification, design parameters for die, a press tool as per given application of the component, tool material and tool geometry on the basis of technical as well as economic parameters. So it is virtually important to give suitable exposure to these areas.

**Course Details:**

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS
<b>Unit. I- Metal Cutting Principle, and Cutting Fluid</b>	<p><b>1.1 Metal Cutting Principle:</b>            Essential features of metal cutting, types of metal cutting- orthogonal cutting and oblique cutting, physical principle of metal cutting (chip formation), mechanism of chip formation, analysis of orthogonal cutting. Thermal aspects and other factors affecting performance of metal cutting.</p> <p><b>1.2 Cutting Fluids:</b>            Introduction to cutting fluids, purpose of cutting fluid, types of cutting fluids, properties and applications of cutting fluids, various application techniques. Effect on environment, storage and disposal of cutting fluids, swarf removal.</p>	<ul style="list-style-type: none"> <li>1. Differentiate orthogonal and oblique cutting.</li> <li>2. Describe mechanism of chip formation.</li> <li>3. Explain the Purpose of cutting fluid.</li> <li>4. Explain the various properties and applications of cutting fluid.</li> </ul>	<b>12</b>	<b>16</b>
<b>Unit. II - Tool Geometry of Various Cutting Tools</b>	<p><b>2.1 Tool Geometry of Various Cutting Tools :</b>            Nomenclature and importance of various angles &amp; surfaces of single point cutting tools and multi point cutting tools such as milling cutter, drill, tap, reamer, broach, grinding wheel etc.</p> <p><b>2.2 Introduction to form tool,</b>  <b>Introduction to Plastics as cutting Tool</b></p>	<ul style="list-style-type: none"> <li>1. Draw the Nomenclature of Single point cutting tool.</li> <li>2. Draw the Nomenclature of multipoint point cutting tools.</li> <li>3. Classify the types of form tools.</li> </ul>	<b>10</b>	<b>12</b>
<b>Unit. III- Elements of</b>	<b>3.1 Jig and Fixture-</b> Introduction to jig and	<ul style="list-style-type: none"> <li>1. Differentiate the Jig and fixture.</li> </ul>	<b>10</b>	<b>12</b>

<b>Jigs And Fixture</b>	<p>fixture, Design Principles, Advantages of jig and fixture, Gig and fixture Design Factors, Design steps, Types of jigs, Choosing a Locating Surfaces, types of Jig bushes, Locating Methods and Devices, Use of dowel pin, Types of clamping Devices.</p> <p><b>3.2 Types of Fixtures:</b> Milling, Lathe, Grinding</p>	<p>2. Explain the design principle of jigs and fixture.</p> <p>3. Describe the Types of jig bushes.</p> <p>4. Explain the types of clamping devices.</p> <p>5. Explain the milling , lathe and Grinding fixture.</p>		
<b>Unit. IV- Drill Jig, Sheet metal Blanking and Piercing Dies</b>	<p><b>4.1 Drill Jig :</b> Types of drill jig, general consideration in design of drill jigs. Drill bushings, methods of construction of drill jigs.</p> <p><b>4.2 Sheet Metal Blanking and Piercing Dies :</b></p> <p>Power press types, general press information, cutting action in punch and die operation, die clearance. Blanking and piercing die construction, pilots, strippers and pressure pads. Strip layout.</p>	<p>1.Explain the design principle of drill jig.</p> <p>2.Describe the procedure for designing drill jig.</p>	<b>12</b>	<b>16</b>
<b>Unit. V- Bending Forming and Drawing Dies</b>	<p><b>5.1 Bending Forming and Drawing dies:</b></p> <p>Introduction to bending, Types of Bending, Bending forces and Allowance, Types of Forming Dies, Drawing Dies, Factor Affecting the Dies Design procedure for Drawing dies, Design calculation of Drawing and bending dies(Simple numerical)</p>	<p>1. Explain the Types of bending.</p> <p>2. Describe the types of forming dies.</p>	<b>10</b>	<b>12</b>

<b>Unit. VI</b> <b>Materials for Various Parts of Press</b>	<b>6.1 Materials for various Parts of Press :</b> Materials for various parts of press such as punch, die, stripper, die block, bolster plate, bed of ram, die shoe, guide post, punch plate, punch holder, back up plate, ram etc.	1. Identify the various parts of press. 2. Select the various materials for die manufacturing. 3. Select appropriate tool holder for punching.	<b>10</b>	<b>12</b>
--	---	--	-----------	-----------

### ASSIGNMENTS:

<b>Sr. No.</b>	<b>Practical/ Assignments Exercises (Outcomes' in Psychomotor Domain)</b>	<b>Approx. Hrs. Required</b>
1.	Demonstration of various cutting processes in workshop (Eg. cutting and milling machine)	2
2.	Demonstration of various cutting tools in workshop (E.g., single point cutting tool, multipoint cutting tool and tap and reamer)	4
3.	Develop jigs and fixtures for given job (e.g., drilling , milling and fixture)	4
4.	Identify various press tools die parts for cutting operations.	2
5.	Identify various parts for forming operations.	2
6.	Design and calculations of bending dies.	4
7.	Design and calculations of drawing dies.	4
8.	Identify and selection of material for various press tools such as punch, die, stripper plate, die block.	4
9.	Identify and selection of material for bolster plates, ram, backup plate.	4
10.	Industrial visit and prepare report on it.	4
	<b>Total</b>	<b>32</b>

## SPECIFICATION TABLE

Unit No.	Unit Title	Teaching Hours	Distribution of Marks			
			R Level	U Level	A Level	Total
1	Metal Cutting Principle, and Cutting Fluid	12	4	8	4	<b>16</b>
2	Tool Geometry of Various Cutting Tools	10	4	6	2	<b>12</b>
3	Elements of Jigs And Fixture	10	4	4	4	<b>12</b>
4	Drill Jig, Sheet metal Blanking and Piercing Dies	12	4	4	8	<b>16</b>
5	Bending Forming and Drawing Dies	10	4	4	4	<b>12</b>
6	Materials for Various Parts of Press	10	4	4	4	<b>12</b>
<b>TOTAL</b>		<b>64</b>	<b>24</b>	<b>30</b>	<b>26</b>	<b>80</b>

### TEACHING METHODOLOGY:

Chalk-Board, Discussions, Charts, PPT, Industrial visits

#### v) Intellectual Skills:

- Selection of appropriate tool for a particular operation.
- Understand the importance of cutting tool nomenclature.
- Identify materials for jigs, fixtures, dies and other industrial components.
- Selection of appropriate jigs and fixtures for a given component.
- Improvement of interpersonal skills through presentations.
- Enhance learning to learn skills.

#### vi) Motor Skills:

- Preparation of power point presentation

#### Professional Practices:-

- At least two topics from the syllabus have to be selected by group of student and they are supposed to give seminar / presentation.
- One visit to a relevant industry and student will submit a report of the visit as a part of term work.

## SUGGESTED LEARNING RESOURCES

### Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Donaldson, George H. Lecain and V.C. Goold	Tool Design	Tata-McGraw Hill Publishing Company Ltd., 1976, Reprint-2002.
2	P.C. Sharma	Reston Publishing Company, Inc	S.Chand and Company Ltd., 1994.
3	R. K. Jain and S. C. Gupta	Production Technology	Khanna Publishers, 1986.
4	P. H. Joshi	Jigs and Fixtures	Tata-McGraw Hill Publishing Company Ltd., 2001.
5	V. K. Mahajan	Tool And Die Maker	Tata-McGraw Hill Publishing Company Ltd., 1981.
6	M. H. A. Kempster	An Introduction To Jig and Tool Design	ELBS.

### Mapping matrix of CO's, PO's and PSO's:

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development	PO4 Engineering Tools,	PO5 Engineering practices for society,	PO6 Project	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and	PSO2 Communicating effectively to work as a team member or a	PSO3 Pursuing higher studies and engaging
CO1	2	2	2	0	2	0	1	0	0	2
CO2	2	2	1	0	0	2	2	0	1	1
CO3	1	1	1	0	1	1	2	2	1	0
CO4	2	2	1	0	1	1	1	0	2	1

### 3: High 2: Moderate and 1:Low Relationship

# CUSROW WADIA INSTITUTE OF TECHNOLOGY PUNE-1

## DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

**COURSE: TOTAL QUALITY MANAGEMENT**

**COURSE CODE: R18ME5205**

**COURSE CATEGORY: Specialized**

**CREDIT: 06**

### Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
4	2	3	80	20	-	50	50	200

### Rationale:

Indian organizations are facing a challenge from the inflow of MNCs ever since the Government implemented the policies of liberalization, privatization & globalization. In the light of this, there is a dire need of new ideas, approaches and techniques for attaining a competitive edge. The course aims at exposing various aspects of TQM like cost of quality, QC tools, Kaizen, quality circles, team work for quality, customer satisfaction, benchmarking, quality culture, quality standards and quality audit.

### Course Outcomes:

1. Understand the concept of Quality.
2. Adopt suitable TQM tool.
3. Discuss and design Six – Sigma Methodology.
4. Understand the need of Waste Elimination.
5. Suggest suitable quality improvement tool.

### Course Details:

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS	MARKS
UNIT NO.1	<b>1. Introduction to Quality</b> 1.1 What is Quality? 1.2 Definition of Quality according to TQM. 1.3 Basic Terminology related to quality. 1.4 Eight Dimensions of Quality. 1.5 Methods of generating ideas for quality improvement.	12. Understand the concept of Quality. 13. Understand the need of Waste Elimination.	07	12

	1.6 Quality Gurus.			
<b>UNIT NO.2</b>	<b>2. Cost of Quality</b> 2.1 Quality Equation. 2.2 Definition. 2.3 Classification of Quality related cost. 2.4 Elimination of Total Quality Cost (COQ Approach to TQM) 2.5 Total Quality Cost. 2.6 Views of Quality Gurus on Cost of Quality.	4. Understand the concept of Quality. 5. Understand the need of Waste Elimination. 6. Suggest suitable quality improvement tool.	<b>08</b>	<b>12</b>
<b>UNIT NO.3</b>	<b>3. Total Quality Management</b> 3.1 Definition. 3.2 Progress from Quality Control to TQM. 3.3 Aims of TQM. 3.4 Guideline principles of TQM. 3.5 Five Pillars of TQM. 3.6 Difference between ISO 9000 and TQM	4. Understand the concept of Quality. 5. Understand the need of Waste Elimination. 6. Suggest suitable quality improvement tool. 7. Adopt suitable TQM tool.	<b>09</b>	<b>16</b>
<b>UNIT NO.4</b>	<b>4. Quality Improvement Techniques.</b> 4.1 Need of Quality Improvement. 4.2 Kaizen – Kaizen and Innovation, Kaizen and Management. 4.3 Kaizen umbrella. 4.4 Kanban. 4.5 Six Sigma. 4.6 TQMEX Model – Operation Management – 5S, BPR ( Business Process Reengineering ) 4.7 Quality Management – Quality Control Circle, Total Productive Maintenance (TPM), Total Quality Management. 4.8 Objectives and Benefits of TPM.	4. Understand the concept of Quality. 5. Understand the need of Waste Elimination. 6. Suggest suitable quality improvement tool. 7. Adopt suitable TQM tool.	<b>09</b>	16
<b>UNIT NO.5</b>	<b>5. Old Tools for Quality Improvement.</b> 5.1 Quality Improvement Old Tools – Brainstorming, check sheets, histograms, scatter diagrams, Parito diagram, Ishikawa diagram or cause and effect. 5.2 Waste Elimination. 5.3 Quality Assurance. 5.4 Quality of Product – Design and Development. 5.5 Quality control and Total Quality	6. Understand the concept of Quality. 7. Understand the need of Waste Elimination. 8. Suggest suitable quality improvement tool. 9. Adopt suitable TQM tool. 10. Explain alignment test on lathe Machine.	<b>07</b>	<b>12</b>

	Control.			
<b>UNIT NO.6</b>	<b>6. Six – Sigma, the Quality Improvement Program.</b> 6.1 Objectives of Six – Sigma. 6.2 What is Six Sigma? 6.3 Six – Sigma vs Cost of Quality. 6.4 Six Sigma Methodology. 6.5 Design of Six Sigma ( DFSS ) 6.6 Merits of Six Sigma, Limitations of Six Sigma.	6. Understand the concept of Quality. 7. Understand the need of Waste Elimination. 8. Suggest suitable quality improvement tool. 9. Adopt suitable TQM tool. 10. Discuss and design Six – Sigma Methodology.	<b>08</b>	<b>12</b>

### SUGGESTED EXERCISES/PRACTICALS:

<b>Sr. No.</b>	<b>Unit No.</b>	<b>Practical Exercises (Outcomes' in Psychomotor Domain)</b>	<b>Appro. Hrs. Required</b>
<b>1.</b>	I	To study quality and quality related concepts.	02
<b>2.</b>	I	To study eight dimensions of quality and Methods of generating ideas for quality improvement.	02
<b>3.</b>	II	To study quality equation and classification of quality related cost.	02
<b>4.</b>	II	To study elimination of total quality cost.	02
<b>5.</b>	III	To study quality management and progress from quality control to total quality management.	02
<b>6.</b>	III	To study aims and five pillars of TQM.	02
<b>7.</b>	IV	To study kaizen and kaizen umbrella.	02
<b>8.</b>	IV	To study benefits of TQM and total productive maintenance.	04
<b>9.</b>	V	To study quality improvement old tools.	02
<b>10.</b>	V	To study waste elimination techniques and quality assurance.	02
<b>11.</b>	VI	To study six sigma and its objectives.	04
<b>12.</b>	IV, V	To study concepts developed by quality Gurus. Study ISO 9000 standards.	04
<b>13.</b>		Industrial visit.	02
<b>Total</b>			<b>32</b>

## SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN:

Unit No.	Unit Title	Teaching Hours	Distribution of Marks			
			R Level	U Level	A Level	Total
1	Introduction to Quality	7	2	8	2	12
2	Cost of Quality	8	2	6	4	12
3	Total Quality Management	9	4	8	4	16
4	Quality Improvement Techniques	9	4	8	4	16
5	Old Tools for Quality Improvement.	7	2	6	4	12
6	Six – Sigma, the Quality Improvement Program.	8	2	6	4	12
<b>TOTAL</b>		<b>48</b>	<b>16</b>	<b>42</b>	<b>22</b>	<b>80</b>

### **TEACHING METHODOLOGY:**

Chalk Board, Discussions, Power Point Presentations, Visits, Charts.

### **III. Intellectual Skills:**

- Understand the eight dimensions of Quality.
- Understand the methods of generating ideas for Quality Improvement Interpret the data into readings.
- Understand the aims of TQM.
- Use of Five Pillars of TQM.

### **IV. Motor Skills:**

- Handling various data related to TQM.

### **SUGGESTED LEARNING RESOURCES:**

#### **L) REFERENCE BOOKS:**

Sr.No.	Title of Book	Author	Publication
1	TOTAL QUALITY MANAGEMENT	Poornima M. Charantimath	PEARSON Education
2	TOTAL QUALITY MANAGEMENT	N. V. S. Raju	CENGAGE Learning
3	TOTAL QUALITY MANAGEMENT	Dale H. Besterfield Carol Besterfield – Michna Glen H. Besterfield Mary Besterfield - Sacre	PEARSON Education
4	TOTAL QUALITY MANAGEMENT	DR. K.C. Arora	S.K. KATARIA and SONS

## SOFTWARE/LEARNING

<https://www.youtube.com/watch?v=vSRN3yuZUT0>  
[https://www.youtube.com/watch?v=2-cm\\_ocn9p4](https://www.youtube.com/watch?v=2-cm_ocn9p4)  
<https://www.youtube.com/watch?v=Hi7NUJdznc0>  
<https://www.youtube.com/watch?v=owiuBoVooY4>  
<https://www.youtube.com/watch?v=50qt5k1IqwI>  
<https://www.youtube.com/watch?v=WlcA1iJH1iE>  
<https://www.youtube.com/watch?v=wqc5cG9npwo>

## WEBSITES:

### Mapping matrix of CO's, PO's and PSO's:

CO's	PO1 Basic knowledge Discipline specific Knowledge	PO2 Problem analysis	PO3 Design/development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1 Applying fundamentals of mechanical engineering and mathematics to simple engineering problems.	PSO2 Communicating effectively to work as a team member or a leader with professional ethics.	PSO3 Pursuing higher studies and engaging in lifelong learning.
CO1	2	0	2	0	0	3	2	0	0	0
CO2	2	1	0	1	0	3	2	0	2	1
CO3	2	1	3	0	0	3	0	0	2	1
CO4	2	0	0	0	1	3	0	1	0	1
CO5	2	0	1	0	0	1	0	0	2	0

### 3: High 2: Moderate and 1:Low Relationship