



GOVERNMENT OF INDIA  
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP  
DIRECTORATE GENERAL OF TRAINING

**COMPETENCY BASED CURRICULUM**

# **DRAUGHTSMAN MECHANICAL**

(Duration: Two Years)

**CRAFTSMEN TRAINING SCHEME (CTS)**  
**NSQF LEVEL- 5**



**SECTOR – PRODUCTION & MANUFACTURING**

# **DRAUGHTSMAN MECHANICAL**

**(Engineering Trade)**



**(Revised in 2018)**

**CRAFTSMEN TRAINING SCHEME (CTS)**

**NSQF LEVEL - 5**

**Skill India**  
कौशल भारत - कुशल भारत

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

**CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE**

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<b>S No.</b>	<b>Topics</b>	<b>Page No.</b>
1.	Course Information	1-2
2.	Training System	3-6
3.	Job roles	7
4.	General Information	8-9
5.	NSQF Level Compliance	10
6.	Learning/ Assessment Outcome	11-12
7.	Learning Outcome with Assessment Criteria	13-21
8.	Syllabus	22-40
9.	Syllabus – Core Skill	
	9.1 Core Skill – Workshop Calculation & Science	41-44
	9.2 Core Skill – Employability Skill	45-48
10.	Annexure – I List of Tools & Equipment	49-50
11.	Annexure – II Format for Internal Assessment	51



## 1. COURSE INFORMATION

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During the two years duration, a candidate is trained on subjects- Professional Skill, Professional Knowledge, Workshop Science & Calculation and Employability Skills. In addition to this, a candidate is entrusted to make/do project work and extracurricular activities to build up confidence. The practical skills are imparted in simple to complex manner & simultaneously theory subject is taught in the same fashion to apply cognitive knowledge while executing task. The practical part starts with basic freehand sketches and conventional drawing using instruments. At the end of the course, skill is developed with computer aided production drawing and detailing. The broad components covered under Professional Skill subject are as follows:

**1<sup>st</sup> Semester**–This semester includes construction of geometrical figures using drawing instruments, freehand drawing of machine components in correct proportions, procedure to prepare a drawing sheet as per BIS standard. After becoming familiar with basic drafting terminology, students begin to develop multi-view drawings and learning about projection methods, auxiliary views and section views. Lettering, tolerance, metric construction, technical sketching and orthographic projection, isometric drawing, oblique and perspective projection are also covered.

**2<sup>nd</sup> Semester**–This semester introduces drawing of different fasteners, welds, and locking devices as per specification mentioned in SP-46:2003 and use of CAD technology in 2D environment. The candidate also imparted training on allied trades viz. Fitter, Turner, Machinist, Sheet Metal Worker, Welder, Foundryman, Electrician and Maintenance Motor Vehicles. The safety aspects covers components like OSH&E, PPE, Fire extinguisher, First Aid and in addition 5S being taught.

**3<sup>rd</sup> Semester** – To develop skill in CAD application practical assignments are given by using commands in various methods. Detail and assembly drawing of machine parts viz., Pulleys, Pipe fittings, Gears and Cams applying range of cognitive and practical skills. Construct production drawing applying quality concept in CAD. Creation of objects in 3D Modeling Space and generate views, print preview to plot in .dwg and .pdf format.

**4<sup>th</sup> Semester** – Individual skill is developed by preparing production drawing of machine parts applying conventional sign and symbol by taking measurement. Impart knowledge to draw workshop layout of a production industry considering process path and human ergonomics. In SolidWorks/AutoCAD Inventor/ 3D modeling environment the assignment is to create and plot assembly and detailed views of machine parts with dimensions, annotations, title block and bill of materials.

Professional Knowledge subject is simultaneously taught in the same fashion to apply cognitive knowledge while executing task. In addition components like physical properties of engineering materials, interchangeability, method of expressing tolerance as per BIS Fits, different types of iron, properties and uses, special files, honing, metallurgical and metal working processes such as heat treatment, the various coatings used to protect metals, different bearing, working material with finished surface as aluminium, duralumin and stainless steel, topics related to non-ferrous metals, method of lubrication are also covered under theory part.

At the end part of each semester, the trainees should express their skills by presenting project works. Total three projects need to be completed by the candidates in a group. In addition to above components the core skills components viz., workshop calculation & science, engineering drawing, employability skills are also covered. These core skills are essential skills which are necessary to perform the job in any given situation.



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## 2. TRAINING SYSTEM

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### 2.1 GENERAL

The Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers a range of vocational training courses catering to the need of different sectors of economy/ Labour market. The vocational training programmes are delivered under the aegis of National Council of Vocational Training (NCVT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programmes of NCVT for propagating vocational training.

Draughtsman Mechanical trade under CTS is one of the most popular courses delivered nationwide through a network of ITIs. The course is of two years (04 semester) duration. It mainly consists of Domain area and Core area. In the Domain area, Trade Theory & Practical impart professional skills and knowledge, while Core area imparts Workshop Calculation & science and Employability Skills impart requisite core skills, knowledge and life skills. After passing out of the training programme, the trainee is being awarded National Trade Certificate (NTC) by NCVT which is recognized worldwide.

### **Trainee broadly needs to demonstrate that they are able to:**

- Read & interpret technical parameters/document, plan and organize work processes, identify necessary materials and tools;
- Perform task with due consideration to safety rules and standard procedure.
- Apply professional skill, knowledge, core skills & employability skills while performing/ drawing the job.
- Check the various parameters of the drawing for correctness identify and rectify errors in job/ assembly drawing.
- Document the technical parameters related to the task undertaken.

### 2.2 CAREER PROGRESSION PATHWAYS:

- Can appear in 10+2 examination through National Institute of Open Schooling (NIOS) for acquiring higher secondary certificate and can go further for General/ Technical education.
- Can take admission in diploma course in notified branches of Engineering by lateral entry.
- Can join Apprenticeship programme in different types of industries leading to National Apprenticeship certificate (NAC).

- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.

### **2.3 COURSE STRUCTURE:**

Table below depicts the distribution of training hours across various course elements during a period of two years (04 semesters):

<b>S No.</b>	<b>Course Element</b>	<b>Notional Training Hours</b>
1	Professional Skill (Trade Practical)	2464
2	Professional Knowledge (Trade Theory)	528
3	Workshop Calculation & Science	352
4	Employability Skills	110
5	Library & Extracurricular activities	66
6	Project work	320
7	Revision & Examination	320
	<b>Total</b>	<b>4160</b>

### **2.4 ASSESSMENT & CERTIFICATION**

The trainee will be tested for his skill, knowledge and attitude during the period of course and at the end of the training programme as notified by the Govt. of India from time to time. The employability skills will be tested in first two semesters itself.

a) The **Internal Assessment** during the period of training will be done by **Formative Assessment Method** by testing for assessment criteria listed against learning outcomes. The training institute have to maintain individual *trainee portfolio* as detailed in assessment guideline. The marks of internal assessment will be as per the template (Annexure – II).

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NTC will be conducted by NCVT at the end of each semester as per the guideline of Govt. of India. The pattern and marking structure is being notified by Govt. of India from time to time. The learning outcome and assessment criteria will be basis for setting question papers for final assessment. The examiner during final examination will also check individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

### 2.4.1 PASS REGULATION

The minimum pass percentage for Practical is 60% & minimum pass percentage for Theory subjects is 40%. For the purposes of determining the overall result, 25% weightage is applied to the result of each semester examination.

### 2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking assessment. Due consideration should be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/wastage as per procedure, behavioral attitude, sensitivity to environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based, comprising the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work

Evidences of internal assessments are to be preserved until forthcoming semester examination for audit and verification by examination body. The following marking pattern to be adopted while assessing:

Performance Level	Evidence
(a) Weightage in the range of 60 -75% to be allotted during assessment	
For performance in this grade, the candidate should produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and due regard for safety procedures and practices.	<ul style="list-style-type: none"> <li>• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment.</li> <li>• Below 70% tolerance dimension achieved while undertaking different work with those demanded by the component/job.</li> <li>• A fairly good level of neatness and consistency in the finish.</li> <li>• Occasional support in completing the project/job.</li> </ul>
(b) Weightage in the range of 75% - 90% to be allotted during assessment	

<p>For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices.</p>	<ul style="list-style-type: none"> <li>• Good skill levels in the use of hand tools, machine tools and workshop equipment.</li> <li>• 70-80% tolerance dimension achieved while undertaking different work with those demanded by the component/job.</li> <li>• A good level of neatness and consistency in the finish.</li> <li>• Little support in completing the project/job.</li> </ul>
<p>(c) Weightage in the range of above 90% to be allotted during assessment</p>	
<p>For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.</p>	<ul style="list-style-type: none"> <li>• High skill levels in the use of hand tools, machine tools and workshop equipment.</li> <li>• Above 80% tolerance dimension achieved while undertaking different work with those demanded by the component/job.</li> <li>• A high level of neatness and consistency in the finish.</li> <li>• Minimal or no support in completing the project.</li> </ul>

### 3. JOB ROLES

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#### **Brief description of job roles:**

**Draughtsman Mechanical**; prepares drawings of machines, plants, mechanical components, equipments etc. from sketches, notes, data or sample for purposes of manufacture or repairs. Takes instructions from **Mechanical Engineer** and calculates dimensions as required, from available materials (notes, data etc.) or sample. Draws to scale detailed drawings, assembly drawings, showing plan, elevations, sectional views etc. according to nature of work and operations required. Prints (writes) dimensions, tolerances, material to be used and other details to give clear picture and facilitate understanding. Maintains copies of drawings and makes prints. They may trace drawings and may design simple mechanical parts. May prepare estimates for materials and labour required. May specialize in making drawings of jigs and tools and be designated accordingly. Create component parts on Drawing Space using toolbars, commands and menus in CAD application software and also creating objects on 3D modeling space in CAD viewing printable drawing and plotting them.

Draughtsman Mechanical selects the appropriate equipment and drawing software to use based on the type and complexity of the drawing functions to be carried out and the use of a CAD system linked bills of material, file management and associated customization of installed software including the use of macros, menus and default settings.

In addition, Draughtsman Mechanical has the ability to visualize the job, good coordination, mechanical attitude, manual dexterity and perform work related mathematical calculations.

Plan and organize assigned work and detect & resolve issues during execution. Demonstrate possible solutions and agree tasks within the team. Communicate with required clarity and understand technical English. Sensitive to environment, self-learning and productivity.

#### **Reference NCO - 2015:**

- i) 3118.0401
- ii) 3118.0402

## 4. GENERAL INFORMATION

<b>Name of the Trade</b>	<b>DRAUGHTSMAN MECHANICAL (DMM)</b>
<b>N.C.O - 2015</b>	3118.0401, 13118.0402
<b>NSQF Level</b>	Level- 5
<b>Duration of Craftsmen Training</b>	Two years (04 Semesters)
<b>Entry Qualification</b>	Passed 10 <sup>th</sup> Class with Science and Mathematics under 10+2 system of education or its equivalent
<b>Unit Strength (No. of Students)</b>	16 (Supernumeraries/Ex-Trainee allowed: 5)
<b>Space Norms</b>	64 Sq. m
<b>Power Norms</b>	3.7 KW
<b>Instructors Qualification for:</b>	
<b>1. Draughtsman Mechanical Trade</b>	<p>Degree in Mechanical Engineering from recognized Engineering College/university with one year post qualification experience in the relevant field.</p> <p style="text-align: center;"><b>OR</b></p> <p>Diploma in Mechanical Engineering from recognized board of technical education with two-year post qualification experience in the relevant field.</p> <p style="text-align: center;"><b>OR</b></p> <p>NTC/NAC passed in the Trade of “Draughtsman Mechanical” with three-year post qualification experience in the relevant field.</p> <p><b>Desirable:</b> Preference will be given to a candidate with CIC (Craft Instructor Certificate) in “Draughtsman Mechanical” trade or RoD&amp;A course under NCVT.</p> <p><b>Note:</b> <i>Out of two Instructors required for the unit of 2 (1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.</i></p>
<b>2. Workshop Calculation &amp; Science</b>	<p>Degree in Engineering with one year experience.</p> <p style="text-align: center;"><b>OR</b></p> <p>Diploma in Engineering with two-year experience.</p>
<b>3. Employability Skill</b>	MBA or BBA with two-year experience or Graduate in Sociology/ Social Welfare/ Economics with two-year experience.



	<p style="text-align: center;"><b>OR</b></p> <p>Graduate/ Diploma with two-year experience and trained in Employability Skills from DGT institutes.</p> <p style="text-align: center;"><b>AND</b></p> <p>Must have studied English/ Communication Skills and Basic Computer at 12<sup>th</sup> / Diploma level and above.</p> <p style="text-align: center;"><b>OR</b></p> <p>Existing Social Studies Instructors duly trained in Employability Skills from DGT institutes</p>				
<b>List of Tools and Equipment</b>	As per Annexure – I				
<b>Distribution of notional training on hourly basis: (Indicative only)</b>					
<b>Total Hours/Week</b>	<b>Trade Practical</b>	<b>Trade Theory</b>	<b>Workshop Cal. &amp;Sc.</b>	<b>Employability Skills</b>	<b>Extra-curricular Activity</b>
40 Hours	28 Hours	6 Hours	2 Hours	2 Hours	2 Hours


  
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## 5. NSQF LEVEL COMPLIANCE

NSQF level for **Draughtsman Mechanical** trade under CTS: **Level 5**

As per notification issued by Govt. of India dated- 27.12.2013 on National Skill Qualification Framework total 10 (Ten) Levels are defined.

Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are:

- a. Process
- b. Professional Knowledge
- c. Professional Skill
- d. Core Skill
- e. Responsibility

The broad learning outcome of **Draughtsman Mechanical** trade under CTS mostly matches with the Level descriptor at Level- 5.

The NSQF level-5 descriptor is given below:

Level	Process Required	Professional Knowledge	Professional Skill	Core Skill	Responsibility
<b>Level 5</b>	Job that requires well developed skill, with clear choice of procedures in familiar context	Knowledge of facts, principles, processes and general concepts, in a field of work or study	A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information	Desired mathematical skill, understanding of social political and some skill of collecting and organizing information, communication	Responsibility for own work and learning and some responsibility for other's work and learning

## **6. LEARNING/ ASSESSABLE OUTCOME**

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*Learning outcomes are a reflection of total competencies of a trainee and assessment will be carried out as per the assessment criteria.*

### **6.1 GENERIC LEARNING OUTCOME**

The following are minimum broad learning outcomes after completion of the Draughtsman Mechanical course of two years duration:

1. Recognize & comply with safe working practices, environment regulation and housekeeping.
2. Work in a team, understand and practice soft skills, technical English to communicate with required clarity.
3. Demonstrate knowledge of concept and principles of basic arithmetic, algebraic, trigonometric, statistics, co-ordinate system and apply knowledge of specific area to perform practical operations.
4. Understand and explain basic science in the field of study including basic electrical, and hydraulics & pneumatics.
5. Read and apply engineering drawing for different application in the field of work.
6. Understand and explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day-to-day work to improve productivity & quality.
7. Explain energy conservation, global warming and pollution and contribute in day-to-day work by optimally using available resources.
8. Explain personnel finance, entrepreneurship and manage/organize related task in day-to-day work for personal & societal growth.
9. Understand and apply basic computer working, basic operating system and uses internet services to get accustomed & take benefit of IT developments in the industry.

### **6.2 SPECIFIC LEARNING OUTCOME**

#### **Semester - I**

10. Construct different Geometrical figures using drawing Instruments.
11. Draw orthographic Projections giving proper dimensioning with title block and heading using appropriate line type and scale.
12. Construct free hand sketches of simple machine parts with correct proportions.
13. Construct plain scale, comparative scale, diagonal scale and vernier scale.

14. Draw Sectional views showing orthographic projections.
15. Develop surface and interpenetration of solid in orthographic projection.
16. Draw isometric projection from orthographic views (and vice-versa) and draw oblique projection from orthographic views.

### **Semester – II**

17. Draw and indicate the specification of different types of fasteners, welds and locking devices as per SP-46:2003
18. Acquire basic knowledge on tools and equipment of Allied trades viz. Fitter, Turner, Machinist, Sheet Metal Worker, Welder, Foundry man, Electrician and Maintenance Motor Vehicles.
19. Draw different types of gears, couplings and bearings with tolerance dimension and indicating surface finish symbol.
20. Create 2D objects on CAD drawing space using commands from ribbon, menu bar, toolbars and by typing in command prompt.

### **Semester – III**

21. Construct projection views of geometrical figures with dimension and annotation on CAD in model space and viewport in layout space.
22. Draw detail and assembly drawing of machine parts viz., Pulleys, Pipe fittings, Gears and Cams applying range of cognitive and practical skills.
23. Construct drawing of engine parts with detailed and assembly in template layout applying quality concept in CAD.
24. Create 3D solid by switching to 3D modeling workspace in CAD, generate views, Print Preview and Plotting.

### **Semester – IV**

25. Construct detailed and assembled drawing applying conventional sign & symbols.
26. Prepare drawing of machine part by measuring with gauges and measuring instruments.
27. Draw a machine shop layout considering process path and ergonomics (human factor).
28. Create and plot assembly and detail views of machine part with Dimensions, Annotations, Title Block and Bill of materials in SolidWorks/AutoCAD Inventor/3D Modeling.
29. Create production drawing of machine part.

## 7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

<b>GENERIC LEARNING/ASSESSABLE OUTCOME</b>	
<b>LEARNING/ ASSESSABLE OUTCOMES</b>	<b>ASSESSMENT CRITERIA</b>
1. Recognize & comply with safe working practices, environment regulation and housekeeping.	1.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements and according to site policy.
	1.2 Recognize and report all unsafe situations according to site policy.
	1.3 Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	1.4 Identify, handle and store/ dispose of dangerous goods and substances according to site policy and procedures following safety regulations and requirements.
	1.5 Identify and observe site policies and procedures with regard to illness or accident.
	1.6 Identify safety alarms accurately.
	1.7 Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
	1.8 Identify and observe site evacuation procedures according to site policy.
	1.9 Identify Personal Protective Equipment (PPE) and use the same as per related working environment.
	1.10 Identify basic first aid and use them under different circumstances.
	1.11 Identify different fire extinguisher and use the same as per requirement.
	1.12 Identify environmental pollution & contribute to the avoidance of instances of environmental pollution.
	1.13 Deploy environmental protection legislation & regulations.
	1.14 Take opportunities to use energy and materials in an environmentally friendly manner.
	1.15 Avoid waste and dispose waste as per procedure.
	1.16 Recognize different components of 5S and apply the same in the working environment.
2. Work in a team, understand and practice soft skills, technical English to communicate with required clarity.	2.1 Obtain sources of information and recognize information.
	2.2 Use and draw up technical drawings and documents.
	2.3 Use documents and technical regulations and occupationally related provisions.
	2.4 Conduct appropriate and target oriented discussions with

	higher authority and within the team.
	2.5 Present facts and circumstances, possible solutions & use English special terminology.
	2.6 Resolve disputes within the team.
	2.7 Conduct written communication.
3. Demonstrate knowledge of concept and principles of basic arithmetic, algebraic, trigonometric, statistics, co-ordinate system and apply knowledge of specific area to perform practical operations.	3.1 Semester examination to test basic skills on arithmetic, algebra, trigonometry and statistics.
	3.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.
4. Understand and explain basic science in the field of study including basic electrical, and hydraulics & pneumatics.	4.1 Semester examination to test basic skills on science in the field of study including basic electrical and hydraulics & pneumatics.
	4.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.
5. Read and apply engineering drawing for different application in the field of work.	5.1 Semester examination to test basic skills on engineering drawing.
	5.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.
6. Understand and explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day-to-day work to improve productivity & quality.	6.1 Semester examination to test the concept in productivity, quality tools and labour welfare legislation.
	6.2 Their applications will also be assessed during execution of assessable outcome.
7. Explain energy conservation, global warming and pollution and contribute in day-to-	7.1 Semester examination to test knowledge on energy conservation, global warming and pollution.
	7.2 Their applications will also be assessed during execution of assessable outcome.

<p>day work by optimally using available resources.</p>	
<p>8. Explain personnel finance, entrepreneurship and manage/organize related task in day-to-day work for personal &amp; societal growth.</p>	<p>8.1 Semester examination to test knowledge on personnel finance, entrepreneurship.</p> <p>8.2 Their applications will also be assessed during execution of assessable outcome.</p>
<p>9. Understand and apply basic computer working, basic operating system and uses internet services to get accustomed &amp; take benefit of IT developments in the industry.</p>	<p>9.1 Semester examination to test knowledge on basic computer working, basic operating system and uses internet services.</p> <p>9.2 Their applications will also be assessed during execution of assessable outcome.</p>

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<b>SPECIFIC LEARNING/ASSESSABLE OUTCOME</b>	
<b>SEMESTER-I</b>	
<b>LEARNING/ASSESSABLE OUTCOME</b>	<b>ASSESSMENT CRITERIA</b>
10. Construct different Geometrical figures using drawing Instruments.	10.1 Perform assignment using drawing instruments: Draw straight and parallel lines, triangles, polygons, circles, parallelogram, angle bi-sector and line bi-sector.
	10.2 Construct regular polygons (up to 8 sides) on equal base.
	10.3 Layout a A3 drawing sheet as per Sp -46 : 2003 with margin and name plate.
	10.4 Fold a sheet of A0 size for filing Cabinets or binding as per SP: 46-2003
	10.5 Write block letters & numerals in single & double stroke.
	10.6 Write name of the drawing title on heading at centre alignment in double stroke 5:4 block letter.
	10.7 Draw a sample title block as used in industry.
	10.8 Label a drawing views showing the types of line are used.
	10.9 Construct ellipse, parabola & hyperbola.
	10.10 Construct involutes, cycloid curves, helix & spiral.
11. Draw Orthographic Projections giving proper dimensioning with title block using appropriate line type and scale.	11.1 Generate views in orthographic projection by placing object between horizontal and vertical plane of axes.
	11.2 Generate side view of laminar objects in different inclination on VP and HP by auxiliary vertical plane.
	11.3 Provide dimension on object as per SP-46:2003
	11.4 Draw orthographic projection of points, lines and plain laminar figures.
	11.5 Draw orthographic projection of solids viz. prism, cones, pyramids and their frustums in 1 <sup>st</sup> angle and 3 <sup>rd</sup> angle method.
12. Construct free hand sketches of simple machine parts with correct proportions.	12.1 Sketch Free hand drawing viz. straight lines, curved lines polygons, circles, elliptical figures with irregular contour.
	12.2 Sketch free hand of a machine part such as tool post of a Lathe, Bench Vice, Cutting Tools, Bolts, Studs & Nuts, gland, Pipe Flange, Hand Wheel, Crane hook, Steel bracket.
	12.3 Give dimensions of machine parts in accordance with as specified proportion.
13. Construct plain scale, comparative scale, diagonal scale and vernier	13.1 Draw different types of scales.
	13.2 Find out R.F of the scale; calculate the length of scale on drawing.



scale.	13.3 Construct Scale- plain scales, diagonal scales. 13.4 Comparative scales, vernier scale & scale of chords and apply RF indrawing.
14. Draw sectional views showing orthographic projections.	14.1 Sketch Conventional signs and symbols for section. 14.2 Draw sectional views with adjacent object showing cutting plane and direction of view. 14.3 Sketch different types of section lines and abbreviations for different materials as per SP-46:2003. 14.4 Draw Orthographic drawing of solids (viz., cube, prisms, cone and pyramids) finding out the true shape surfaces cut by oblique planes.
15. Develop surface and interpenetration of solid in orthographic projection.	15.1 Develop the surface of cylinder, prisms, cone, pyramids and their frustum. 15.2 Draw development of an oblique cone with elliptical base. 15.3 Draw the development of a 45° single cut pipe elbow, 3-pieces pipe elbow, a pipe hole through it, bucket and a funnel. 15.4 Draw development of solids intersecting each other. 15.5 Draw orthographic projection of interpenetrated two prisms with their axes intersecting at different angles. 15.6 Draw orthographic projection of interpenetrated cone, cylinder & pyramids intersecting each other. 15.7 Draw the curves of intersection of cylinder penetrating in a sphere and a cylinder offset from their center.
16. Draw isometric projection from orthographic views (and vice-versa) and draw oblique projection from orthographic views.	16.1 Construct an Isometric scale to a given length. 16.2 Draw the isometric projection of regular solids. 16.3 Draw the isometric views for the given solids with hollow and cut sections. 16.4 Draw the orthographic views of hanger, bracket & support from their isometric view. 16.5 Draw isometric view of machine elements (viz. V-block, Angle plate, Sliding block, Journal bearing). 16.6 Draw oblique projection of circular lamina in receding axis at 30° & 45°. 16.7 Draw oblique projection of crank lever and V-block.
<b>SEMESTER-II</b>	
17. Draw and indicate the specification of different types of fasteners, welds and locking devices as per SP-46:2003.	17.1 Draw different Screw threads with SP-46:2003 conventions. 17.2 Draw bolts, studs, nuts, washers and other fasteners as per SP-46:2003 conventions. 17.3 Draw different locking arrangement of nuts, machine screws, caps screw set screw as per convention.

	17.4	Draw a half sectional view of a coupler nut.
	17.5	Draw eye foundation bolt, rag foundation bolt and Lewis foundation bolt.
	17.6	Draw welded joints giving welding symbols in welded structures.
	17.7	Draw section of welded steel structural column & bracket fabricated by plate.
	17.8	Draw keys, cotters, circlips and pins as per convention.
	17.9	Draw different types of pipe fittings and pipe joints (flanged, welded, threaded, socket and spigot).
	17.10	Draw structural steel sections with dimension as per IS specification.
	17.11	Draw rivets and riveted joints with conventional specification.
	17.12	Draw a double strap, double riveted zig-zag butt joint.
	18. Acquire basic knowledge on tools and equipments and their application in Allied trades viz. Fitter, Turner, Machinist, Sheet Metal Worker, Welder, Foundry man, Electrician and Maintenance Motor Vehicles.	18.1
18.2		Identify Plain turning , stepped turning ,Taper turning with different method.
18.3		Identify and use of jigs and fixtures Simple operations on milling machine such as plain milling and key waycutting.
18.4		Check how to mark out castings and forgings, setting up and operation of shaping, slotting and planing machines.
18.5		Identify and use of hand tools such as planishing hammers, stakes, mallet, bricks prick punch etc. evaluate development of surfaces.
18.6		Identify the hand tools used in gas and electric welding of object according to drawing.
18.7		Acquaint with different types of mould, cores and coredressing and use of moulding tools.
18.8		Identify the measuring instruments, machinery and panels used in electrician trade. Electrical and electronic symbols used in simple wiring diagrams.
18.9		Identify different parts of IC Engines (Both spark ignition & compression ignition in 2 stroke & 4 stroke engines).
19. Construct different types of gears, couplings and bearings with tolerance dimension and indicating surface finish symbol.	19.1	Draw the diagram illustrating basic size deviations and tolerances.
	19.2	Draw symbols for machining and surface finishes(grades and micron values).
	19.3	Draw the system of indication of geometrical tolerances of form and position as per standard.
	19.4	Draw muff coupling, flanged coupling, friction grip

	coupling, pin type flexible coupling, universal coupling, Oldham's coupling, claw coupling, cone friction clutch.
	19. 5 Draw details and assembly of simple bearing and foot step bearing, Plummer Block and self-aligning bearing (swivelbearing).
	19. 6 Construct tooth profile of a spur gear above 30 teeth.
	19. 7 Draw two spur gears and bevel gears in mesh.
<b>SEMESTER-III</b>	
20. Perform computer application and create 2D objects on CAD drawing space using commands from ribbon, menu bar, toolbars and by typing in command prompt.	20. 1 Perform file management in Windows operating system.
	20. 2 Create, save and print a document, worksheet and pdf file.
	20. 3 Start drawing in CAD from: new, template wizard and existing drawing file.
	20. 4 Select Drawing limit of the CAD drawing space.
	20. 5 Select proper setting of ribbon and toolbars, choice of workspace, scale.
	20. 6 Draw object in CAD drawing space using commands from icons in the ribbon, from menu bar, from floating toolbar and by typing command at the command prompt.
	20. 7 Use functional keys to access certain commands.
	20. 8 Input or locate point by Absolute Coordinate system, Polar Co-ordinate System and Relative Co-ordinate System.
	20. 9 Create geometrical figures using draw tools.
21. Construct projection views of geometrical figures with dimension and annotation on CAD in model space and viewport in layout space.	21. 1 Draw object CAD drawing space using line, polyline, polygon, circle, rectangle, arc, ellipse commands.
	21. 2 Modify object using Break, Erase, Trim, Offset, Fillet, Chamfer, Commands.
	21. 3 Manage object using Move, Copy, Array, Insert Block, Make Block, Scale, Rotate, Hatch Commands.
	21. 4 Create templates, Insert drawings, Layers, Modify Layer properties.
	21. 5
	21. 6 Provide dimension, annotation on object and customized different Dimension and Text styles.
	21. 7 Construct orthographic drawing using shortcut keyboard command.
	21. 8 Construct isometric drawing of machine blocks.
	21. 9 Create viewports in layout space to view drawings in model space.
22. Draw in CAD detail and assembly Drawing of machine parts viz.,	22. 1 Draw Pulleys-solid, stepped built up and pulley with different types of arms, rope pulleys, belt pulleys.
	22. 2 Draw Pipe fittings: tee, flanges, unions, valves. Different types of pipes layout systems. Different types of pipe joints.

Pulleys, Pipe fittings, Gears and Cams applying range of cognitive and practical skills.	22. 3	Draw gears such as spurs helical, bevel & worm, worm and worm wheel.
	22. 4	Draw Cams with different motions to followers, different types of follower and involute tooth profile of a gear.
23. Construct drawing of engine parts with detailed and assembly in template layout applying quality concept in CAD.	23. 1	Draw Eccentrics, Piston, Cross Head, Connecting rod of I.C. Engines with the application of tolerances using CAD.
	23. 2	Construct detailed drawing of an air valve and a fuel injector of IC engine.
24. Create 3D solid by switching to 3D modeling workspace in CAD, generate views, Print Preview and Plotting	24. 1	Identify 3D toolbars, menus, co-ordinate system by switching 3D modeling workspace.
	24. 2	Identify three axes of the object.
	24. 3	Change origin to create aligned objects under supervision.
	24. 4	Create 3D solid objects using command from 3D primitives, Extrude, Revolve, subtract, union. Create 3D drawing by changing User co-ordinate systems.
	24. 5	Annotate and dimension of the 3D model.
	24. 6	Generate orthographic views from model space to layout space.
	24. 7	Generate Print preview and Plotting.
	24. 8	Customize page set up, Print preview and Plotting of 3D drawing.
<b>SEMESTER-IV</b>		
25. Construct detailed and assembled drawing applying conventional sign & symbols using CAD.	25. 1	Construct detailed drawing of a lever safety valve.
	25. 2	Construct detailed drawing of a gate valve.
	25. 3	Construct detailed drawing of a blow off cock.
	25. 4	Create library folder containing blocks of Hydraulic and pneumatic conventional signs and symbols.
	25. 5	Draw a sectional view of a hydraulic jack and a pneumatic valve actuator.
	25. 6	Draw detailed view of a volute casing centrifugal pump.
	25. 7	Draw assembled and detailed drawing of tool post of a lathe.
	25. 8	Construct detailed & assembly drawing of tail stock and revolving centre.
	25. 9	Construct detailed drawing of a milling fixture.
	25. 10	Construct detailed & assembly drawing of shaper tool head slide.
	25. 11	Draw a simple drilling jig for drilling holes in a given component.

	25. 12 Draw Press Tool giving nomenclature of each part and dies & punches.
	25. 13 Construct detailed drawing of a simple carburetor.
	25. 14 Construct detailed and assembly drawing of a simple pressure vessel.
26. Prepare drawing of machinepart by measuring with gauges and measuring instruments.	26. 1 Identify proper measuring tools and gauges to measure the part.
	26. 2 Check the accuracy of the instruments.
	26. 3 Measure with the help of different types of gauges, such as plug, snap, thread, taper, measuring instruments etc.
	26. 4 Prepare detailed drawing of a C-clamp or machine vice.
27. Draw a machine shop layout considering process path and ergonomics (human factor).	27. 1 Draw a machine shop layout of small production industry showing process path from raw material inflow to finished product store.
	27. 2 Draw walk-way inside the workshop.
28. Create and plot assembly and detail views of machine part with Dimensions, Annotations, Title Block and Bill of materials in SolidWorks/AutoCAD Inventor/ 3D Modeling.	28. 1 Draw 3D solid figures by Sketching features & applied features.
	28. 2 Sketch an angle plate and a block – Create / Modify constraints.
	28. 3 Create a sketch of a new part.
	28. 4 Create 3D solid and edit solid.
	28. 5 Create a new assembly, Insert components into an assembly, Add mates (degree of freedom) and perform components configuration in an assembly.
	28. 6 Create a 3D model putting: Driving dimensions, Bill of materials, Driven (Reference) Dimensions and Annotations.
	28. 7 Prepare drawings & detailing: Named views, standard 3 views, auxiliary views, section views and detail views.
	28. 8 Create a 3D transition figure.
	28. 9 Create 3D model by annotating Holes and Threads, centerlines, symbols and leaders.
	28. 10 Create simulation.
	28. 11 Plot the 3D model.
29. Create production drawing of machine part.	29. 1 Create a simple Drill jig with Part model and assembly-detailing.
	29. 2 Create a screw jack with Part model and assembly-detailing.
	29. 3 Create a check list by self-assessment and provide Revision mark by noting in the Revision table.

## 8. SYLLABUS

<b>SYLLABUS - DRAUGHTSMAN MECHANICAL</b>			
<b>FIRST SEMESTER- 06 MONTHS</b>			
<b>Week No.</b>	<b>Learning Outcome</b>	<b>Professional Skill (with indicative hour)</b>	<b>Professional Knowledge</b>
1	Recognize & comply with safe working practices, environment regulation and housekeeping.	<ol style="list-style-type: none"> <li>1. Importance of trade training, List of tools &amp; Machinery used in the trade. (02 hrs)</li> <li>2. Safety attitude development of the trainee by educating them to use Personal Protective Equipment (PPE). (05 hrs)</li> <li>3. First Aid Method and basic training. (03 hrs)</li> <li>4. Safe disposal of waste materials like cotton waste, metal chips/burrs etc. (02 hrs)</li> <li>5. Hazard identification and avoidance. (02 hrs)</li> <li>6. Safety signs for Danger, Warning, caution &amp; personal safety message. (02 hrs)</li> <li>7. Preventive measures for electrical accidents &amp; steps to be taken in such accidents. (05 hrs)</li> <li>8. Use of Fire extinguishers. (07 hrs)</li> </ol>	<p>Importance of safety and general precautions observed in the industry/shop floor. All necessary guidance to be provided to the newcomers to become familiar with the working of Industrial Training Institute system including stores procedures.</p> <p>Soft Skills: its importance and Job area after completion of training.</p> <p>Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Introduction to 5S concept &amp; its application. Response to emergencies e.g. power failure, fire, and system failure.</p>
2	Construct different Geometrical figures using drawing Instruments.	<p>Perform assignment using drawing instruments:</p> <ol style="list-style-type: none"> <li>9. Draw straight lines of a given length. (01hr)</li> <li>10. Draw perpendicular, inclined (given angle) and parallel lines. Draw triangles with given sides and angles. (03hrs)</li> <li>11. Construct regular polygons (up to 8 sides) on equal base. (04hrs)</li> <li>12. Draw inscribed and</li> </ol>	<p>Nomenclature, description and use of drawing instruments &amp; various equipments used in drawing office. Their care and maintenance.</p>

		<p>circumscribed circles of triangle, pentagon and hexagon. (04hrs)</p> <p>13. Draw a parallelogram with a given length included angle. (02hrs)</p> <p>14. Draw an angle bi-sector and a line bi-sector. (08hrs)</p> <p>15. Divide a line into given equal divisions. (06hrs)</p>	
3	-do-	<p>16. Layout a A3 drawing sheet as per Sp -46 : 2003 with margin and name plate. (05hrs)</p> <p>17. Draw a sample title block providing details as:  <i>(i)</i> Title of the drawing  <i>(ii)</i> Sheet number  <i>(iii)</i> Scale  <i>(iv)</i> Symbol, denoting the method of projection  <i>(v)</i> Revision with sign  <i>(vi)</i> Name of the firm  <i>(vii)</i> Initials of staff drawn, checked and approved. (05hrs)</p> <p>18. Draw different types of lines &amp; write their uses in drawing. (05hrs)</p> <p>19. Label a drawing views showing most of the types of line. (13hrs)</p>	<p>Lay out and designation of a drawing sheet as per Sp -46 : 2003</p> <p>Recommended scale of engineering drawing as per Sp -46 : 2003</p> <p>Types of Lines and their application.</p> <p>Folding of prints for filing Cabinets or binding as per SP: 46-2003</p>
4	-do-	<p>20. Write Block letters &amp; numerals in single &amp; double stroke of ratio 7:4 and 5:4 in drawing sheet. (28hrs)</p>	<p>Type of lettering proportion and spacing of letters and words.</p>
5 - 6	-do-	<p>21. Construction of ellipse, parabola &amp; hyperbola in different methods. (28hrs)</p> <p>22. Construction of involutes, cycloid curves, helix &amp; spiral. (28hrs)</p>	<p>Definition of ellipse, parabola, hyperbola, different methods of their construction. Definition &amp; method of drawing involutes cycloid curves, helix &amp; spiral.</p>
7	Draw orthographic Projections giving proper dimensioning with title block using	<p>23. Construct object drawing with dimensioning in different alignment as per SP-46. (03hrs)</p>	<p>Terminology – feature, functional feature, functional dimension, datum dimension,</p>

	appropriate line type and scale.	24. Create dimensions in previous assignments. (25hrs)	principles. Units of dimensioning, System of dimensioning, Method of dimensioning & common features.
8	-do-	25. Draw orthographic projection of points and lines. (10hrs) 26. Draw projection of plane figures (lamina). (18hrs)	Methods of obtaining orthographic view. Position of the object, selection of the views, three views of drawing. Planes and their normal projections.
9 - 10	-do-	27. Draw orthographic projection of solids- prisms, cylinders, cones, pyramids. (28hrs) 28. Draw orthographic projection of cut section/ frustums of solids- prism, cylinders, cones, pyramids. (28hrs)	Orthographic projection. First angle and third angle projection. Principal of orthographic projection. Projection of solids like prism, cones, pyramids and their frustums.
11	Construct free hand sketches of simple machine parts with correct proportions.	29. Free hand sketch (in proper proportion) of tool post of a Lathe, Bench Vice, Cutting Tools, Bolts, Stud & Nut, gland, Pipe Flange, Hand Wheel, Crane hook, Steel bracket. (28hrs)	Methods of free hand sketching for machine parts.
12	Construct plain scale, comparative scale, diagonal scale and vernier scale	30. Draw plain scales, diagonal scales, comparative scales, venire scale & scale of chords. (28hrs)	Knowledge of different types of scales, scale of cords, their appropriate uses, Principle of R.F, diagonal & vernier.
13-14	Draw Sectional views of orthographic projections.	31. Sketch Conventional signs and symbols. (10hrs) 32. Sketch different types of section lines and abbreviations for different materials as per SP-46:2003. (10hrs) 33. Draw Orthographic drawing of solids (viz., cube, prisms, cone and pyramids) finding out the true shape surfaces cut by oblique planes. (36hrs)	Knowledge of solid section. Types of sectional views & their uses. Cutting plane and its representation. Parts not shown in section. Conventional signs, symbols, abbreviations & hatching for different materials. Solution of problems to find out the true shape of



			surfaces when solids are cut by different cutting planes.
15 -16	Develop surface and interpenetration of solid in orthographic projection.	<p>34. Construct the development of surface of cylinder, prisms, Cone, pyramids and their frustum. (28hrs)</p> <p>35. Draw development of an oblique cone with elliptical base. (05hrs)</p> <p>36. Draw the development of a 3-pieces pipe elbow, a pipe hole through it, a bucket and a funnel. (23hrs)</p>	<p>Definition of development, its need in industry &amp; different method of developing the surfaces.</p> <p>Development of surfaces bounded by plane of revolution intersecting each other.</p> <p>Development of an oblique cone with elliptical base etc. Calculation of developed lengths of geometrical solids.</p>
17-18	-do-	<p>37. Construct orthographic projection of interpenetrating solids (cylinder, cones, prism &amp; pyramid) of axes right angle to each other and axes inclined to each other. (36hrs)</p> <p>38. Generate the curves of intersection of cylinder penetrating through a sphere, cone and a cylinder. (20hrs)</p>	<p>Definition of Intersection &amp; interpenetration curves. Common method to find out the curve of interpenetration.</p> <p>Solution of problems on interpenetration of prism, cones, &amp; pyramids with their axes intersecting at an angle. Intersection of cylinder.</p>
19	Draw isometric projection from orthographic views (and vice-versa) and draw oblique projection from orthographic views.	<p>39. Construct the isometric view of Polygons and circular lamina. (10hrs)</p> <p>40. Draw isometric view of solid geometrical figures from orthographic views with dimension. (10hrs)</p> <p>41. Draw isometric views of truncated cone and pyramid. (08hrs)</p>	<p>Principle of isometric projection and Isometric drawing. Methods of isometric projection and dimensioning. Isometric scale. Difference between Isometric drawing &amp; Isometric projection.</p>
20-21	-do-	<p>42. Construct orthographic views from isometric drawing of solid blocks with holes, grooves, notches, dove-tail cut, square cut, round cut, stepped, etc. (18hrs)</p>	<p>Principles of making orthographic views from isometric drawing.</p> <p>Selection of views for construction of</p>

		<p>43. Construct orthographic views of hanger, bracket &amp; support (10hrs)</p> <p>44. Draw isometric view of V-block, Angle plate, sliding block. (18hrs)</p> <p>45. Draw isometric drawing of a simple Journal Bearing. (10hrs.)</p>	<p>orthographic drawings for clear description of the object.</p>
22	-do-	<p>46. Draw oblique projection of circular lamina in receding axis at 30° &amp; 45°. (05hrs)</p> <p>47. Draw oblique projection of levers and hollow blocks. (23hrs)</p>	<p>Principle and types of oblique projection. Advantage of oblique projection over isometric. Projection.</p>
23 -24	<p><b>Project work/ on-the-job training:</b></p> <p>a. Create solid stepped block by thermocol and represent 1<sup>st</sup> angle and 3<sup>rd</sup> angle projection in the co-ordinate planes of paper board and transparent sheet.</p> <p>b. Create solid hexagonal pyramid cut of section by thermocol and represent projection and impression of true shape in the co-ordinate planes of paper board and transparent sheet.</p> <p>c. Prepare by paper cutting of developed surface of prisms, cone and pyramids.</p> <p>d. Prepare the models of interpenetrated solids (by thermocol / plasticine)</p> <p>e. Prepare models of V-block, angle plate, hanger and bracket.</p>		
25	<b>Revision</b>		
26	<b>Examination</b>		

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<b>SYLLABUS- DRAUGHTSMAN MECHANICAL</b>			
<b>SECOND SEMESTER - 06 MONTHS</b>			
<b>Week No.</b>	<b>Learning Outcome</b>	<b>Professional Skill (with indicative hour)</b>	<b>Professional Knowledge</b>
27-28	Draw and indicate the specification of different types of fasteners, welds and locking devices as per SP-46:2003	48. Draw Screw threads with SP-46:2003 conventions. (10hrs) 49. Draw different types of bolts, studs, nuts and washers as per SP-46:2003 conventions.(10hrs) 50. Draw different locking arrangement of nuts, machine screws, caps screw set screw as per convention. (10hrs) 51. Draw a half sectional view of a coupler nut. (06hrs) 52. Draw four different types of foundation bolt. (20hrs)	Screw threads, terms nomenclature, types of screw thread, proportion and their uses, threads as per SP-46:2003 conventions. Types of bolts, nuts and studs, and their proportion, uses. Different types of locking devices. Different types of machine screws, cap screws, set screws as per specification. Different types of foundation bolts and their uses.
29	-do-	53. Draw fillet weld and butt weld joint specifying the basic term of the joint. (05hrs) 54. Draw a weld joint representing the position and dimensioning of the weld with conventional symbols on the drawing. (08hrs) 55. Draw section of welded steel structural column & bracket fabricated by plate. (15hrs)	Description of Welded Joints and their representation (Actual and Symbolic) Indication of Welding Symbol on drawing as per SP-46.
30	-do-	56. Draw a half-sectional view of Cotter joint with socket and spigot ends. (18hrs) 57. Draw different types of Keys, splined shaft, circlips and pins as per convention. (10hrs)	Different types of keys (Heavy duty and Light duty) cotters, splined shaft, pins and circlips. Calculation of sizes and proportions of keys.
31	-do-	58. Draw the different types of pipe fittings. (08hrs) 59. Draw pipe joints: flanged joint, welded joint, threaded joint,	Pipe Joints: selection of materials as per carrying fluid and conditions. Description of different

		socket and spigot joint.(20hrs)	pipe joints fitted on pipe. Expansion joint, loop and other pipe fittings.
32	-do-	<p>60. Draw rolled steel sections as per IS specification. (05hrs)</p> <p>61. Draw the different types of rivet heads indicating the dimensions related to diameter of the rivet as per convention. (10hrs)</p> <p>62. Draw riveted joints of lap and butt with covers in chain and zig-zag orientation. (13hrs)</p>	<p>Types of rivets, their size proportions and uses.</p> <p>Types of riveted joints, terms and proportions of riveted joints.</p> <p>Conventional representation. Relation between rivet size and thickness of plates and calculation for arrangement of rivets position.</p> <p>Causes of failure of riveted joint efficiency of riveted joints.</p>
33	Acquire basic knowledge on tools and equipments and their application in Allied trades viz. Fitter, Turner, Machinist, Sheet Metal Worker, Welder, Foundry man, Electrician and Maintenance Motor Vehicles.	<p>63. Allied Trade- Fitting</p> <p>Use of different types of fitters hand tools.</p> <p>Work on MS plate by filing, hack sawing, check dimensions, mark the plate, punch centre mark, cut a v-notch by chisel, drill a hole on the center mark. (28hrs)</p>	<p>Description and application of simple measuring tools.</p> <p>Description of vices, hammers, cold chisel, files, drills, etc.-proper method of using them.</p> <p>Method of using precision measuring instrument.</p> <p>Maintaining sequence of operation in fitting shop and safety precaution.</p>
34	-do-	<p>64. Allied Trade Turning</p> <p>Cut a round bar in power saw, centering and facing the bar, perform the turning, grooving, stepped and taper operation on the bar. (28hrs)</p>	<p>Safety precaution for lathes. Description of parts of Lathe &amp; its accessories. Method of using precision measuring instrument such as inside &amp; outside micrometers, depth gauges, vernier callipers, dial indicators, slip gauges, sine bars, universal bevel protractor, etc.</p>
35	-do-	<p>65. Allied Trade Machinist:</p> <p>Use of jigs and fixtures Simple</p>	<p>Brief Description of milling, shaping, slotting</p>

		<p>operations on milling machine such as plain-milling and key way cutting.</p> <p>Mark out on castings and forgings work piece, set up and perform operation of shaping, slotting and planning machines. (28hrs)</p>	<p>and planning machines. Quick return mechanism of these machines.</p> <p>Maintaining sequence of operation in machine shop and safety precaution.</p>
36	-do-	<p>66. Allied Trade: Sheet Metal</p> <p>Use of hand tools such as planishing, hammers stakes, mallet, bricks prick punch etc. Mark and cut a sheet to make a container. (28hrs)</p>	<p>Brief description of common equipment required for sheet metal work. Different types of joints used in sheet metal work.</p>
37	-do-	<p>67. Allied Trade: Welding</p> <p>Use of hand tools used in gas and in electric arc welding</p> <p>Weld an object according to drawing. (14 hrs)</p> <p>68. Foudryman/Moulder</p> <p>Different types of mould, cores and core dressing, use of moulding tools. (14 hrs)</p>	<p>Maintaining sequence of operation in machine shop and safety precaution.</p> <p>Brief description of the hand tools used gas &amp; arc welding. Different types of welded joints and necessary preparation required for these.</p> <p>Safety precautions, Hand tools used for molding. The description, use and care of hand tools.</p>
38	-do-	<p>69. Allied Trade: Electrician</p> <p>Prepare a simple wiring for residential room. Identify the electrical equipment and measuring instruments. (14hrs)</p> <p>70. Allied Trade: MMV- IC Engine</p> <p>Identify different parts of IC Engines (Both spark ignition &amp; compression ignition-2 stroke &amp; 4 stroke engines). (14hrs)</p>	<p>Safety precaution maintained in electrician shop.</p> <p>A.C &amp; D.C Motors Generators of common types and their uses and brief description of common equipment necessary for sheet metal work. Electrical units and quantities. Laws of electricity. Simple examples of calculation of current voltage, resistance in series and parallel connection (D.C.Circuit).</p> <p>Brief description of</p>

			internal combustion engines, such as cylinder block piston, carburettor spark plug, camshaft, crank shaft, injector fuel pump etc.
39	Construct different types of gears, couplings and bearings with tolerance dimension and indicating surface finish symbol.	<p>71. Draw the diagram illustrating basic size deviations and tolerances. (05hrs)</p> <p>72. Draw symbols for machining and surface finishes (grades and micron values) (05hrs)</p> <p>73. Draw the system of indication of geometrical tolerances of form and position as per standard: Straightness, flatness, circularity, cylindricity, parallelism, perpendicularity, angularity, concentricity, coaxiality, symmetry, radial run-out, axial run-out. (10hrs)</p> <p>74. Construct a machine part indicating geometrical tolerance. (08hrs)</p>	<p>Limits, fit, tolerance.</p> <p>Toleranced dimensioning, geometrical tolerance. Indications of symbols for machining and surface finishes on drawing(grades and micron values)</p> <p>Production of interchangeable parts, geometrical tolerance. Familiarization with IS: 919, IS:2709.</p>
40-41	-do-	<p><b>Construct the sectional view of:</b></p> <p>75. Muff coupling, (08hrs)</p> <p>76. Flanged coupling, (12hrs)</p> <p>77. Friction grip coupling,(12hrs)</p> <p>78. Pin type flexible coupling, (12hrs)</p> <p>79. Universal coupling.(12hrs) (conventional method)</p>	<p>Couplings, necessity of coupling, classification of couplings.</p> <p>Uses and proportion of different types of couplings.</p> <p>Materials used for couplings.</p>
42-44	-do-	<p><b>Draw detailed and assembly drawing of:</b></p> <p>80. Simple bearing (15hrs)</p> <p>81. Foot step bearing. (13hrs)</p> <p>82. Plummer block. (28hrs)</p> <p>83. Self-aligning bearing (swivel bearing). (28hrs)</p>	<p>Knowledge of bearing to reduce friction, types of bearing, frictional and anti-frictional bearings.</p> <p>Material used for frictional bearings.</p> <p>Properties of frictional bearing (sliding bearing) materials.</p> <p>Parts of anti-frictional bearings (ball, roller, thrust ball, needle &amp; taper roller). Materials and</p>

			proportion of parts. Difference between frictional and anti-frictional bearings. Advantages of anti-frictional bearings.
45	-do-	84. Construct tooth profile of a spur gear above 30 teeth. (10hrs) 85. Draw two spur gears in mesh (08hrs) 86. Draw two bevel gears in mesh (10hrs)	Gears and gear drives-uses, types, nomenclature and tooth profiles.
46	Perform computer application and create 2D objects on CAD drawing space using commands from ribbon, menu bar, toolbars and by typing in command prompt.	87. <b>Perform Computer operation:</b> (10 hrs) i) create new folder, ii) add subfolders, iii) create application files, iv) change appearance of windows, v) search for files, vi) sort files, vii) copy files, viii) create shortcut folder, ix) create shortcut icon in desktop and taskbar x) move files to and from removable disk/ flash drive. xi) install a printer from driver software in operating system. 88. Create, save and print a document, worksheet and pdf (portable document format) files.(18hrs)	Introduction to computer, Windows operating system, file management system. Computer hardware and software specification. Knowledge of installation of application software.
47	-do-	89. Perform application in CAD: i) Change the Workspace dropdown menu in CAD screen and follow the ribbon and toolbar settings. ii) Locate origin and the graphical limit of drawing space from co-ordinate display. iii) Use buttons of mouse for pan, zoom in and zoom out.	Introduction to CAD Advantages of using CAD, CAD main Menu, screen menu, command line, model space, layout space. Drawing layouts, Tool bars, File creation, Save, Open existing drawings, creation of Drawing

		<ul style="list-style-type: none"> <li>iv) Use functional keys to access certain commands.</li> <li>v) Use commands from icons in the ribbon, from menu bar and from floating toolbar.</li> <li>vi) Drag and drop figures from tool palettes.</li> <li>vii) Type the command at the command prompt and invoke.</li> <li>viii) Open existing drawings</li> <li>ix) Create of drawing Sheet layout</li> <li>x) Open drawing sheet layout from template. (28hrs.)</li> </ul>	Sheet as per ISO.
48	-do-	<p>90. Create 2D objects using Absolute Co-ordinate system, Polar Co-ordinate System and Relative Co-ordinate System. (10hrs)</p> <p>91. Create geometrical figures using draw tools. (18hrs)</p>	<p>Absolute Co-ordinate system , Polar Co-ordinate System and Relative Co-ordinate System Create Line, Break, Erase, Undo</p>
49-50	<p><b>In-plant training/</b> Project work (work in a team)</p> <ul style="list-style-type: none"> <li>a. Prepare model of square threaded bolt (by thermocole).</li> <li>b. Prepare models of different riveted joints (by thermocole).</li> <li>c. Prepare models of different welding joints (by thermocole).</li> <li>d. Prepare a poster of illustrating basic size deviations and tolerances.</li> <li>e. Prepare model of a spur gear (by thermocole).</li> </ul>		
51	<b>Revision</b>		
52	<b>Examination</b>		



<b>SYLLABUS - DRAUGHTSMAN MECHANICAL</b>			
<b>THIRD SEMESTER- 06 MONTHS</b>			
<b>Week No.</b>	<b>Learning Outcome</b>	<b>Professional Skill (with indicative hour)</b>	<b>Professional Knowledge</b>
53	Construct projection views of geometrical figures with dimension and annotation on CAD in model space and viewport in layout space.	92. CAD: draw 2D object using line, polyline, ray, polygon, circle, rectangle, arc, ellipse commands. (28 hrs)	Drawing of Line, polyline, ray, polygon, circle, rectangle, arc, ellipse using different options.
54	-do-	93. CAD: modify 2D objects using Break, Erase, Trim, Offset, Fillet, Chamfer Commands. (28 hrs)	Trim, Offset, Fillet, Chamfer, Arc and Circle under modify commands.
55	-do-	94. CAD: manage 2D objects using Move, Copy, Array, Insert Block, Make Block, Scale, Rotate, Hatch Commands. (28 hrs)	Move, Copy, Array, Insert Block, Make Block, Scale, Rotate, Hatch Commands.
56	-do-	95. CAD: Create templates, Insert drawings. Create objects in different Layers and Modify Layer properties. (28 hrs)	Creating templates, Inserting drawings, Layers, Modify Layers.
57	-do-	96. CAD: Provide dimension on object. Create dimension by customizing dimension styles (lines, arrows, text, unit and alignment) Put dimension with scale factor. (28 hrs)	Format dimension style, creating new dimension style, Modifying styles in dimensioning. Writing text on dimension line and on leader. Edit text dimension.
58	-do-	97. CAD: Construct orthographic sectional view of a steel bracket with dimension using shortcut keyboard command.(10 hrs) 98. Construct isometric view of machine blocks. (10 hrs) 99. Create viewports in layout space and place views for	Knowledge of shortcut keyboard command. Customization of keyboard command. Customization of drafting settings, changing orthographic snap to isometric snap. Procedure to create viewport

		model space in different scale. (08 hrs)	in layout space in zooming scale.
59-60	Draw in CAD detail and assembly Drawing of machine parts viz., Pulleys, Pipe fittings, Gears and Cams applying range of cognitive and practical skills.	100. Construct Pulleys: solid, stepped and built up pulleys. (25 hrs) 101. Construct pulley with different types of arms. (21hrs) 102. Draw rope pulley and v-belt pulley using CAD. (10 hrs)	Belt-drive. Materials of belts, slip and creep, Velocity of belt. Arc of contact. Simple exercise in calculation of belt speeds, nos. of belts needed in V-belt drive, velocity, pulley ratio etc. Standard pulleys width of pulley face, velocity ratio chain drive.
61-62	-do-	103. Draw pipe fittings: tee, elbow (90° & 45°), flange, union and valve. (15 hrs) 104. Draw conventional symbols of different types of valves and joints used in pipe line diagram. (10 hrs) 105. Draw a piping layout systems from a sump to an overhead tank through a pump with possible fittings and valves. (15 hrs) 106. Draw sectional views of different types of pipe joints using CAD. (16 hrs)	Knowledge of different pipe materials and specifications of Steel, W.I. & PVC pipes. Brief description of different types of pipe joints. Pipe threads. Pipe fittings (threaded, welded and pressed). Specifications of pipe fittings. Different types of valves.
63-65	-do-	107. Draw: i) spur gear, (18 hrs) ii) helical gear, (18 hrs) iii) bevel gear, (18 hrs) iv) worm and worm wheel. (18hrs) 108. Construct involute tooth profile of a gear (using CAD). (12 hrs)	Gear drive- Different types of gears. Cast gears and machined gears. Knowledge of profile of gears etc.
66-67	-do-	109. Draw a symmetrical cam profile. (28 hrs) 110. Draw different types of follower (using CAD). (28 hrs)	Use of Cams in industry. Types of cam, kinds of motion in cam, displacement diagrams. Terms used in cam. Types of follower.
68-70	Construct drawing of engine parts with detailed and assembly in template layout applying quality	111. Construct detailed and assembly drawing (using CAD) of i) Eccentrics (10 hrs), ii) Stuffing box (18 hrs) iii) Piston assembly of a	Knowledge of engine mechanism. Transmission of motion from reciprocating to circular through eccentric, crank and connecting rod.

	concept in CAD.	petrol engine (28 hrs), iv) IC engine connecting rod. (28 hrs)	
71-72	-do-	112. Construct detailed drawing of an air valve. (28 hrs) 113. Construct detailed drawing of a fuel injector of a diesel engine. (28 hrs) (using CAD)	Knowledge of fuel injection system in petrol and diesel engine.
73-74	Create 3D solid by switching to 3D modeling workspace in CAD, generate views, Print Preview and Plotting.	114. <b>3D Modeling:</b> i) Create 3D solid objects using command from 3D primitive (viz. box, sphere, cylinder and poly-solids) , from solid (extrude, revolve, sweep and loft), from Boolean (union, subtract and intersect) (28 hrs) ii) Create 3D drawing using User co-ordinate systems. (15 hrs) iii) Annotate and dimension of the 3D model. (05 hrs) iv) Generate views from model space to layout space. (05 hrs) v) Generate Print preview and Plotting. (03 hrs)	Introduction to 3D modeling, 3D primitives (viz. box, sphere, cylinder, mesh and poly-solids), solid figure by extrude, revolve, sweep and loft command, solid editing: fillet, offset, taper, shell and slice command. Setting of User co-ordinate Systems, Rotating, Print preview and Plotting.
75-76	<b>In-plant training/</b> Project work (work in a team)  a. Prepare a chart showing details of a 4-stroke petrol engine. b. Prepare a chart showing Valve timing diagram of a 4-stroke petrol engine. c. Prepare models of different types of cams and followers. d. Prepare a paper cutting chart showing different parts of a gate/globe/check valve.		
77	<b>Revision</b>		
78	<b>Examination</b>		

<b>SYLLABUS- DRAUGHTSMAN MECHANICAL</b>			
<b>FOURTH SEMESTER- 06 MONTHS</b>			
<b>Week No.</b>	<b>Learning Outcome</b>	<b>Professional Skill (with indicative hour)</b>	<b>Professional Knowledge</b>
79-80	Construct detailed and assembled drawing applying conventional sign & symbols using CAD.	115. Construct detailed drawing of a lever safety valve.(28 hrs) 116. Construct detailed drawing of a gate valve.(28 hrs) (using CAD)	Working principle of valves and their description.
81	-do-	117. Construct detailed drawing of a steam stop valve and blow off cock. (28 hrs) (using CAD)	Knowledge of simple stationary fire tube boiler, boiler mountings. Function and purpose of blow off cock.
82	-do-	118. Create library folder containing blocks of hydraulic and pneumatic conventional signs and symbols. (10 hrs) 119. Draw a sectional view of a hydraulic jack and a pneumatic valve actuator. (18 hrs) (using CAD)	Brief description of a typical hydraulic system, components, working principle and function of hydraulic jack. Different types of hydraulic actuator. Symbol and working of hydraulic DC valve, non-return valve and throttle valve. Knowledge of typical pneumatic system, FRL or air service unit and pneumatic actuator.
83	-do-	120. Draw detail and full sectional view of a volute casing centrifugal pump(using CAD). (28 hrs)	Different types of pump systems.Characteristics of a pump system: pressure, friction and flow.Energy and head in pump systems.
84	-do-	121. Draw assembly and detailed drawing of tool post of a lathe. (using CAD) (28 hrs)	Different clamping devices on lathe.
85	-do-	122. Construct detailed & assembly drawing of tail stock and revolving centre. (using CAD) (28 hrs)	Description of different job holding devices in lathe operation.

		hrs)	
86	-do-	123. Construct detailed drawing of a milling fixture. (using CAD) (28 hrs)	Different clamping devices on milling operation.
87	-do-	124. Construct detailed & assembly drawing of shaper tool head slide. (using CAD) (28 hrs)	Different clamping devices on shaping operation.
88	-do-	125. Draw a simple drilling jig for drilling holes in a given component. (using CAD) (28 hrs)	Knowledge of accuracy and interchangeability in the manufacturing of products.
89	-do-	126. Draw a Press Tool giving nomenclature of each part. (08 hrs) 127. Draw dies & punches for the production of simple work pieces. (using CAD) (10 hrs) 128. Develop isometric drawing for manufacturing 2 cavity injection moulds with side cavities. (10 hrs) (using CAD)	Knowledge of various parts of press tools and their function.  Knowledge of different moulding processes. Introduction to Die casting, gating system design, force calculation, defects and remedies and estimation.
90	-do-	129. Construct detailed drawing of a simple carburetor. (using CAD) (28 hrs)	Description of different parts of petrol engine.
91	-do-	130. Construct detailed and assembly drawing of a simple pressure vessel. (using CAD) (28 hrs)	Knowledge of design, manufacture, and operation of pressure vessels.
92	Prepare drawing of machine parts by measuring with gauges and measuring instruments.	131. Prepare detailed drawing of a C-clamp and a machine vice by taking measurement using gauges and measuring instrument. (using CAD) (28 hrs)	Proper measurement practice in workshop. Principles of good measurement result: right measurement, right tools, right sketching, review and right procedures.
93	Draw a machine shop layout considering process path and ergonomics (human factor).	132. Draw a machine shop layout of small production industry showing material inflow to finished product stock. (using CAD) (28 hrs)	Lay out of Machine foundations. Brief treatment of the principle Involved and the

		hrs)	precautions to be observed. Lay out of machine Foundation. Consideration of ergonomics (human factor) for shop layout.
94	Create and plot assembly and detail views of machine part with Dimensions, Annotations, Title Block and Bill of materials in SolidWorks/AutoCAD Inventor/ 3D Modeling.	SolidWorks/AutoCAD Inventor/ 3D Modeling: 133. Draw 3D solid figures by Sketching features & applied features. (10 hrs) 134. Sketch an angle plate and a block – Create/ Modify constraints. (08 hrs) 135. Create a sketch of a new part. (10 hrs)	Introduction to SolidWorks/ AutoCAD Inventor/ 3D Modeling User interface - Menu Bar – Command manager – Feature manager – Design Tree – settings on the Default options – suggested settings – key board short cuts. Create the best profile – create a sketch – create a new part
95	-do-	136. Create 3D solid and edit using: i) Copy & Paste, (04 hrs) ii) Filleting, (04 hrs) iii) Chamfering, (04 hrs) iv) Editing a feature definition. (04 hrs) v) Create ribs, mirror pattern, the Hole wizard, (04 hrs) vi) Create part configurations, Part design tables, (04 hrs) vii) Inset Design Table, Inset new design table. (04 hrs)	Extrude bosses and cuts, add fillets, and chamfer changing dimensions. Revolved features using axes, circular patterning changes and Rebuild problems.
96	-do-	137. Create New assembly part: i) Create a new assembly (08 hrs) ii) Insert components into an assembly, (04 hrs) iii) Add mates (degree of freedom). (04 hrs) iv) Perform components configuration in an assembly, (04 hrs) v) Insert subassemblies, (04	Bottom up assembly modeling Components configuration in an assembly, Insert subassemblies, Interference detection.

		hrs) vi) Perform Interference detection. (04 hrs)	
97	-do-	<p>138. Create a 3D model putting:</p> <ul style="list-style-type: none"> <li>i) Driving dimensions, (02 hrs)</li> <li>ii) Bill of materials, (04 hrs)</li> <li>iii) Driven (Reference) Dimensions, (02 hrs)</li> <li>iv) Annotations, (02 hrs)</li> <li>v) Alternate position view. (02 hrs)</li> </ul> <p>139. Prepare drawings &amp; detailing:</p> <ul style="list-style-type: none"> <li>i) Create drawing sheets, (04 hrs)</li> <li>ii) Add drawing items, (02 hrs)</li> <li>iii) Named views, standard 3 views, auxiliary views, section views, detail views. (02 hrs)</li> <li>iv) Reattach and replace dimensions, (02 hrs)</li> <li>v) Edit sketch, (02 hrs)</li> <li>vi) Edit sketch plane, (02 hrs)</li> <li>vii) Edit definition. (02 hrs)</li> </ul>	<p>Drawings &amp; Detailing, create drawing sheets, Add drawing items, Named views, std. 3 views, auxiliary views, section views, detail views.</p> <p>Drawings &amp; Detailing, create drawing sheets, Add drawing items, Named views, standard 3 views, auxiliary views, section views, detail views.</p>
98	-do-	<p>140. Create a 3D transition figure</p> <ul style="list-style-type: none"> <li>• using loft feature. (03 hrs)</li> <li>• using sweep feature. (03 hrs)</li> <li>• using library features.(03 hrs)</li> </ul> <ul style="list-style-type: none"> <li>i) Create 3D model by annotating Holes and Threads, (05 hrs)</li> <li>ii) Create Centerlines, symbols and leaders, (05 hrs)</li> <li>iii) Create Simulation. (03 hrs)</li> <li>iv) Plot the model. (01 hr)</li> </ul> <p>141. Convert or save as Solid Works and Inventor file</p>	<p>Difference between sweep and loft.</p> <p>Exploded views – Configuration manager, Animation controller.</p> <p>Annotating Holes and Threads, Creating Centerlines, symbols and leaders, Simulation.</p> <p>Introduction to plot &amp; Different ways of plotting.</p>

		into .dwg format. (05 hrs)	
99	Create production drawing of machine part.	142. Create production drawing of a simple Drill jig – Part model – assembly-detailing (using CAD). (28 hrs)	Knowledge of production drawing, name plate and bill of materials, etc.
100	-do-	143. Create production drawing of a Screw jack – Part model – assembly-detailing. (26 hrs) (using CAD) 144. Create a check list by self-assessment and provide Revision mark by noting in the Revision table. (02 hrs)	Study of production drawing. Procedure of preparing Revision Drawing: putting revision mark, writing remarks in the table as per check list.
101-102	In-plant training / Project work (work in a team) a. Prepare a model of a drill jig. b. Prepare a chart of exploded view of a centrifugal pump. c. Prepare a model of pipeline layout with necessary fittings.		
103	<b>Revision</b>		
104	<b>Examination</b>		

**Note:**

1. Some of the sample project works (indicative only) are given against each semester.
2. Instructor may design their own project and also inputs from local industry may be taken for designing such new project.
3. The project should broadly cover maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, Work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and application of Learning. They need to submit Project report.
4. If the instructor feels that for execution of specific project more time is required than he may plan accordingly to produce components/ sub-assemblies in appropriate time i.e., may be in the previous semester or during execution of normal trade practical.



## 9. SYLLABUS – CORE SKILLS

### 9.1 WORKSHOP CALCULATION & SCIENCE

First Semester	
Duration: Six Months	
S No.	Workshop Calculation and Science
1.	<b><u>Unit:</u></b> Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units
2.	<b><u>Fractions:</u></b> Fractions, Decimal fraction, L.C.M., H.C.F., Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems using Scientific Calculator.
3.	<b><u>Square Root:</u></b> Square and Square Root, method of finding out square roots, Simple problem using calculator.
4.	<b><u>Ratio &amp; Proportion:</u></b> Simple calculation on related problems.
5.	<b><u>Percentage:</u></b> Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.
6.	<b><u>Material Science:</u></b> properties-Physical & Mechanical, Types –Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals, introduction of Iron, Cast Iron, Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non-Ferrous metals, Non-Ferrous Alloys.
7.	<b><u>Mass, Weight and Density:</u></b> Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals.
8.	<b><u>Speed and Velocity:</u></b> Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation, equations of motions, simple related problems.
9.	<b><u>Work, Power and Energy:</u></b> work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.

Second Semester Duration: Six Months	
S No.	Workshop Calculation and Science
1.	<b><u>Algebra</u></b> : Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).
2.	<b><u>Mensuration</u></b> : Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi-circle, Volume of solids – cube, cuboids, cylinder and Sphere. Surface area of solids – cube, cuboids, cylinder and Sphere.
3.	<b><u>Trigonometry</u></b> : Trigonometrical ratios, measurement of angles. Trigonometric tables
4.	<b><u>Heat &amp; Temperature</u></b> : Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation.
5.	<b><u>Basic Electricity</u></b> : Introduction, use of electricity, how electricity is produced, Types of current_ AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections – series, parallel, electric power, Horse power, energy, unit of electrical energy.
6.	<b><u>Levers and Simple Machines</u></b> : levers and its types. Simple Machines, Effort and Load, Mechanical Advantage, Velocity Ratio, Efficiency of machine, Relationship between Efficiency, velocity ratio and Mechanical Advantage.

Skill India  
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<b>Third Semester</b>	
<b>Duration: Six Months</b>	
<b>S No.</b>	<b>Workshop Calculation and Science</b>
1.	- Geometrical construction & theorem: division of line segment, parallel lines, similar angles, perpendicular lines, isosceles triangle and right angled triangle.
2.	- Area of cut-out regular surfaces: circle and segment and sector of circle.
3.	- Area of irregular surfaces. - Application related to shop problems.
4.	- Volume of cut-out solids: hollow cylinders, frustum of cone, block section. - Volume of simple machine blocks.
5.	- Material weight and cost problems related to trade.
6.	- Finding the value of unknown sides and angles of a triangle by Trigonometrical method.
7.	- Finding height and distance by trigonometry.
8.	- Application of trigonometry in shop problems. (viz. taper angle calculation).
9.	- Forces definition. - Compressive, tensile, shear forces and simple problems. - Stress, strain, ultimate strength, factor of safety. - Basic study of stress-strain curve for MS.
10.	- Temperature measuring instruments. Specific heats of solids & liquids.
11.	- Thermal Conductivity, Heat loss and heat gain.
12.	- Average Velocity, Acceleration & Retardation. - Related problems.
13.	- Circular Motion: Relation between circular motion and Linear motion, Centrifugal force, Centripetal force

कौशल भारत - कुशल भारत

Fourth Semester Duration: Six Months	
S No.	Workshop Calculation and Science
1.	<p><b><u>Graph:</u></b></p> <ul style="list-style-type: none"> <li>- Read images, graphs, diagrams</li> <li>- Bar chart, pie chart</li> <li>- Graphs: abscissa and ordinates, graphs of straight line, related to two sets of varying quantities.</li> </ul>
2.	<p>Simple problem on Statistics:</p> <ul style="list-style-type: none"> <li>- Frequency distribution table</li> <li>- Calculation of Mean value.</li> <li>- Examples on mass scale productions.</li> <li>-Cumulative frequency</li> <li>-Arithmetic mean</li> </ul>
3.	Acceptance of lot by sampling method (within specified limit size) with simple examples (not more than 20 samples).
4.	<ul style="list-style-type: none"> <li>- Friction- co-efficient of friction, application and effects of friction in Workshop practice.</li> </ul> <p><b>Centre of gravity</b> and its practical application.</p>
5.	<ul style="list-style-type: none"> <li>- Magnetic substances- natural and artificial magnets.</li> <li>- Method of magnetization. Use of magnets.</li> </ul>
6.	<ul style="list-style-type: none"> <li>- Electrical insulating materials.</li> <li>- Basic concept of earthing.</li> </ul>
7.	<ul style="list-style-type: none"> <li>- Transmission of power by belt, pulleys &amp; gear drive.</li> <li>- Calculation of Transmission of power by belt pulley and gear drive.</li> </ul>
8.	<ul style="list-style-type: none"> <li>- Heat treatment and advantages.</li> </ul>
9.	Concept of pressure – units of pressure, atmospheric pressure, absolute pressure, gauge pressure – gauges used for measuring pressure
10.	Introduction to pneumatics & hydraulics systems.

## 9.2 EMPLOYABILITY SKILLS (DURATION:110 HRS)

<b>CORE SKILL – EMPLOYABILITY SKILL</b>	
<b>First Semester</b>	
<b>1. English Literacy</b>	<b>Duration : 20 hrs Marks : 09</b>
Pronunciation	Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)
Functional Grammar	Transformation of sentences, voice change, change of tense, spellings.
Reading	Reading and understanding simple sentences about self, work and environment
Writing	Construction of simple sentences Writing simple English
Speaking/ Spoken English	Speaking with preparation on self, on family, on friends/ classmates, on known people, picture reading, gain confidence through role-playing and discussions on current happening job description, asking about someone's job, habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing on messages and filling in message forms, greeting and introductions, office hospitality, resumes or curriculum vitae essential parts, letters of application reference to previous communication.
<b>2. IT Literacy</b>	<b>Duration : 20 hrs Marks : 09</b>
Basics of Computer	Introduction, computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down computer.
Computer Operating System	Basics of Operating System, WINDOWS, User interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc., Use of common applications.
Word Processing and Worksheet	Basic operating of Word Processing, Creating, opening and closing documents, Use of shortcuts, Creating and Editing Text, Formatting the text, Insertion & creation of tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets.
Computer Networking	Basic of computer Networks (using real life examples), Definitions of

and Internet	Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web browser, Website, Web page and Search Engines. Accessing the Internet using web browser, Downloading and printing web pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.
<b>Duration : 15 hrs</b>	
<b>Marks : 07</b>	
<b>3. Communication Skills</b>	
Introduction to Communication Skills	Communication and its importance Principles of effective communication Types of communication - verbal, non-verbal, written, email, talking on phone. Non-verbal communication- characteristics, components-Para-language Body language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort.
Listening Skills	Listening-hearing and listening, effective listening, barrierstoeffective listening, guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active listening skills.
Motivational Training	Characteristics essential to achieving success. The power of positive attitude. Self-awareness Importance of commitment Ethics and values Ways to motivate oneself. Personal goal setting and employability planning.
Facing Interviews	Manners, etiquettes, dress code for an interview. Do's & Don'ts for an interview.
Behavioral Skills	Problem solving, confidence building, attitude.
<b>Second Semester</b>	
<b>Duration : 15 hrs</b>	
<b>Marks : 06</b>	
<b>4. Entrepreneurship Skills</b>	
Concept of Entrepreneurship	Entrepreneur - Entrepreneurship - Enterprises: Conceptual issue Entrepreneurship vs. management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation

	to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, and the process of setting up a business.
Project Preparation & Marketing Analysis	Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of PLC, Sales & distribution management. Difference between small scale & large scale business, Market survey, Method of marketing, Publicity and advertisement, Marketing mix.
Institution's Support	Preparation of project. Role of various schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non-financing support agencies to familiarizewith the Policies/ Programmes & procedure & the available scheme.
Investment Procurement	Project formation, feasibility, Legal formalities i.e., Shop Act, Estimation & costing, Investment procedure - Loan procurement - Banking processes.
<b>5. Productivity</b>	
<b>Duration : 10 hrs</b> <b>Marks : 05</b>	
Benefits	Personal/ Workman - Incentive, Production linked Bonus, Improvement in living standard.
Affecting Factors	Skills, Working Aids, Automation, Environment, Motivation - How it improves or slows down productivity.
Comparison with Developed Countries	Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.
Personal Finance Management	Banking processes, Handling ATM, KYC registration, Safe cash handling, Personal risk and insurance.
<b>6. Occupational Safety, Health and Environment Education</b>	
<b>Duration : 15 hrs</b> <b>Marks : 06</b>	
Safety & Health	Introduction to occupational safety and health importance of safety and health at workplace.
Occupational Hazards	Basic Hazards, Chemical Hazards, Vibroacoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygiene, Occupational Diseases/ Disorders & its prevention.
Accident & Safety	Basic principles for protective equipment. Accident prevention techniques - control of accidents and safety

	measures.
First-Aid	Care of injured & sick at the workplaces, First-Aid & Transportation of sick person.
Basic Provisions	Idea of basic provision legislation of India. Safety, health, welfare under legislative of India.
Ecosystem	Introduction to Environment. Relationship between society and environment, Ecosystem and factors causing imbalance.
Pollution	Pollution and pollutants including liquid, gaseous, solid and hazardous waste.
Energy Conservation	Conservation of energy, re-use and recycle.
Global Warming	Global warming, climate change and Ozone layer depletion.
Ground Water	Hydrological cycle, Ground and surface water, Conservation and Harvesting of water.
Environment	Right attitude towards environment, Maintenance of in-house environment.
<b>7. Labour Welfare Legislation</b>	
<b>Duration : 05 hrs</b> <b>Marks : 03</b>	
Welfare Acts	Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's Compensation Act.
<b>8. Quality Tools</b>	
<b>Duration : 10 hrs</b> <b>Marks : 05</b>	
Quality Consciousness	Meaning of quality, Quality characteristic.
Quality Circles	Definition, Advantage of small group activity, Objectives of quality circle, Roles and function of quality circles in organization, Operation of quality circle. Approaches to starting quality circles, Steps for continuation quality circles.
Quality Management System	Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.
House Keeping	Purpose of House-keeping, Practice of good housekeeping.
Quality Tools	Basic quality tools with a few examples.



<b>DRAUGHTSMAN MECHANICAL</b>		
<b>LIST OF TOOLS AND EQUIPMENT (For batch of 16 candidates)</b>		
<b>A :Trainees Tool Kit:</b>		
S No.	Name of the items	Quantity
1.	Draughtsman drawing instrument box containing Compasses with pencil point, point driver, interchangeable, Divider pen point interchangeable, divider spring bow, pen Spring bow lengthening bar, pen drawing liner, screw driver Instrument, tube with lead.	2 set
2.	Set square celluloid 45° (250 X 1.5 mm)	2 set
3.	Set square celluloid 30°-60° (250 X 1.5 mm)	2 set
4.	French-curves (set of 12 celluloid)	4 nos.
5.	Mini drafter	16+1 set
6.	Drawing board (700mm x500 mm)IS: 1444	16+1 set
<b>B: GENERAL MACHINERY &amp; SHOP OUTFIT</b>		
7.	Chest of drawer 8 drawers(Standard)	2 nos.
8.	Draughtsmantable	16 nos.
9.	Draughtsmanstool	16 nos.
10.	Desktop Computer Latest version compatible for running CAD software, preloaded with windows and 20" colour Monitor.	16+1 nos.
11.	Sever (True dedicated sever)	1 no.
12.	Software: MS- office latest version, CAD with latest Licensedversion,[Optional: Latest Version of SOLIDWOKS, AUTODESK INVENTOR, CATIA & PRO-E (CREO-2)]	16 users
13.	Plotter (Max. A0 size)	1 no.
14.	Laser Jet printer latest model	1 no.
15.	UPS - 5 KVA	2 nos.
16.	White Board for using LCD projector(optional)	1 no.
17.	Instructor Table	1 no.
18.	Instructor Chair	2 nos.
19.	Almirah steel	1 no.
20.	Computer table	16+1 nos.
21.	Computer chairs	16+1 nos.

22.	Table for server, printers	1 no. each
23.	LCD projector/OHP	1 no.
24.	External storage device (8 GB)	2 nos.

**Note:** No additional items are required to be provided for the batch working in the second shift except the items from S No. 1 to 6 under trainee's tool kit.

TOOLS & EQUIPMENTS FOR EMPLOYABILITY SKILLS		
S No.	Name of the Equipment	Quantity
1.	Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software	10 nos.
2.	UPS - 500VA	10 nos.
3.	Scanner cum Printer	1 no.
4.	Computer Tables	10 nos.
5.	Computer Chairs	20 nos.
6.	LCD Projector	1 no.
7.	White Board 1200mm x 900mm	1 no.
<p><i>Note: Above Tools &amp; Equipments not required, if Computer LAB is available in the institute.</i></p>		

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**FORMAT FOR INTERNAL ASSESSMENT**

<b>Name &amp; Address of the Assessor:</b>		<b>Year of Enrollment:</b>												
<b>Name &amp; Address of ITI (Govt./Pvt.):</b>		<b>Date of Assessment:</b>												
<b>Name &amp; Address of the Industry:</b>		<b>Assessment location: Industry / ITI</b>												
<b>Trade Name:</b>		<b>Semester:</b>		<b>Duration of the Trade/course:</b>										
<b>Learning Outcome:</b>														
<b>S No.</b>	<b>Maximum Marks (Total 100 Marks)</b>		<b>15</b>	<b>5</b>	<b>10</b>	<b>5</b>	<b>10</b>	<b>10</b>	<b>5</b>	<b>10</b>	<b>15</b>	<b>15</b>	<b>Total Internal Assessment Marks</b>	<b>Result (Y/N)</b>
	<b>Candidate Name</b>	<b>Father's /Mother's Name</b>	<b>Safety Consciousness</b>	<b>Workplace Hygiene</b>	<b>Attendance/ Punctuality</b>	<b>Ability to follow Manuals/ Written Instructions</b>	<b>Application of Knowledge</b>	<b>Skills to Handle Tools &amp; Equipment</b>	<b>Economical Use of Materials</b>	<b>Speed in Doing Work</b>	<b>Quality in Workmanship</b>	<b>VIVA</b>		
<b>1</b>														
<b>2</b>														