

**CHHATTISGARH SWAMI VIVEKANANAD TECHNICAL UNIVERSITY,  
BHILAI**

**DIPLOMA PROGRAMME IN MECHANICAL ENGINEERING**

**Semester-V**

**COURSE OF STUDY AND SCHEME OF EXAMINATION**

S. NO.	Board of Study	Subject Code	Subject	Periods / week (In Hours)			Scheme of Examination					Credit L+ (T+P) /2	
				L	T	P	Theory			Practical			Total Marks
							ESE	CT	TA	ESE	TA		
1.	Mechanical Engineering	237511 (37)	Theory of machines	4	1	-	100	20	20	-	-	140	5
2.	Mechanical Engineering	237512 (37)	Metrology & Instrumentation	4	1	-	100	20	20	-	-	140	5
3.	Mechanical Engineering	237513 (37)	CAD/CAM	3	1	-	100	20	20	-	-	140	4
4.	Mechanical Engineering	237514 (37)	Design of Machine elements	4	1	-	100	20	20	-	-	140	5
5.	Mechanical Engineering	237515 (37)	Machine Tool Technology	3	-	-	100	20	20	-	-	140	3
6.	Mechanical Engineering	237521 (37)	Theory of machines Lab	-	-	4	-	-	-	50	25	75	2
7.	Mechanical Engineering	237522 (37)	Metrology & Instrumentation Lab	-	-	3	-	-	-	50	25	75	2
8.	Mechanical Engineering	237523 (37)	CAD/CAM Lab	-	-	6	-	-	-	50	25	75	3
9.	Mechanical Engineering	237524 (37)	Industrial Training	-	-	1	-	-	-	50	25	75	1
<b>TOTAL</b>				<b>18</b>	<b>4</b>	<b>14</b>	<b>500</b>	<b>100</b>	<b>100</b>	<b>200</b>	<b>100</b>	<b>1000</b>	<b>30</b>

L : Lecture hours, T : Tutorial hours, P : Practical hours,

**ESE : End of Semester Exam, CT: Class test, TA : Teacher's Assessment**

Note:- 1. Industrial Training will be done by the student after completion of 4<sup>th</sup> Semester examination.

2. Duration of training must be 4 weeks.

3. Training will be organised in 4<sup>th</sup> Semester & its evaluation will be done on 5<sup>th</sup> Semester.

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL  
UNIVERSITY, BHILAI**

- A) **SEMESTER** : **V**  
 B) **SUBJECT TITLE** : **THEORY OF MACHIENS**  
 C) **CODE** : **237511 (37)**  
 D) **BRANCH/DISCIPLINE** : **MECHANICAL ENGINEERING**  
 E) **RATIONALE** :

The work of Mechanical and Production technicians is not only to supervise run and plan production processes, but also includes fault diagnosis and prevention of breakdowns. This is only be done, if he is familiar with the working of basic mechanism used in shop floors machines, how they fail and what are the loads coming on different numbers and different joints of the machines. The aim of the course is to provide exposure to the basic mechanism and machines to enhance their capability of designing and development of prototype.

**F) TEACHING AND EXAMINATION SCHEME:**

Course Code	Scheme of Examination								Total Marks	Credit L+(T+P)/2
	L	T	P	Theory			Practical			
				ESE	CT	TTA	ESE	PTA		
237511 (37)	4	1	-	100	20	20	-	-	140	5
237521 (37)	-	-	4	-	-	-	50	25	75	2

**G) DISTRIBUTION OF MARKS AND HOURS:**

Chapter No.	Chapter Name	Hours	Marks
1.	Simple Mechanisms	08	10
2.	Velocity and Acceleration of Links	08	10
3.	Friction	08	10
4.	Flywheels and Crank Effort Diagrams	08	10
5.	Power transmission	08	10
6.	Gears and Gear Trains	08	10
7.	Governors	08	10
8.	Cams and Followers	08	10
9.	Balancing of Machine Parts	08	10
10.	Vibration	08	10
	<b>Total</b>	<b>80</b>	<b>100</b>

## H) DETAILED COURSE CONTENTS:

### Chapter- 1: Simple Mechanism:

- Introduction of theory of machines,
- Definitions- statics, dynamics, Kinematics, Kinetics,
- Kinematic pair, Kinematic chain, Machine, Structure,
- Mechanism, Mechanism Inversions,
- Relation between number of links, joints and pairs,
- Four Bar chain and its inversion,
- Slider Crank chain and its inversions.

### Chapter- 2: Velocity & Acceleration of Links:

- Concept of Relative and Absolute velocity, Angular and linear velocity of a point on a link,
- Instantaneous center of a link, its properties and uses,
- Acceleration of a link-centripetal, tangential, total, relative & absolute accelerations,
- Velocity and Acceleration diagrams for four bar and other mechanisms,
- Klein's construction for single slider crank mechanism,
- Analytical method of calculating the velocity and acceleration of piston in a reciprocating engine mechanism.

### Chapter- 3: Friction

- Pivot & collars friction,
- Power lost assuming uniform pressure and uniform wear,
- Clutch-need, classification, construction & working of single & multiplate clutches,
- Power transmitted by single and multiplate clutches,
- Brakes -need, types, braking force, braking torque,
- Band brakes, block brakes, Internally expanded brakes,
- Dynamometer-meaning, need types,
- Simple numerical calculation in above items.

### Chapter- 4: Flywheel & Crank Effort Diagrams

- Dynamics of reciprocating engine mechanism,
- Inertia force due to reciprocating mass,
- Piston effort, crank effort, turning moment of Crankshaft,
- Analytical and graphical methods of construction of turning moment diagrams for Steam and I.C. engines,
- Fluctuation of energy and speed,
- Coefficient of fluctuation of energy and speed,
- Principle and application of Flywheel,

- Calculation of moment of inertia, weight of flywheel for steam and I.C. Engines.

#### **Chapter- 5: Power Transmission**

- Drives meaning, classification,
- Belt, chain and rope and gear drives,
- Flat and ‘V’ belt, Ratio of tensions, Slip,
- Length of belt calculation for open and cross belt drives,
- Power transmitted,
- Effect of centrifugal force, centrifugal, tension, Total tension, Maximum stress in belt,
- Maximum Power transmitted. Velocity for maximum Power condition,
- V-belt drives Advantages and disadvantages,
- Rope drives – types, Ratio of tensions, Designation of ropes as per B.I.S,
- Chain drives:- classification, Designation of chain drives as per B.I.S.

#### **Chapter- 6: Gears and Gear Train**

- Types of Gears
- Simple and compound Gear Train
- Epicyclic Gear Train
- Law of Gearing, Interference
- Minimum number of teeth calculation for pinion and wheel to avoid interference
- Planet and Sun Gear

#### **Chapter- 7: Governer**

- Function of Governer & its comparison with flywheel,
- Classification -Watt, Porter, Proell and Hartnell, their construction and working,
- Sensitivity, stability, Isochronism power and effort.

#### **Chapter- 8: Cams & Followers**

- Need, Classification,
- Motion of follower,
- Displacement, velocity and acceleration diagrams uniform velocity, uniform acceleration, simple harmonic motion,
- Cam profile for radial, effect knife edged follower.

#### **Chapter- 9: Balancing of Machine Parts**

- Concept,
- Static and dynamic balancing of rotating parts,
- Simple numerical problems on static balancing of several masses in single plane-graphical and analytical method.

## Chapter- 10: Vibrations

- Introduction, elements of vibration.
- System classification and explanation of the types of vibration according to the actuating force on the body like undamped vibration, free damped vibration, forced undamped vibration and forced damped vibration.
- Classification and explanation of the types vibration according to the number of degrees of freedom.
- Natural frequency of free vibrations:
- Critical speed of shaft.

### I) SUGGESTED INSTRUCTIONAL STRATEGIES:

- **Lecture Method:**
  - Teaching through chalk board
  - H.P, LCD Projector.
  - Interaction with students through seminar.
  - As far as possible concepts are to visualized by extensive use of charts models
- **Industrial Visits:**
  - Visits to nearby industries **Expert Lecturer:**
  - Expert lectures are to be arranged on above subject through guest faculty.
- **Demonstration:**
  - Demonstration of different mechanisms using perplex sheet models and Computer aided simulations.

### J) SUGGESTED LEARNING RESOURCES:

#### (a) Reference Books

S.No.	Title	Author/Publisher
1.	Theory of Machines	J.M.Shah and H.M.Jadhvani
2.	Theory of Machines	Abdulla Shariff
3.	Theory of Machines	D.R.Malhotra
4.	Theory of Machines	P.L.Ballaney
5.	Theory of Machines	Thomas Bevan.
6.	Theory of Machines	Khurmi & Gupta
7.	Theory of Machines	S.S.Ratan

**SUBJECT TITLE: THEORY OF MACHIENS LAB**

**PRACTICAL CODE: 237521 (37)**

**HOURS: 64**

**LIST OF PRACTICALS / TUTORIALS:**

1. Identification, sketching & diagrams with labeling of various simple mechanisms such as Minidrafter, Manual Typewriter, bicycle brake, bicycle rear wheel Ratchet mechanism, foot operated pump, Internal expanding brakes of two or four wheelers.
2. Four problems on velocity & Acceleration by relative velocity method and instantaneous center method to be solved graphically on sheet.
3. To determine velocity & Acceleration of a slider in slider crank mechanism by Klein's construction.
4. To draw cam profile for
  - Simple Harmonic Motion
  - Uniform acceleration & deceleration both for knife edge & roller follower.
5. Determine rotating mass to balance different rotating masses on different planes on an experimental four plane balancing machine.
6. To analyse sources of unbalancing in working model of single cylinder I.C. Engine.
7. Study & analysis of valve operating mechanism of an IC engine.
8. Analysis and study of gears in the following (any two)-
  - Sugar cane crushing machine,
  - Differential of automobile
  - Gear box of two wheelers
  - Hand Drilling Machine

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL  
UNIVERSITY, BHILAI**

- A) **SEMESTER** : **V**  
 B) **SUBJECT TITLE** : **METROLOGY AND INSTRUMENTATION**  
 C) **CODE** : **237512 (37)**  
 D) **BRANCH/DISCIPLINE** : **MECHANICAL ENGINEERING**  
 E) **RATIONALE** :

This subject has earned its importance in the curriculum due to major activities of inspection & quality control department. Today in almost all factories search is going on for answers to the problems like better way of making and assembling parts. Many of these answers are provided by metrology through accuracy in production, high standards of inspection, new and improved use of instrument etc. metrology therefore, is a fast growing, changing and increasingly significant employment field. The subject is based on two sequential step i.e. introducing concepts, and providing practice in applying/ interpreting these concepts. After going through this subject the technicians would be able to develop skill in using , selecting and servicing the instrument. Also by actually using the equipment, the technician will know the suitability of method or instrument, for any measurement and to develop the general technique of measurement.

**F) TEACHING AND EXAMINATION SCHEME:**

Course Code	Scheme of Examination								Total Marks	Credit L+(T+P)/2
	L	T	P	Theory			Practical			
				ESE	CT	TTA	ESE	PTA		
237512 (37)	4	1	-	100	20	20	-	-	140	5
237522 (37)	-	-	3	-	-	-	50	25	75	2

**G) DISTRIBUTION OF MARKS AND HOURS:**

Chapter No.	Chapter Name	Hours	Marks
1.	Simple Inspection	08	10
2.	General measurement concept	08	10
3.	Linear measurement	08	10
4.	Angular measurement	08	10
5.	Straightness flatness square ness & roundness testing	08	10
6.	Surface roughness	08	10

7.	Screw thread measurement	08	10
8.	Gear measurement	08	10
9.	Limit gauges	08	10
10.	Transducers & Temperature measurement	08	10
	<b>Total</b>	<b>80</b>	<b>100</b>

## H) DETAILED COURSE CONTENTS:

### Chapter- 1: Simple Inspection

- Meaning and application of inspection,
- daily life example of inspection, concept of inspection as applied to daily life and industries,
- Effect of absence of inspection in an industry,
- Classification of inspection function,
- meaning and advantages of each concept of inspection applied to metrology. Definition/ meaning of precision, its accuracy and error,
- Differentiation between precision measurement in industry,
- meaning of standard inspection and specification,
- relationship between cost and accuracy,
- Interchange ability and selective assembly.

### Chapter- 2: General Measurement Concept

- Limits, fits and tolerance definition,
- Selection of fit,
- calculation of fundamental deviation,
- limit of sizes,
- selection of limit of sizes,
- selection of limits,
- tolerances and allowances.

### Chapter- 3: Linear Measurements

- Standards of length,
- Classification and use of slip gauges, wringing process,
- Gauge block calibration precautions to be observed while using gauge blocks, classification of linear measuring instrument direct and indirect,
- Construction and working of Vernier caliper, micrometers- outside and inside and depth, vernier height gauge, dial vernier and dial height gauge identification of parts, finding least count, precautions of each type, types of errors,
- Dial gauge types construction, principle, accuracy and precaution to be observed in handling, field of application,



- Comparators principle, type, working, use field of application of Mechanical, Electrical, Optical and Pneumatic comparators selection specific work , Measuring Machine-type, application limitations, working principle,
- Interferon meters type, working principle, and applications.

#### **Chapter- 4: Angular Measurements**

- Classification- direct and indirect,
- Protractor- vernier and optical, universal- working use and limitation, precautions,
- Angle blocks-set size, accuracy, calibration, method of measuring unknown angle and checking know angle,
- Sine bar- common types, use in actual practice for finding out known and unknown angle,
- Spirit level- types, use field of application, sensitivity,
- Clinometers types, working principle, accuracy,
- Angle Dakar-type, Principle of working method, field of application.

#### **Chapter- 5: Straightness Flatness Squareness & Roundness Testing**

- Concept of square ness, flatness, square ness & Roundness,
- Straight edge method,
- Light gap and feeler gauge method,
- Wedge method,
- Precision level method,
- Auto collimator method, squariness- - indicator method,
- Square tester,
- Auto collimator method,
- Determination of straightness, flatness, squariness of a given piece,
- Use of v- block and dial indicator for determining roundness.

#### **Chapter- 6: Surface Roughness**

- Definition of primary and secondary texture,
- Real surface, geometrical surface, effective surface,
- Real profile, geometrical profile, effective profile,
- Reference line, lay, traversing length, sampling length, mean time,
- Center line of profile,
- “M” and “S” system of surface assessment,
- Salient features, merits and demerits of each basic unit of indication surface roughness- CL No. R.M.S., Ten point height,
- Interpretation of units graphically and mathematically,
- Types of surface measuring instruments,
- Method of surface measurement stylus skid, stylus pressure,
- Mechanical amplification, Tomlinson Mechanical surface finish recorder working principle,

- Electrical amplification, Principle of current generating type and voltage variation type stylus instrument,
- Profilographits units, advantage, working principle,
- surface inspection by comparison methods (a) Touch inspection (b) Visual inspection (c) Scratch inspection (d) Microscope inspection – Limitations.

### **Chapter- 7: Screw Thread Measurements**

- Type of screw threads,
- Threads nomenclatures, Errors in screw thread pitch errors,
- Progressive and periodic instrument,
- Equipment required for measuring pitch, effective diameter and angle – procedure, advantages, limitation and precautions of each method,
- Limit gauges for screw thread measurement, procedure,
- Advantages and limitation of catch Gauge,
- Precautions observed while using a limit gauge.

### **Chapter- 8: Gear Measurements**

- Types of gears,
- Gear nomenclature,
- Gear elements requiring measurement,
- Necessity of measuring gear elements accuracy,
- Types of gear tests,
- Different method of inspecting gear tooth from,
- Measurement of chordal thickness & constrict chord using vernier tooth caliper,
- Gear tooth profile check- involutes testing M/C- principle and uses,
- Electricity-Tests - Principle and use,
- Parkerson gear tester principle and use.

### **Chapter- 9: Limit Gauges**

- Definition of gauge and gauging,
- Necessity of gauging in industrial practice,
- Gauges types- according to use (shop, Inspection and reference gauge) type fixed limit, indicating and combination,
- Specific use (Screw pitch, gauge, template, feeler gauge- and their uses, application identification, selection and precautions,
- Working tolerance of gauges,
- Maximum and minimum metal conditions of tolerances,
- Calculation maximum and minimum metal conditions from given tolerances, tolerance frames and their use, selection and specification as per IS, 2251, 3455, 3484,
- Wear allowances and its selection for design,
- Taylor’s principle for design of “Go and NOGO” gauges,
- Application of principal, deviation, calculation of gauge dimensions from formula given in IS 3455,

- Selection of parameters necessary for calculation.

## **Chapter- 10: Transducers Temperature Measurements**

- Meaning, function,
- Primary and secondary transducers,
- Classification – Mechanical Electrical, Active, Passive,
- Advantages of Electrical transducer,
- Working principle and application of resistance type, inductance type, capacitance type and piezo electric type,
- Transducers for pressure, temperature and flow measurement.
- Principle on which temperature measuring device work,
- Example of each type Temperature range,
- Various instruments/devices used, Bimetal thermometer, pressure spring thermometer, resistance thermometer, thermo meter working principle, range,
- Materials used and their characteristics, application,
- Comparison of resistance thermometer and thermister,
- Thermo couple principle, material working compensating lead, working range, Methods of measuring output i.e. mill voltmeter, potentiometer – application, comparison of various thermocouple,
- Pyrometer- redial and optical- working principle, construction, advantages, limitations, application in industrial situation,
- Types of error in temperature measurement (instrument error, thermal probe error)- reasons and effects of these errors way of reducing error.

### **I) SUGGESTED INSTRUCTIONAL STRATEGIES:**

- **Lecture Method:**
  - Teaching through chalk board
  - H.P, LCD Projector.
  - Interaction with students through seminar.
  - Concepts are to visualized by extensive use of charts models
- **Industrial Visits:**
  - Visits to nearby industries to expose them to industrial environment, their working, ways of measurement & inspection.
- **Expert Lectures:**
  - Expert lectures are to be arranged on above subject through guest faculty.
- **Demonstration:**

**J) SUGGESTED LEARNING RESOURCES:**

**(a) Reference Books**

<b>S.No.</b>	<b>Title</b>	<b>Author/Publisher</b>
1.	Engineering Metrology	R.K. Jain, Khanna publishers Delhi
2.	Inspection & Gauging	Kennedy, The industrial press,93 Wortinstreet, New York. Mac Donald & Co.
3.	Engineering Metrology	K.J. Hume, The industrial press,93 Wortinstreet, New York. Mac Donald & Co. Ltd. London
4.	Practical Metrology	K.J. Hume & C.H.Shard, The industrial press,93 Wortinstreet, New York. Mac Donald & Co.
5.	Hand book of Industrial Metrology	A.S.T.M.E., Practic Hall of India
6.	Metrology & gauging	S.A.J. Parsons, Mac Donald & Erass Ltd. London
7.	Industrial Instrumentation	D.P. Eckman, Wiley easter Ltd. New Delhi
8.	Measurement Techniques in Mechanical Engineering	R.J. Sweeny, Jon wiley & sons, New York. Addison Wesley publishing London.
9.	Mechanical Measurement	Beejwith & Buck, Addison

**SUBJECT TITLE: METROLOGY AND INSTRUMENTATION LAB**

**PRACTICAL CODE: 237522 (37)**

**HOURS: 48**

**LIST OF PRACTICALS / TUTORIALS:**

1. Measurement of a gap by means of slip gauges.
2. Measurement of diameter and height of a circular spigot.
3. Comparing methods of internal Measurement.
4. Comparing methods of external Measurement
5. Comparing methods of angular Measurement
6. Checking a sine bar.
7. Comparing methods of external, taper Measurement
8. Comparing methods of internal, taper Measurement
9. Given a set of slip gauges, straightedge to be tested and surface plat, the student will test the straightness error in the given straightedge.
10. Given the surface plate, spirit level and straight edge the student will test the flatness of surface plate in the laboratory.
11. Check an engineers square in the laboratory provided with parallel set, slip gauges and plate and determine the square ness error.
12. Examination of the surface texture of the work piece of machined surface by microscope when specimen of corresponding standard surface is provided.
13. Determination of effective diameter of a screw with the help of screw thread
14. Micrometer and three wire and hand micrometer. Compare these two methods.
15. Determination of screw plug core diameter with the help of V shaped steel pieces and a micrometer.
16. Determination of out side diameter of a screw by a micrometer.
17. Determination of core diameter of an internal screw gauge with the help of pair of precision wedge parallels and outside micrometer.
18. Preparation of a cast internal screw thread with sulpher and graph its.
19. Setting of a roller type of adjustable thread gauge and inspection of given screw of given nominal size.
20. Inspect the gear tooth form by direct measurement.
21. Inspect the gear tooth spacing by any one method.

**NOTE:** The experiments for instrumentation topics can be designed depending upon the type of instruments available in the laboratories.

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL  
UNIVERSITY, BHILAI**

- A) **SEMESTER** : **V**  
 B) **SUBJECT TITLE** : **CAD/CAM**  
 C) **CODE** : **237513 (37)**  
 D) **BRANCH/DISCIPLINE** : **MECHANICAL ENGINEERING**  
 E) **RATIONALE** :

Computer based numerically controlled machine tools are increasingly finding place in industries. Further integration of the computer Aided Design and Drafting (CADD), which has been in use in the industry for some years now, with CAM operations has lead to efficient product design & Prototyping and shorter production runs. The need to absorb CAD/CAM technology for its effective and efficient use has, therefore, become imperative. The course aims at developing appreciation of the use of CAD/DAM as a computer based tool in drafting, designing and manufacturing processes. The focus is therefore, to familiarize students with a CAD/CAM environment, its components, their functions, and methods of using the existing CAD/CAM software, in general, with a view to improve efficiency in drafting and designing.

**F) TEACHING AND EXAMINATION SCHEME:**

Course Code	Scheme of Examination								Total Marks	Credit L+(T+P)/2
	L	T	P	Theory			Practical			
				ESE	CT	TTA	ESE	PTA		
237513 (37)	3	1	-	100	20	20	-	-	140	4
237523 (37)	-	-	6	-	-	-	50	25	75	3

**G) DISTRIBUTION OF MARKS AND HOURS:**

Chapter No.	Chapter Name	Hours	Marks
1.	Introduction of CAD	08	10
2.	Drawing using Auto CAD	08	10
3.	Editing and viewing Drawing	06	10
4.	Dimensioning	06	10
5.	Working with three dimensional space using Auto-Cad	06	10
6.	Solid molding	06	10
7.	Printing/Plotting Drawing	06	10
8.	Introduction to conventional Numerical Control	06	10

9.	Introduction to part programming through numerical control	06	10
10.	Introduction to different types of computer based numerical control system	06	10
	Total	64	100

## **H) DETAILED COURSE CONTENTS:**

### **Chapter- 1: Introduction of CAD**

- Computer Aided Drafting Concept,
- List of various CAD Software,
- Components of Auto CAD 2000 window such as Tool bar, standard tool bar, menu bar,

### **Chapter- 2: Drawing using AUTO CAD**

- Setting drawing units, limits, Grid, and snap searing the life opening on existing file,
- Drawing basic activities like Line, Circle, Arc, and Polygon etc,
- Using object Snap like END POINT, MID POINT, INTERSECTION, and CENTER POINT etc.

### **Chapter- 3: Editing Viewing Drawing**

- Selecting objects selection set with its option Like, Pick box, Window, Crossing, Previous, Add Remove,
- Editing commands like Erase, Copy, Array, Mirror, Break, Fillet etc.,
- Display Command like Zoom All, 400 Previous 400 Extents etc.,
- Concept of Layers. Concept of Block.

### **Chapter- 4: Dimensioning**

- Types of dimension Linear, Horizontal, Vertical, Aligned, and Rotated,
- Text Style, Selecting Font Size, Alignment,
- TEXT:- Style key Line text, Multilane text, Text Style,
- Selecting font size, Alignment.

### **Chapter- 5: Working with Three Dimensional Entities using Auto CAD**

- Right hand rule. Specifying coordinates using x,y,z Co-ordinates, using x,y,z filters,
- Entering cylindrical Co-ordinates,
- Entering Spherical Co-ordinates,
- Defining user-do ordinate system, world Co-ordinate system.

## **Chapter- 6: Solid Modeling**

- Concept of solid modeling,
- Creating predefined solid primitives such as box, core, cylinder, sphere, torus, and wedge,
- Construction a region using Region Command, Creasing and extruded solid, creasing revealed solid,
- Creating Composite solids using union, intersection and interfere commands,
- Creating cross sections of solid with section command. Using solid EDIT command with its option,
- Creating fillets and chamfers on solids.

## **Chapter- 7: Printing Plotting Drawing**

- Selecting various parameters such as paper size, paper units, Drawing orientation,
- Plot Scale. Plot Offset,
- Plot area, and Print preview.

## **Chapter- 8: Introduction to Conventional Numerical Control**

- Introduction,
- Basic components of NC system,
- The NC procedures,
- NC coordinates systems,
- NC motion control systems,
- Applications of Numerical control and potential applications of NC machine tools.

## **Chapter- 9: Part Programming through Numerical Control**

- Purpose of part programming,
- steps of part-programming,
- Difference between manual and computer assisted part programming,
- Difference between language based and CAD package based part programming.

## **Chapter- 10: Computer Based Numerical Control Systems**

Classification of NC Controller technology as: -

- Computer numerical control.
- Direct numerical control.
- Adoptive control machining systems.



## I) SUGGESTED INSTRUCTIONAL STRATEGIES.

- **Lecture Method:**
  - Teaching through chalk board
  - H.P, LCD Projector.
  - Interaction with students through seminar.
  - Concepts are to visualized by extensive use of charts models
- **Industrial Visits:**
  - Visits to nearby industries to expose them to industrial environment, their working,
- **Expert Lectures:**
  - Expert lectures are to be arranged on above subject through guest faculty.
- **Demonstration:**

## J) SUGGESTED LEARNING RESOURCES:

### (b) Reference Books

S.No.	Title	Author/Publisher
1.	Computer-Aided Design and Manufacturing by M.P. Groover, & E.W. Zimmer, Sr. Prentice	Hall of India Pvt. Ltd., (EEE), New Delhi, 1986.
2.	Inside AUTO CAD	Daniel Raker and Harbest Rice, BPB publications, Delhi (Latest edition.)
3.	Introduction to computer Aided Drafting	Donald D. Voisinet (2 <sup>nd</sup> Fd.), MC. Grow-Hill.
4.	Mastering Auto CAD	BPB publication, Delhi
5.	Illustrated Auto CAD	W.Berghauser and P.L. Achieve, BPB. Publications, Delhi.
6.	Numerical control	Marthin, E.L.B.S
7.	Understanding CAD/DAM- Design with computer	by D.J. Bowman, and R.N. MC-Douglas , BPB Publications, Delhi.

**SUBJECT TITLE: CAD/CAM LAB**

**PRACTICAL CODE: 237523 (37)**

**TOTAL HOURS: 96**

**LIST OF PRACTICALS / TUTORIALS:**

Auto CAD commands and their applications in various types of Designs/Drawings  
Ten/Fifteen experiments.

CAM experiments on:

1. Entry of part programmed.
2. Preparation of control tape.
3. Development and execution of programs using following features.
  - Tool control.
  - Base control.
4. Use of point cut, point to point out and continuous cutting following tool path.
5. Execution of programmed using linear cutting and contour interpolation.
6. Material job handling using Robot system and conveyer assembly.

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL  
UNIVERSITY, BHILAI**

A)	<b>SEMESTER</b>	:	<b>V</b>
B)	<b>SUBJECT TITLE</b>	:	<b>DESIGN OF MACHINE ELEMENTS</b>
C)	<b>CODE</b>	:	<b>237514 (37)</b>
D)	<b>BRANCH/DISCIPLINE</b>	:	<b>MECHANICAL ENGINEERING</b>
E)	<b>RATIONALE</b>	:	

Through this course the students are introduced to simple design of machine elements subjected to different types of loading environment.

**F) TEACHING AND EXAMINATION SCHEME:**

Course Code	Scheme of Examination								Total Marks	Credit L+(T+P)/2
	L	T	P	Theory			Practical			
				ESE	CT	TTA	ESE	PTA		
237514 (37)	4	1	-	100	20	20	-	-	140	5

**G) DISTRIBUTION OF MARKS AND HOURS:**

Chapter No.	Chapter Name	Hours	Marks
1.	Introduction to Machine Design	08	10
2.	Design of Joints	08	10
3.	Design of Shaft and Axle	08	10
4.	Design of Keys and Coupling	08	10
5.	Design of Levers and Pulley Arm	08	10
6.	Design of Helical and Leaf Spring	08	10
7.	Belt and Rope Drives	08	10
8.	Riveted Joint	08	10
9.	Design of Welded and Threaded Joint	08	10
10.	Selection of Bearings	08	10
	Total	80	100

**H) DETAILED CONTENTS:**

**Chapter –1 : Introduction to machine design :**

- Introduction to machine design,
- Basic design requirements for machine parts,

- Factor influencing design of machine elements-strength, stiffness, light weight, wear resistance, minimum size, availability, processibility, safety, and compliance with standards,
- Basic design procedure,
- Types of failures, types of forces, types of loading,
- Common designation of materials, I.S. codes and values of tensile, compressive and shear strengths for commonly used materials.

#### **Chapter –2 : Design of Joints:**

- Function and application of Cotter Joints, Knuckle Joints,
- Members subjected to tensile, compressive and shear load,
- Design of Cotter Joint,
- Design of Knuckle Joint.

#### **Chapter –3 : Design of Shaft and Axle:**

- Introduction of pure bending, member subjected to bending,
- Introduction to torsion equation, member subjected to torsion,
- Design of shaft and axle,
- Combined bending and twisting moment.

#### **Chapter –4 : Design of Keys and Coupling:**

- Types of keys and its uses,
- Design of rectangular, square key and splines,
- Types of coupling,
- Design of flanged coupling, protective type flanged coupling.

#### **Chapter –5 : Design of Levers and Pulley Arm:**

- Types of lever, bell crank lever,
- Design of bell crank lever,
- Design of C-clamp,
- Machine element subjected to bending-pulley arm, girder beam etc.
- Design of pulley arm,
- Materials of pulley arm.

#### **Chapter –6 : Design of Helical and Leaf Spring:**

- Function of spring,
- Types of spring and its uses,
- Terminology used in spring design,
- Design of Helical spring,
- Design of semi-elliptical leaf spring,
- Introduction of helper spring, initial gap.

## **Chapter –7: Belt and Rope Drives:**

- Comparative advantages and disadvantages of belt and rope drive,
- Belt tension, tension ratio,
- Power transmitted by belt,
- Calculation of thickness and width of belt,
- Design of rope drive,
- Materials selection for belt and rope drive.

## **Chapter- 8: Rivetted Joints:**

- Types of fasteners –temporary and permanent,
- Types of rivetted joint-lap and butt joint,
- Definition of common terms like pitch, back pitch, diametral pitch, efficiency and margin,
- Types of failure in a rivetted joints,
- Derivation of equation for checking the failure of a rivetted joint,
- Design of a single and double row lap & butt joint for a given tensile load,
- Efficiency of rivetted joint.

## **Chapter- 9:Design of Welded & Threaded Joints:**

- Advantages of welding over rivetting,
- Types of welded joints,
- Strength of the butt -weld, types of fillet joints and strength of fillet joint,
- Types of threads and their proportions,
- Types of bolts,
- Proportion of nut -bolt dimensions,
- Design of bolt,
- Designation of threads as per I.S. codes.

## **Chapter- 10:Selection of Bearing:**

- Types of bearing,
- Radial and axial load, equivalent load,
- Static and dynamic capacity,
- Selection of bearing,
- Calculation of bearing life.

## **I) SUGGESTED INSTRUCTIONAL STRATEGIES:**

- **Lecture Method:**
  - Teaching through chalk board

- H.P, LCD Projector.
- Interaction with students through seminar.
- As far as possible concepts are to visualized by extensive use of charts & wooden models of different machine components.
- Production Drawings from Industries.
- **Industrial Visits:**
  - Arrange visits to demonstrate the ergonomically aspects of design.
- **Expert Lectures:**
  - Expert lecturer as to be arranged on above subject through guest faculty.
- **Demonstration:**

Use wooden cut models of different components to show the resisting area in different type of failures.

**J) SUGGESTED LEARNING RESOURCES:**

**(c) Reference Books**

<b>S.No.</b>	<b>Title</b>	<b>Author/Publisher</b>
1.	Machine design	P.L. Balleny
2.	Design of machine elements	Abdul shariff
3.	Machine design	G.R. Nagpal
4.	Machine design	Sharma Agarwal
5.	Machine design	R.S. Khurmi
6.	Machine design	Padey & Shah

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL  
UNIVERSITY, BHILAI**

- A) SEMESTER : V  
 B) SUBJECT TITLE : MACHINE TOOL TECHNOLOGY  
 C) CODE : 237515 (37)  
 D) BRANCH/DISCIPLINE : MECHANICAL ENGINEERING  
 E) RATIONALE :

The course “ Machine Tool Technology” is of vital importance to practicing engineers and technicians, the course not only gives the opportunity of exposing the fundamentals, but also the latest developments happened in the field. The focus has been to improve effectiveness of the course by introducing various industrial applications. The accent at technical level should be upon practical and demonstration. Indeed equal practical and demonstration. Indeed equal emphasis been placed on this by allocating most of the available time for this course to the practical in the workshop. The study of this course will help the student to acquire the capability of solving complex problems in the field of manufacturing.

**F) TEACHING AND EXAMINATION SCHEME:**

Course Code	Teaching Scheme (Hrs./week)			Scheme of Examination						Credit L+(T+P)/2	
	L	T	P	Total Hours	Theory			Practical			Total Marks
					ESE	CT	TTA	ESE	PTA		
237515 (37)	3	-	-		100	20	20	-	-	140	3

**G) DISTRIBUTION OF MARKS AND HOURS:**

S. No.	Chapter No.	Chapter Name	Hours	Marks
1.		Introduction to Metal Cutting	04	10
2.		Lathe Machine	05	10
3.		Boring Machines	05	10
4.		Milling machines and milling processes	05	10
5.		Grinding machine and finishing processes	05	10
6.		Unconventional machining	05	10
7.		Special purpose machines	05	10
8.		Jigs and fixtures	04	10
9.		Machine tools and machine tool drives	05	10
10.		Installation and testing of machine tools	05	10
		<b>Total</b>	<b>48</b>	<b>100</b>

## H) DETAILED CONTENTS:

### Chapter- 1: Introduction & Metal Cutting

- Need of machine tool technology and it's use
- Material removal processes,
- Types of machine tools,
- Stages in cutting, factors affecting cutting,
- Types of chips, Continuous, discontinuous & built up edge(BUE),
- BUE formation condition and its effect upon surface finish
- Definition of cutting force, feed force, radial force power requirement for each type of force,
- Tool geometry and influence of tool angles,
- Desirable properties of cutting tool.
- Material and their influences on the choice of tools materials.
- Primary and secondary function of cutting fluids and properties of cutting fluids commonly used,
- Types of cutting fluids.
- Cutting variables, tool wear and tool life,
- Tools life specifications,
- Taylor's tool life equation
- Cutting speed calculation, Economics of metal cutting.

### Chapter-2: Lathe Machine:

- Basic difference between central lathe, turret and capstan lathes, Constructional Details and specifications,
- Working principle and features of mechanical hydraulic and Electrical copying system,
- Working principle and types of automatic, work holding and tool holding devices,
- Tooling layout of capstan and turret Lathe indexing and bar feeding mechanism of capstan and lathes

### Chapter- 3: Boring machine

- Types of horizontal and vertical boring machines,
- Constructional features and working control features,
- Jig boring machine, its construction operation and application.

### Chapter- 4: Milling Machines & Milling Processes

- Definition of milling,
- Classification of milling machine part and their functions,
- Types of table movement in universal milling machine,



- Specification of milling M/C,
- Conventional and climb milling and different milling operations and applications,
- Milling cutters and tools angles,
- Classification of cutting tool materials,
- Use of arbor, collect and adapters machine attachment,
- Methods of mounting the cutter, work holding devices, dividing heads, direct simple, angular and differential indexing selection
- Cutting speed, feed and Depth of cut

### **Chapter-5: Grinding And Finishing Processes**

- Definition of grinding and action in grinding,
- Types of abrasive materials and their properties,
- Bonding materials,
- Grinding wheel classification,
- Condition for selection of grinding wheels,
- Balancing of grinding wheels,
- Glazing, loading dressing and Trueing.
- Principles of working of grinding machines and functions of main parts,
- Types of grinding processes,
- Function of tool and work holding devices, feed arrangement,
- Table drive in surface and cylindrical grinders,
- Types of lubricants and coolants used in Grinding, Grinding defects, their remedy and safety practices,
- Definition of micro finishing, honing, lapping, super finishing methods, Equipments involved, materials used,
- Tolerances obtained and limitations,
- Application of honing and lapping processes.

### **Chapter- 6: Unconventional Machining**

- Need for unconventional methods,
- Limitation of conventional machining,
- Scope of the Electro chemical machining process and limitations,
- Scope and limitation of ultra sonic machining process.

### **Chapter- 7: Special purpose machines**

- Difference between forming and generation of gears,
- Principle of gear shaping hobbing and shaving,
- Principle of machining, rate of production, accuracy and limitations of these methods,
- Thread production:use of die for threading, thread rolling & thread Milling,
- Broaches, Definition of broaching,

- Broaching machines, their working principles, advantages and limitations,
- Machining centers, transfer lines.

### **Chapter- 8: Jigs And Fixtures**

- Definition and functions of jigs and fixtures,
- Location of components by dowel pins and buttons, bushes and restrainer screws,
- Design criteria for simple jigs and fixtures,
- Selections criteria for method of preparation of jigs and fixtures.

### **Chapter- 9: Machine Tools and Machine Tool Drives**

- Definition and Classification of machine tools,
- Requirement of machine tools,
- Drive systems stepped and step-less, drives,
- Advantages and limitations of the gear box drive,
- Function of feed box, types of feed gear boxes and advantages,
- Working principles of straight line motion,
- Control systems- multi handle, single lever and pre selective control systems.

### **Chapter- 10: Installation and Testing of Machine Tools**

- Need for leveled concrete foundation,
- Effect of foundation on accuracy of the product and life of the machine,
- Effect of weight of machine, soil bearing capacity and loading pattern upon foundation,
- Industrial safety,
- Selection of proper lifting devices for leveling of machines after grouting,
- Instruments and aids required for testing the accuracy of machine,
- Load testing and product testing,
- Understanding of test chart and check list.

## **D) SUGGESTED INSTRUCTIONAL STRATEGIES.**

- **Lecture Method:**
  - Teaching through chalk board
  - H.P, LCD Projector.
  - Interaction with students through seminar.
  - As far as possible concepts are to visualized by extensive use of charts models
- **Industrial Visits:**
  - Visits to nearby industries to expose them to industrial environment, their working,

- **Expert Lecturer:**  
- Expert lecturer as to be arranged on above subject through guest faculty.
- **Demonstration:**

**J) SUGGESTED LEARNING RESOURCES:**

**(d) Reference Books**

<b>S.No.</b>	<b>Title</b>	<b>Author/Publisher</b>
1.	Manufacturing processes.	Young
2.	Manufacturing science & technology vol.I & II	Suresh deleia
3.	Workshop technology vol.I and II	Hazara Chaudhary
4.	Workshop technology vol.I and II	Raghuvanshi
5.	Manufacturing processes.	Rousnoff
6.	Workshop technology vol.I and II	Chapman.
7.	Manufacturing processes.	Young

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL  
UNIVERSITY, BHILAI**

<b>A)</b>	<b>SEMESTER</b>	<b>:</b>	<b>V</b>
<b>B)</b>	<b>COURSE TITLE</b>	<b>:</b>	<b>INDUSTRIAL TRAINING</b>
<b>C)</b>	<b>CODE</b>	<b>:</b>	<b>237524 (37)</b>
<b>D)</b>	<b>BRANCH/DISCIPLINE</b>	<b>:</b>	<b>MECHANICAL ENGINEERING</b>
<b>E)</b>	<b>RATIONALE</b>	<b>:</b>	

The purpose of industrial training is to offer wide range of practical exposures to latest practices, equipments, machines used in Govt. industries, Semi Govt. Industries, private industry, workshops and ancillary units. Industrial training also helps the students in acquiring hands-on-experience of various practices and events required to perform in different job situations. Through the industrial training the students try to integrate all that they have learnt and put that into practice.

The duration of four weeks is kept for compulsory industrial training for all students of the programme. It has been suggested that industrial training must be offered only after completion of fourth semester examination.

**F) TEACHING AND EXMINATION SCHEME:**

Course Code	Periods/Week (In Hours)			Scheme of Examination						Credit L+(T+P)/2
	L	T	P	Theory			Practical		Total Marks	
				ESE	CT	TA	ESE	TA		
237524 (37)	-	-	1	-	-	-	50	25	75	1

**Objectives of Industrial Training**

The objective of the industrial training is to correlate theory and practice. Through industrial training students will be able to :-

1. Acquaint themselves to industrial environments
2. Follow industry work discipline
3. Understand the psychology of the workers, their habits, attitudes and approach to problems.
4. Familiarize with various materials, processes, products and their applications along with relevant aspects of shop floor management.
5. Realize the size and scale of operations in the industries
6. Get opportunities to use their knowledge in problem solving and in project assignments
7. Understand various constraints of time and cost, within which goods/parts are produced and services rendered in specified quantum
8. Understand the scope, function and job responsibilities in various departments of organizations.

## **Components of Industrial Training**

The industrial Training has basically the following three components: -

1. Orientation Programme
2. Industrial Training in the Industry
3. Report Writing and Evaluation

During the orientation programme complete guidelines will be provided to the students regarding planning, implementation and evaluation of industrial training.

During the training student will have to maintain a daily dairy to record his observations and experiences at field and on the basis of daily dairy student has to prepare and submit Industrial Training Report.

For evaluation each student has to prepare and present a seminar paper related to experience gained during the industrial training. Each student will be evaluated on the following criteria as mentioned in the evaluation.

## **Areas of Industrial Training**

Some of the areas for industrial training is suggested below :

1. Repair & maintenance of machines, equipment and tools
2. Welding and fabrication
3. Foundry Shop
4. Manufacturing of parts, components etc.
5. Repairing maintenance of air conditioner & refrigerator.
6. Workshop management.
7. CNC machines-operation and maintenance
8. Design and development of drawing using CAD software.
9. Inventory and store management
10. Calibration of measuring instruments.

## **Expected outcome**

Expected outcome of industrial training is the work done by the student or a group of students during the industrial training. Proper recording of events and work done shall be recorded and assessed in the requisite format. The student shall be assessed on the basis of work done during industrial training and report submitted and also by way of oral/ viva voce examination/presentation after completion of the training.

## **Evaluation**

The industrial training work of the student or a group of students will be evaluated jointly by faculty member and an expert from industry/field. The basis of evaluation will cover following criteria:

- Nature and extent of technical skills learnt
- Innovative skills/problem solving skills.

- Coordination and integration between theory and practice.
- Planning and decision making skills.
- Organization of work.
- Assemble the component/materials being used in given task.
- Work in group or independently and confidently.
- Submission of report.
- Skills and attitudes necessary in a technician.

Note: To assess the student performance, general guidance will be provided by the teacher.