

# DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING

## SCHEME OF TEACHING AND EXAMINATION

(Scheme of Teaching for Students admitted to first year in 2018-19)

**B.E. (I&PE) IV SEMESTER 175 CREDITS**

Sl	Subject Code	Subject	Credits	Hours/week			Examination Marks		
				Lecture	Tutorial	Practical	CIE	SEE	Total
1	UMA433C	Mathematics –IV	3	2	2	0	50	50	100
2	UIP414C	Kinematics of Machines	4	3	2	0	50	50	100
3	UIP425C	Foundry and welding Technology	3	3	0	0	50	50	100
4	UIP431C	Metrology & Measurement	4	4	0	0	50	50	100
5	UIP465L	Computer Aided Machine Drawing	3	1	0	4	50	50	100
6	UHS001N	Fundamentals of Quantitative Aptitude and Soft Skills /BBC-I	1	1	0	0	50	50	100
7	UIP415L	Foundry and Welding Practice Lab	1.5	0	0	3	50	50	100
8	UIP432L	Metrology & Measurements Laboratory	1.5	0	0	3	50	50	100
9	UMA430M	Bridge Course mathematics-II	-	4	-	-	50	50	100
10	UHS226M	Constitution of India	-	-	-	-	50	50	100
		<b>Total</b>	<b>21</b>	<b>14</b>	<b>4</b>	<b>10</b>	<b>500</b>	<b>500</b>	<b>1000</b>

**UIP414C: KINEMATICS OF MACHINES[04 Credits] [L-T-P:3-2-0]**

Programme Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
No	Course Outcomes	Engineering knowledge	Problem analysis	Design / Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	The Industrial and Production Engineering Graduates will be able to effectively design, implement, improve and manage systems /activities in manufacturing and service organizations.	Use the knowledge and skills of industrial engineering to model and analyze the real life problems to develop solutions	Engage professionally in industries or as an entrepreneur by applying manufacturing and management practices
	<b>The students will be able to:</b>															
1	understand the basic concepts of kinematic chains and their inversions and mechanisms	3	3	2	1					1	1			3		
2	develop the skill to draw and analyze the velocity and acceleration diagrams of basic mechanisms	3	3	2	1					1	1			3		
3	classify, compare and evaluate the kinematics of gears and gear trains	3	3	2	1					1	1			3		
4	design, develop and investigate the cam profiles to obtain desired movements in basic types of followers	3	3	2	1					1	1			3		
5	demonstrate the competency to balance the revolving and reciprocating masses	3	3	2	1					1	1			3		

## UIP414C: KINEMATICS OF MACHINES[04 Credits] [L-T-P:3-2-0]

### UNIT-I

**Introduction:** Definitions: Link or element, kinematic pairs, degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, structure, Mobility of Mechanism, Inversion, Machine.

**Kinematic Chains and Inversions:** Inversions of Four bar chain; Single slider crank chain and Double slider crank chain.

**Mechanisms:** Quick return motion mechanisms- Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism. Straight line motion mechanisms Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms, Geneva mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph, Steering gear mechanism.

**10 +04Hrs.**

### UNIT-II

**Velocity and acceleration analysis of mechanisms (graphical methods):** Velocity and acceleration analysis of Four Bar mechanism, slider crank mechanism and Simple Mechanisms by vector polygons: Relative velocity and acceleration of particles in a common link, relative velocity and accelerations of coincident Particles on separate links- Coriolis component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing.

**Velocity analysis by instantaneous center method:** Definition, Kennedy's Theorem, Determination of linear and angular velocity using instantaneous center method.

**Klein's construction:** Analysis of velocity and acceleration of single slider crank mechanism.

**10+08 Hrs.**

### UNIT-III

**Spur gears:** Gear terminology, law of gearing, Characteristics of involute action, Path of contact, Arc of contact, Contact ratio, Interference in involute gears, Methods of avoiding interference, Back lash, Comparison of involute and cycloidal teeth.

**Gear trains:** Simple gear trains, Compound gear trains for large speed reduction, Epicyclic gear trains, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear trains.

**10+06 Hrs.**

### UNIT -IV

**Cams:** Types of cams, Types of followers, Displacement, Velocity and Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife-edge, roller and flat-faced follower, Disc cam with oscillating roller follower, Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.

**Balancing of machinery:** Balancing of revolving masses, in single plane and different planes. Graphical method. Balancing of reciprocating masses partial balancing of single cylinder I.C. engines (simple problems)

**10+08 Hrs.**

### Text Books:

1. **"Theory of Machines"**, Sadhu Singh, Pearson Education Pvt. Ltd, 2<sup>nd</sup> edition. ISBN 9788177581270
2. **"Theory of Machines"**, Rattan S.S, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 3<sup>rd</sup> edition. ISBN: 007014477X, 9780070144774

### Reference Books:

1. *"Theory of Machines and Mechanisms"* John J. Uicker, Jr., Gordon R. Pennock & Joseph E. Shigley Oxford University Press, 4th edition. ISBN-10: 0195371232 ISBN-13: 978-0195371239
2. *"Theory of Machines"*, R. K. Bansal, J. S. Brar Firewall Media, 3rd edition, ISBN: 8170084180, 9788170084181

**UIP425C: Foundry & Welding Technology [03 Credits] [L-T-P:3-0-0]**

Programme Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
No	Course Outcomes	Engineering knowledge	Problem analysis	Design / Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	The Industrial and Production Engineering Graduates will be able to effectively design, implement, improve and manage systems /activities in manufacturing and service organizations.	Use the knowledge and skills of industrial engineering to model and analyze the real life problems to develop solutions	Engage professionally in industries or as an entrepreneur by applying manufacturing and management practices
	<b>The students will be able to:</b>															
1	Students able to describe and compare different manufacturing methods	3	1	2		2	2						1	1	1	1
2	Ability to select different patterns and identify appropriate different types of moulds.	3	2	2		2	2			2			1	1	1	1
3	Student's able to select different special casting process for types of products.	2	2	2		2	1			1			1		1	1
4	Ability to identify and classify different welding processes and analyze the structure of the welds.	3	2	2		2	1			1			1	1	1	1
5	Identify materials and processes commonly used in welding.	2		1		1	2			1			1			
6	Demonstrate ability to use welding tools and machines	3	2			2	1			2			1			1

**UIP425C: Foundry & Welding Technology [03 Credits] [L-T-P:3-0-0]**

**UNIT-I**

**Introduction:** Concept of Manufacturing process, its importance. Classification of Manufacturing processes. Introductions to Hot & Cold working, forging, rolling, extrusion process & drawing operation.

**Patterns:** Introduction to Casting process & steps involved. Advantages & Limitations of casting process.

Definition, Classification of patterns, Pattern materials. And various pattern allowances.

**12 Hrs.**

**UNIT-II**

**Sand Moulding and Methods:** Types of base sand, requirement of base sand. Types of sand moulds, properties. Ingredient of moulding sands. Core sands, ingredients and properties. Method used for sand moulding.

**Special moulding Process:** Study of important moulding processes, Green sand, Core sand, Dry sand, Sweep mould, CO<sub>2</sub> sand, Shell mould, Investment casting; Metal moulds: Gravity die-casting, Pressure die casting,

centrifugal casting, Squeeze Casting, Slush casting, Thixocasting and continuous casting processes.

**12 Hrs.**

**UNIT-III**

**Welding process:** Definition, Principles, Classification, Application, Advantages & limitations of welding.

**Arc Welding:** Principle and Classifications.

**Gas Welding:** Principle, Oxy – Acetylene welding, Reaction in Gas welding, Flame. Flame characteristics.

**08 Hrs.**

**UNIT-IV**

**Special type of welding:** Resistance welding- principles and types. Friction welding, Explosive welding, Thermit welding, Laser welding and Electron beam welding

**08 Hrs.**

**Text Books:**

1. *“Manufacturing Technology: Foundry Forming and Welding”*, P.N.Rao 2<sup>nd</sup> Ed., Tata McGraw Hill, 2003.ISBN:0-07-463180-2
2. *“Foundry Technology”*, by R. K.Jain -4<sup>th</sup> Edition, Tata McGraw hill, 2003. ISBN-0-07-044760-8

**Reference Books:**

1. *“Manufacturing Technology”*, Serope Kalpakjain, Steuen.R.Sechmid, Pearson Education Asia, 5<sup>th</sup> Ed. 2006.ISBN: 81-7808-157-1
2. *“Process and Materials of Manufacturing:”, Roy A Lindberg, 4<sup>th</sup> Ed. Pearson Edu. 2006.-ISBN-81-203-0663-5*
3. *Introduction to Manufacturing Processes* by John. A. Schey, McGraw Hill, 3<sup>rd</sup> Edition, 2000.
4. *Modern Manufacturing Process* by Grover

**UIP431C: METROLOGY AND MEASUREMENTS [04 Credits] [L-T-P:4-0-0]**

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
No	<b>Programme Outcomes</b>	Engineering knowledge	Problem analysis	Design / Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	The Industrial and Production Engineering Graduates will be able to effectively design, implement, improve and manage systems /activities in manufacturing and service organizations.	Use the knowledge and skills of industrial engineering to model and analyze the real life problems to develop solutions	Engage professionally in industries or as an entrepreneur by applying manufacturing and management practices
	<b>Course Outcomes</b>															
<b>The students will be able to:</b>																
1	Gain knowledge about different measurement systems and common types of errors	1			2					1			2	3	2	2

2	Analyze the different types of limits and fits and determine the tolerance	1	3	2	2					1				3	1	2
3	Understand the different types of Comparators, Angular measurement	2	1	1	2								1	2	2	2
4	Understand the different types of sensors, transducers and strain gauges used for measurement	2		1	1	1	1	2		2	1		1	2	3	3
5	Get the knowledge about working of thermocouples, thermometers and flow meters used for measurements.	2	1	2		1		1		1			1	3	2	2

**UIP431C: METROLOGY AND MEASUREMENTS [04 Credits] [L-T-P:4-0-0]**

**UNIT-I**

**Introduction to Metrology:** Definition and concept of metrology, Need of inspection, Principles of measurement, Process of measurement, Methods of Measurement, Classification of measuring instruments, Selection of measuring instruments, Measuring systems and accuracy of measurement, Precision and accuracy, errors in measurement.

**Standards of Measurement:** System of measurement, Material Standard, Wavelength Standards, Subdivision of standards, Line and End standards, Classification of standards and Traceability, calibration of End bars

**Linear Measurement:** Constriction, working principle, measurement procedure, error and its elimination, limitations, calibration and application of different linear measuring instruments, like Steel rule, calipers, surface plates, tool maker's flats, angle plates, V block, Straight edge, Spirit level, combination square, Engineer's square. Slip gauge, wringing of slip gauge, Indian standards on slip gauge, selection of slip gauges, care of slip gauge, slip gauge accessories, adjustable slip gauges, Gauges for internal measurement like Telescopic gauge, Numerical problems for fits and gauges

**13 Hrs.**

**UNIT-II**

**ANGULAR MEASUREMENT:** Construction, working principle, measurement procedure of sine bar, Taper measurement, application of angle gauge

**COMPARATORS:** Introduction to comparator, characteristics, classification of comparators, mechanical comparators-Johnson comparator, Sigma comparator, Dial indicator, Optical comparators-principles, Zeiss ultra optimizer, Electrical and Electronics comparators-principles, LVDT, pneumatic comparators

**SURFACE ROUGHNESS MEASUREMENT:** Introduction to Surface texture, Parameters for measuring surface roughness, Surface roughness measuring instrument: TalySurf.

**Screw Thread Measurement:** Terminology, Classification, Forms of thread, Errors in thread, Measurement of various Elements in threads like major diameter, minor diameter, effective diameter. Measurement of pitch, screw thread gauges, Screw pitch gauge, angle and effective diameter of screw thread by 2 and 3 wire methods, best size wire. Toolmakers microscope, gear terminology, use of gear tooth vernier caliper and gear tooth micrometer

**Advances in Metrology** Coordinate Measuring Machine (CMM): Fundamental features of CMM – development of CMMs – role of CMMs – types of CMM and Applications, – types of probes  
Machine Vision Systems: vision system measurement – Multisensory systems. Interferometer: Principle, NPL Interferometer Laser Metrology: Basic concepts of lasers, advantages of lasers, laser interferometers, types, applications

**13 Hrs.**

### UNIT-III

**Measurements and Measurement systems:** Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-time delay. Error in measurements and classification of errors. Transducers, Transfer efficiency, primary and secondary transducers. Electrical, Mechanical, electronic transducers, advantages of each type transducers.

**Intermediate modifying devices,** Mechanical systems, inherent problems, Electrical Intermediate modifying , devices, input circuitry, ballast, ballast circuit, electronics amplifiers and telemetry, Terminating devices, Mechanical system Cathode Ray Oscilloscope, Oscillographs, X-Y plotters **13 Hrs.**

### UNIT-IV

**Measurement of force:** principle of analytical balance, platform balance, proving ring.

**Measurement of Torque** :-prony brake, hydraulic dynamometer. Pressure Measurements, Principle, use of elastic members, Bridgeman gauge, Mcloed gauge, Pirani Gauge.

**Measurement of Temperature** : resistance thermometer, thermocouple, laws of thermocouples, thermocouple materials used for construction, pyrometers Optical pyrometer.

**Measurement of Strain** : Strain gauges, preparation and mounting of strain gauges, gauge factor, methods of strain measurement

**13 Hrs.**

#### Text Books:

1. Beckwith Marangoni and Lienhard, "*Mechanical measurements*" Pearson Education, 6<sup>th</sup> ed.2002.
2. R. K. Jain, "*Engineering Metrology*", Khanna Publication, 1994.

#### Reference Books:

1. I. C. Gupta, "*Engineering Metrology*" Dhanpat Rai Publications, Delhi.
2. R. K. Jain. "*Mechanical Measurements*"
3. Alsutko, Jerry. D. Faulk, "*Industrial Instrumentation*" Thompson Asia Pvt.Ltd.2002. Ernest O, Doblin "*Measurement Systems Applications and Design*" McGRAW Hill Book Co.

**UIP465L: COMPUTER AIDED MACHINE MODELING LABORATORY [03 Credits] [L-T-P:1-0-4]**

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>No</b>	<b>Programme Outcomes</b>	Engineering knowledge	Problem analysis	Design / Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	The Industrial and Production Engineering Graduates will be able to effectively design, implement, improve and manage systems /activities in manufacturing and service organizations.	Use the knowledge and skills of industrial engineering to model and analyze the real life problems to develop solutions	Engage professionally in industries or as an entrepreneur by applying manufacturing and management practices
	<b>Course Outcomes</b>															
<b>The students will be able to:</b>																
1	Students will be introduced to the use various CAD softwares and learn using the GUI, sketcing commands and initial setup required for drawing. Practice of converting pictorial views into orthographic projections	2	1			1		1						1		
2	Drawing the sectional views of various forms of threads fasteners, keys & joints and convert them into drawings	3	2			2	1	1						1	1	1

3	Understanding and drawing 3D models of different types of riveted joints and couplings	3	3	1	1	3	1	1		1			1	2	2	2
4	Conversion of 2D drawings of different part assemblies into three dimensional models	3	3	2	2	3	1	1		2	1		2	3	2	2

**UIP465L: COMPUTER AIDED MACHINE MODELING LABORATORY [03 Credits] [L-T-P:1-0-4]**

**PART – A**

**Introduction:** Review of graphic interface of the software. Review of basic sketching commands and navigational commands. Starting a new drawing sheet. Sheet sizes.

Naming a drawing. Drawing UNITS, grid and snap

**02 Hrs.**

**Orthographic views:** Conversion of pictorial views into orthographic projections of simple machine parts with or without section. (Bureau of Indian Standards conventions are to be followed for the drawings) Hidden line conventions. Precedence of lines

**05 Hrs.**

**Thread forms:** Thread terminology, sectional views of threads. ISO Metric (Internal & External) BSW

(Internal & External) square and Acme. Sellers thread, American Standard thread.

**05 Hrs.**

**Fasteners:** Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw.

**10 Hrs.**

**PART – B**

**Keys & Joints** Parallel key, Taper key, Feather key, Gibhead key and Woodruff key

**05 Hrs.**

**Riveted Joints:** single and double riveted lap joints, butt joints with single/double cover straps (Chain and Zigzag, using snap head rivets). cotter joint (socket and spigot),

knuckle joint (pin joint) for two rods.

**05 Hrs.**

**Couplings** Split Muff coupling, Protected type flanged coupling, pin (bush) type flexible coupling, Oldham's coupling and universal coupling (Hooks' Joint)

**10 Hrs.**

**PART – C**

**Assembly Drawings**

1. Plummer block (Pedestal Bearing)

2. Petrol Engine piston

3. I.C. Engine connecting rod

4. Screw jack (Bottle type)

5. Tailstock of lathe

6. Machine vice

**20 Hrs.**

**Text Books:**

1. N.D.Bhat & V.M.Panchal '*Machine Drawing*',
2. N. Siddeshwar, P. Kanniah, V.V.S. Sastri, '*Machine Drawing*' , published by Tata Mc GrawHill,2006

**Reference Books:**

1. S. Trymbaka Murthy, '*A Text Book of Computer Aided Machine Drawing*', CBS Publishers, New Delhi, 2007
2. K.R. Gopala Krishna, '*Machine Drawing with Auto CAD*' , Subhash Publication.
3. Goutam Pohit & Goutham Ghosh, '*Machine Drawing with Auto CAD*'. 1st Indian print Pearson Education, 2005
4. Sham Tickoo. '*Solid Edge V18, for engineers and designers*'. Dream tech 2011

**Note:**

All the sheets should be drawn in the class using software. Sheet sizes should be A4. All sheets must be submitted at the end of the class by taking printouts.

Two questions to be set from each Part-A, Part-B and Part-C. Student has to answer one question each from Part-A and Part-B for 20 marks each and one question from Part-C for 60 marks.

PART-A	1x20	= 20 Marks
PART-B	1x20	= 20 Marks
PART-C	1x60	= 60 Marks
<b>Total</b>		<b>=100 Marks</b>

**UHS001N:FUNDAMENTALS OF QUANTITATIVE [01 CREDITS] [L-T-P:1-0-0]**

OVERVIEW		
<b>Semester</b>	4	
<b>Course Objectives</b>	<p>The course objectives for the semester are as follows:</p> <ol style="list-style-type: none"> <li>1. Cover basic to intermediate topics in the following domains:               <ol style="list-style-type: none"> <li>a. quantitative aptitude,</li> <li>b. verbal aptitude, and</li> <li>c. reasoning aptitude.</li> </ol> </li> <li>2. Build confidence and self-esteem through the following:               <ol style="list-style-type: none"> <li>a. life skills, and</li> <li>b. soft skills.</li> </ol> </li> <li>3. Hone career skills and industry awareness.</li> </ol>	
<b>Course Outcome</b>	<p>After the course, the students will be able to:</p> <ol style="list-style-type: none"> <li>1. Answer multiple choice questions from topics in:               <ol style="list-style-type: none"> <li>a. quantitative aptitude, verbal aptitude, and reasoning aptitude.</li> </ol> </li> <li>2. Use tools and techniques learnt in soft skills modules to:               <ol style="list-style-type: none"> <li>a. build confidence and self-esteem.</li> </ol> </li> <li>3. Speak knowledgeable about career prospects and industry.</li> </ol>	
<b>Domain</b>	<b>Hours</b>	<b>Modules</b>
<b>Quantitative Aptitude (QA)</b>	6	3
<b>Reasoning Aptitude (RA)</b>	6	3
<b>Verbal Aptitude (VA)</b>	6	3
<b>Soft Skills (SS)</b>	6	3
<b>Career Skills (CS)</b>	6	3
<b>Total</b>	30	15

DETAILS			
Sl. No.	Domain	Topic	Hours
<b>UNIT I – Quantitative and Reasoning Aptitude Skills Training</b>			
1.	QA	Factors and Multiples	2
2.	QA	Divisibility Rules	2
3.	QA	LCM and HCF	2
4.	RA	Puzzles	2
5.	RA	Venn Diagrams	2
6.	RA	Binary Logic	2
<b>Unit II – Verbal Aptitude Skills Training</b>			
7.	VA	Sentence Completion	2
8.	VA	Para Jumbles	2
9.	VA	Fill in the Blanks (Grammar)	2
<b>Unit III – Career Skills</b>			
10.	CS	Resume Building	2
11.	CS	Group Discussion - Fundamentals	2
12.	CS	Becoming Industry Aware	2
<b>Unit IV – Soft Skills</b>			
13.	SS	Personal Branding	2
14.	SS	Networking	2
15.	SS	Delivering a Prepared Speech	2

REFERENCES:

- ETHNUS

**UIP415L: FOUNDRY AND WELDING PRACTICE [1.5 CREDITS] [L-T-P:0-0-3]**

				PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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No	Programme Outcomes	Engineering knowledge	Problem analysis	Design / Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	The Industrial and Production Engineering Graduates will be able to effectively design, implement, improve and manage systems /activities in manufacturing and service organizations.	Use the knowledge and skills of industrial engineering to model and analyze the real life problems to develop solutions	Engage professionally in industries or as an entrepreneur by applying manufacturing and management practices
	Course Outcomes	The students will be able to:														
1																
2																
3																
4																
5																

## Part-A

### 1. Testing of Moulding sand and Core sand

Preparation of specimen and conduction of the following tests:

- Compression, Shear and Tensile tests
- Permeability test
- Core hardness & Mould hardness tests
- Grain fineness test
- Clay content test

## Part-B

### 2. Foundry Practice

Use of foundry tools and other equipments

Preparation of moulds (ready to pour) using two boxes and three boxes

Preparation of one casting using Aluminium or cast iron (Demonstration only)

### 3. Forging & Welding Practice

Preparing minimum three models involving upsetting, drawing and bending operations

Simple welding joints like LAP, BUTT, using ARC welding . Simple welding joints using GAS welding, TIG & MIG welding ,spot welding.

#### Scheme of Examination:

One question from part A : 20 Marks

One question from part B : 20 Marks

Viva- Voice : 10 Marks

**TOTALS : 50 Marks**

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
No	<b>Programme Outcomes</b>	Engineering knowledge	Problem analysis	Design / Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	The Industrial and Production Engineering Graduates will be able to effectively design, implement, improve and manage systems /activities in manufacturing and service organizations.	Use the knowledge and skills of industrial engineering to model and analyze the real life problems to develop solutions	Engage professionally in industries or as an entrepreneur by applying manufacturing and management practices
	<b>Course Outcomes</b>															
<b>The students will be able to:</b>																
1	The student shall be measuring the various parameters like length, height, angle, displacement, flatness etc., by using various instruments like Vernier callipers, micrometer, dial indicator, etc.	3	3	3	3	1				3				3	2	1
2	The student shall be able to measure the threads, gear tooth profiles and surface roughness using appropriate instruments and analyze the data.	1	2	3	3	1								2	2	1
3	The student shall be able to recognize various types of governors and gyroscopes, and improve their performance as per requirement.	3	2	2	1	1				3				2	2	1
4	The student shall be able to determine the balancing forces, inertial forces of rotating and reciprocating components in real life problems.	2	3	3	2	1				1				3	2	1
5	The student shall be able to check alignment of various components in various mechanisms using advanced scientific tools.	2	2	3	2	2				3				3	2	1

**Part-A**

**Mechanical Measurements**

1. Calibration of Pressure Gauge
2. Calibration of Load Cell
3. Calibration of Thermocouple
4. Calibration of Strain Gauges

**Part-B**

**Metrology Lab**

1. Measurements Using Optical / Tool maker Microscope.
2. Measurements of angle using Sine Center/ Sine Bar/Bevel Protractor.
3. Measurements of the taper angle of given Taper Plug using roller sets.
4. Measurements of Screw thread parameters using two wire or three- wire method
5. Study on Snap, Plug, Ring, Taper and Adjustable Gauges.
6. Calibration of Micrometer, Vernier caliper and Vernier Height Gauge.
7. Measurement of Gear tooth profile using Gear tooth Vernier.
8. Studies on Mechanical/Electronic/Pneumatic Comparator.

**Scheme of Examination:**

One question from part A : 20 Marks

One question from part B : 20 Marks

Viva- Voce : 10 Marks

**TOTALS : 50 Marks**