MSDE (DGT) – 02/01(03)/2019-CD
Government of India
Ministry of Skill Development & Entrepreneurship
Directorate General of Training (DGT)
Employment Exchange Building,
Library Avenue, Pusa Complex,
New Delhi- 110012 dated: 11 .11.2019

To,

- RDSDEs/Director(s)/Principal/HoDs of National Skill Training Institutes (NSTIs).
-Principal, Govt. & Private ITOTs

Subject: Implementation of common syllabus of Workshop Calculation & Science (WCS) and Engineering Drawing (ED) (Except Draughtsman group) for all Engineering Trades under Craft Instructor Training Scheme (CITS) w.e.f. admission session August, 2019 and onwards.

Sir/Madam,

You may be aware that All India Trade Test (AITT) under CITS is conducted in 06 (six) groups in Workshop Calculation & Science and Engineering drawing for Engineering trades under CITS (Except Workshop Calculation & Workshop Science of Draughtsman Group). An analysis has been made and following decisions are taken for implementation w.e.f. admission session August, 2019 and onwards.

a) There will be a common syllabus in Workshop Calculation & Science (WCS) of 80 hours duration for all Engineering trades (Except for Draughtsman Group of trades).

b) For Engineering Trades, the syllabi of Engineering Drawing (ED) have been re grouped in two groups (Group-I: - Mechanical Trade Group consist of 22 trades, Group-II: - Electrical Trade Group consist of 03 trades) and training duration of Engineering Drawing will be 120 hours. The details of trade groups are Annexure-I.

c) The syllabi of WCS and ED have been covered in Engineering Technology, but, AITT exam of WCS and ED will be conducted separately.

The details of the syllabi of Workshop Calculation & Science and Engineering Drawing for Engineering CITS trades are at Annexure-II.

All the Director(s)/Principals of NSTIs/ HoDs/RDSDEs and implementation authorities of Govt. & Private ITOTs are requested to conduct the classes on the above subjects as per the new structure of syllabus for the session August 2019 and onwards.

Yours faithfully

(Deepankar Mallick)
DDG(C,P& Admn)

Copy to: (for information):

- Sr. PPS to DG/AS, DGT, MSDE
- -All Director(s)/Commissioner of the State Government/UTs dealing with Skill Development /Craftsman Training Scheme
- All Directors at DGT (HQ), New Delhi,
- Director, T.T. Cell, DGT, HQ, New Delhi & Director (CFI), DGT (HQ), New Delhi
- Director, CSTARI: is requested to incorporate the changes in all trade syllabi accordingly.
- Executive Director, NIMI: is requested to prepare the instructional materials for all trades accordingly.

(G.Giri)
Joint Director, (CD &STRIVE)

Annexure -I

Grouping of trades in CITS for Engineering Drawing

GROUP NO.	TRADE NAME
I (Mechanical Trade Group)	Carpenter, Foundryman, Sheet Metal Worker, all Welder trades {Welder, Welder (GMAW & GTAW), Welder (Pipe), Welder (Fabrication & Fitting) and Welder (Welding & Inspection)}, Plumber, Mechanic Motor Vehicle, Mechanic Diesel, Mech. Ref. & Air conditioning, Mech. Agricultural Machinery, Fitter, Turner, Machinist & Operator Adv. M/C Tool, Machinist (Grinder), Tool & Die Maker, MMTM, Mech. Tractor.
II (Electrical Trade Group)	Electrician & Wireman, Instrument Mechanic, Electronics Mechanic.

Annex-II

COMPETENCY BASED CURRICULUM

of

ENGINEERING TECHNOLOGY

(Workshop Calculation & Science and Engineering Drawing)

For

CRAFT INSTRUCTOR TRAINING SCHEME (CITS)

Redesigned in 2019

Developed by

Government of India
Ministry Skill Development and Entrepreneurship
Directorate General Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
EN-81, Sector - V, Salt Lake
Kolkata – 700091

CONTENTS

1. RATIONALE

Success & Sustainability of any Training System depends upon the availability of good quality instructors in addition to other aspects. An Instructor should possess, besides trade skills, "Skills to Transfer Skills". To cope up this quality possession of core skills is imperative. It is the skills set which enables comprehending the given job and subsequent planning to complete the task/job. Thus it is regarded as core skills for all Engineering trades.

Knowledge of basic scientific principles creates the foundation for acquiring hard skills. It is the initial/ inherent knowledge set which enables analyzing the given job and subsequent detail planning such as selecting proper physical conditions e. g. Temperature for a heat treatment process, Material of cutting tool etc. Ability to perform simple calculations also creates the foundation for proper hard skills. It is the inherent knowledge set which enables to analyse the given job - Quantitatively and subsequent detail planning such as selecting the physical conditions quantitatively e. g. speed, feed of a cutting operation etc.

Similarly, ability to read Engineering Drawing is essential to perform a job/ task of Engineering Trades. Thus it is also regarded as core skills for all Engineering trades. Knowledge of Engineering Drawing principles creates the foundation for acquiring hard skills. It is the initial/ inherent knowledge set which enables analyzing the given job and consequent detail planning.

Thus Workshop Calculation & Science and Engineering Drawing is regarded as a core skills set for acquiring hard skills in all Engineering Trades. Recognizing this importance of the core skills, the subjects of Workshop Calculation & Science and Engineering Drawing are made integral part of all Engineering Trades for Craft Instructors Training Scheme (CITS) under DGT, MSDE.

2. GENERAL INFORMATION

1.	Name of the Subject	**Engineering Technology (Workshop Calculation & Science and Engineering Drawing)**
2.	Duration of Training	80 (WCSc) + 120 (ED) Hours
3.	Applicability	For all Engineering Trades
4.	Examination	To be held at the end of each year
5.	Space Norms	One class room - 30 Sq. m Drawing Hall - 60 Sq. m CAD Lab. - 50 Sq. m ***Note:*** *No separate CAD Lab. is required if IT Lab. / Information Centre is available in the Institute.*
6.	Power Norms	a. 1 KW for Class room b. 1.3 KW for Drawing Hall c. 1.5 KW for CAD Lab
7.	Unit strength (Batch Size)	25
8.	**Trainers' Qualification for Workshop Calculation and Science**	Degree in Engineering from recognized university with two years experience. OR Diploma in Engineering from recognized Board / University with five years experience. OR NTC/NAC in Engineering trade with seven years experience. ***Essential:*** *Craft Instructor Certificate in any of the variants of RoD& A under DGT.*
9.	**Trainers' Qualification for Engineering Drawing**	Degree in any branch of Engineering with two years experience in relevant field. OR Diploma in any branch of Engineering with five years experience in relevant field. OR NTC/ NAC in the Draughtsman Mechanical/ Relevant trade with seven years experience in relevant field. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in related trade or RoDA, in any of the variants under DGT.

3. GROUPING OF TRADES IN CITS FOR ENGINEERING DRAWING

GROUP NO.	TRADE NAME
I	Carpenter, Foundryman, Sheet Metal Worker, all Welder trades {Welder, Welder (GMAW & GTAW), Welder (Pipe), Welder (Structural), Welder (Fabrication & Fitting) and Welder (Welding & Inspection)}, Plumber, Mechanic Motor Vehicle, Mechanic Diesel, Mech. Ref. & Air Conditioning, Mech. Agricultural Machinery, Fitter, Turner, Machinist & Operator Adv. M/C Tool, Machinist (Grinder), Tool & Die Maker, MMTM, Mech. Tractor.
II	Electrician & Wireman, Instrument Mechanic, Electronics Mechanic,

4. LEARNING OUTCOMES WITH ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
Workshop Calculation & Science	
1. Demonstrate basic mathematical concepts and principles to perform practical operations.	Test basic skills on arithmetic, algebra, trigonometry and statistics.
	Applications will be assessed during execution of assessable outcome and will also be tested during theory and practical examination.
2. Explain basic science in the field of study including simple machines.	Test basic skills on science in the field of study including friction, heat, temperature and simple machines.
	Applications will be assessed during execution of assessable outcome and will also be tested during theory and practical examination.
Engineering Drawing	
1. Apply engineering drawing for different applications in the field of work.	Test basic skills on engineering drawing.
	Applications will be assessed during execution of assessable outcome and will also be tested during theory and practical examination.

5. Common Syllabus for Workshop Calculation & Science for CITS (Engineering Trades)

	Workshop Calculation	Duration in Hours
1.	**Fraction: -** Concept of Fraction, Numbers, Variable, Constant, **Ratio &Proportion**: - Trade related problems	5
2.	**PERCENTAGE:** Definition, changing percentage to decimal and fraction and vice versa. Applied problems related to trade. . Estimation and cost of product.	5
3.	**Algebra:** Fundamental Algebraic formulae for multiplication and factorization. Algebraic equations, simple & simultaneous equations, quadratic equations and their applications.	5
4.	**Mensuration 2D: -** Concept on basic geometrical definitions, basic geometrical theorems. Determination of areas, perimeters of triangles, quadrilaterals, polygons, circle, sector etc.	6
5.	**Mensuration 3D: -** Determination of volumes, surface areas of cube, cuboids cylinders, hollow cylinder, sphere prisms, pyramids cone spheres, frustums etc. Mass, Weight, Volume, Density, Viscosity, Specific gravity and related problems.	6
6.	**TRIGNOMETRY** Concept of angles, measurement of angles in degrees, grades and radians and their conversions. Trigonometrical ratios and their relations. Review of ratios of some standard angles (0, 30,45,60,90 degrees), Height & Distances, Simple problems.	8
7.	**Graphs**: basic concept, importance. Plotting of graphs of simple linear equation. Related problems on ohm's law, series-parallel combination.	5
8.	**Statistics:** Frequency tables, normal distribution, measure of central tendency – Mean, Median & Mode. Concept of probability. Charts like pie chart, bar chart, line diagram, Histogram and frequency polygon.	5
	Workshop Science	

1.	**UNITS AND DIMENSIONS** Conversions between British & Metric system of Units. Fundamental and derived units in SI System, Dimensions of Physical Quantities (MLT)-Fundamental & Derived.	2
2.	**Engineering Materials** –Classification properties and uses of ferrous metals, non-ferrous metals, alloys etc. Properties and uses of non-metals such as wood, plastic, rubber, ceramics industrial adhesives.	3
3.	**Heat & Temperature**: Concepts, differences, effects of heat, different units, relation, specific heat, thermal capacity, latent heat, water equivalent, mechanical equivalent of heat. Different Temperature measuring scales and their relation. Transference of heat, conduction, convection and radiation. Thermal Expansion related calculations.	4
4.	**Force and Motion**: Newton's laws of motion, displacement, velocity, acceleration, retardation, rest & motion such as linear, angular. Force – units, different laws for composition and resolution of forces. Concept on centre of gravity and equilibrium of forces in plane. Concept of moment of inertia and torque.	4
5.	**Work, power & energy** – definitions, units, calculation & application. Concept of HP, IHP, BHP and FHP – related calculations with mechanical efficiency. S.I. unit of power and their relations.	4
6.	**FRICTION** Concept of friction, laws of friction, limiting friction, coefficient of friction and angle of friction. Rolling friction & sliding friction with examples. Friction on inclined surfaces	3
7.	**Stress & Strain:** Concepts of stress, strain, modulus of elasticity. Stress- strain curve. Hook's law, different module of elasticity like Young's modulus, modulus of rigidity, bulk modulus and their relations. Poisson's ratio.	3
8.	**Simple machines: -** Concept of Mechanical Advantage, Velocity Ratio, Efficiency and their relations. Working principles of inclined plane, lever, screw jack, wheel and axle, differential wheel and axle, worm and worm wheel, rack and pinion. Gear train.	4
9.	**Electricity:** -Basic definitions like emf, current, resistance, potential difference, etc. Uses of electricity. Difference between ac and dc. Safety devices. Difference between conductors and semiconductors and resistors, Materials	4

	used for conductors, semiconductors and resistors. Ohm's Law. Series, parallel and series-parallel combination of resistances. Concept, definitions and units of electrical work, power and energy with related problems.	
10.	**FLUID MECHANICS** Properties of fluid (density, viscosity, specific weight, specific volume, specific gravity) with their units. Concept of atmospheric pressure, gauge pressure, absolute pressure, vacuum and differential pressure	**4**
TOTAL		**80**

6. SYLLABUS OF ENGINEERING DRAWING FOR CITS

Group-I

S NO.	TOPICS	Duration in Hours
01	CIRCLES, TANGENTS AND ELLIPSE :- Practical applications procedure for constructing tangent to given circle-lines- loop pattern-- tangential circles-external tangents- internal tangents ellipse	8
02	PARABOLIC CURVES. HYPERBOLA Involutes - Properties and their application. Procedure for constructing parabolic curve-hyperbolic curve-in volute curve. epicycloids, hypocycloid, Involutes, spiral & Archimedes spiral	8
03	TECHNICAL DRAWING/ SKETCHING OF COMPONENTS' PARTS- Views of object Importance of technical sketching-types of sketches-Isometric drawing sketching- Oblique drawing sketching.	8
04	PROJECTIONS Theory of projections (Elaborate theoretical instructions), Reference planes, orthographic projections concept 1st Angle and 3rd Angle, Projections of points, Projections of Lines–determination of true lengths & inclinations. Projections of plane, determination of true shape. Exercises on missing surfaces and views. Orthographic drawing or interpretation of views. Introduction to first angle projections of solids.	8
05	ISOMETRIC VIEWS Fundamentals of isometric projections (Theoretical Projections) Isometric views from 2 to 3 given orthographic views. Preparation of simple working drawing of Furniture items like table, stool and any job prepared in the workshop.	10
06	SECTIONAL VIEWS:- Importance and salient features, Methods of representing sections, conventional sections of various materials, classification of sections, conventional in sectioning. Drawing of full section, half section, partial or broken out sections, offset sections, revolved sections and removed sections. Drawing of different conventions for materials in section, conventional breaks for shafts, pipes, Rectangular, square angle, channel, rolled sections. Exercises on sectional views of different objects. -	10
07	DEVELOPMENT AND INTERSECTIONS -Development of surfaces-Types of surface- Methods of development-Intersection- Methods of drawing intersection lines-critical point or key point.	8
08	FASTENERS Sketches of elements of screw threads, Sketches of studs, cap screws machine screws, set screws, Locking devices, bolts, Hexagonal & square nuts & nut bolt & washer assembly. Sketches of plain spring lock, toothed lock, washers, cap nut, check nut, slotted nut, cassel nut, sawn nut, wing nut, eye blot, tee bolt & foundation bolt. Sketches of various types of rivet heads (snap–pan–conical– countersunk) Sketches of keys (sunk, flat, saddle, gib head, woodruff) Sketches of hole & shaft assembly.	8
09	DETAIL DRAWING AND ASSEMBLY DRAWING –Details of machine drawing-Assembly drawing- surface quality-surface finish standard- Method of indicating surface roughness for general engineering drawing-symbols used for indication of surface roughness-symbols for direction of lay. Geometrical tolerance. Detail drawing of the following with complete dimensioning, tolerances,	22

	material and Surface finish specifications 1. Universal couplings 2. Ball bearing and roller bearing. 3. Fast and loose pulley. 4. Stepped and V belt pulley. 5. Flanged Pipe joints, right angle bend. 6. Tool Post of Lathe Machine. 7. Tail Stock of Lathe Machine 8. Stepped and V belt pulley. 9. Flanged Pipe joints, right angle bend. 10. Tool Post of Lathe Machine. 11. Tail Stock of Lathe Machine Practice of blue print reading on limit, size, fits, tolerance, machining symbols, and reading out of assembly drawing etc., ISO Standards.	
10	READING OF ENGINEERING DRAWING- Blue print and machine drawing reading exercises.	6
11	GRAPHS & CHARTS Types (Bar, Pie, Percentage bar, Logarithmic), Preparation & interpretation of the graphs and charts.	6
12	Familiarization with AutoCAD application in engineering drawing. Practice on AutoCAD using Draw & Modify commands. Practice on AutoCAD with Rectangular snap using Draw, Modify, Inquiry commands. Practice on AutoCAD using text dimensioning& dimensioning styles	6
13	Practice on AutoCAD to draw nuts, bolts & washers. Isometric views-isometric views with square, taper and radial surface-simple & complex views. Perspective views. Practice on AutoCAD using isometric snap to make isometric drawings	6
14	Practice on AutoCAD using Hatch command and application. Practice on AutoCAD using 3D primitives with UCS (User Co-ordinate system).	6
Total		**120**

7. SYLLABUS OF ENGINEERING DRAWING FOR CITS
Group-II

S No.	Topics	Duration in Hours
01	CIRCLES, TANGENTS AND ELLIPSE :- Practical applications procedure for constructing tangent to given circle-lines- loop pattern-- tangential circles-external tangents- internal tangents ellipse	10
02	PARABOLIC CURVES. HYPERBOLA Involutes - Properties and their application. Procedure for constructing parabolic curve-hyperbolic curve-in volute curve. epicycloids, hypocycloid, Involutes, spiral & Archimedes spiral	10
03	TECHNICAL DRAWING/ SKETCHING OF COMPONENTS' PARTS- Views of object Importance of technical sketching-types of sketches-Isometric drawing sketching- Oblique drawing sketching.	10
04	PROJECTIONS Theory of projections (Elaborate theoretical instructions), Reference planes, orthographic projections concept 1st Angle and 3rd Angle, Projections of points, Projections of Lines–determination of true lengths & inclinations. Projections of plane, determination of true shape. Exercises on missing surfaces and views. Orthographic drawing or interpretation of views. Introduction to first angle projections of solids.	15
05	ISOMETRIC VIEWS Fundamentals of isometric projections (Theoretical Projections) Isometric views from 2 to 3 given orthographic views. Preparation of simple working drawing of Furniture items like table, stool and any job prepared in the workshop.	15
06	FASTENERS Sketches of elements of screw threads, Sketches of studs, cap screws machine screws, set screws, Locking devices, bolts, Hexagonal & square nuts & nut bolt & washer assembly. Sketches of plain spring lock, toothed lock, washers, cap nut, check nut, slotted nut, cassel nut, sawn nut, wing nut, eye blot, tee bolt & foundation bolt. Sketches of various types of rivet heads (snap–pan–conical– countersunk) Sketches of keys (sunk, flat, saddle, gib head, woodruff) Sketches of hole & shaft assembly.	10
07	Sign and Symbols of Electrical, Electronics and related trades	10
08	Electrical and Electronics or trade related wiring diagram/ Layout diagram	12
09	Electrical, Electronics/ trade related circuit diagram	12
10	Block diagram of Instruments/ equipment of related trades	08
11	Practice of blue print reading on Electrical / Electronics / Computer or IT related drawing etc., ISO Standards.	08
Total		**120**

8. LIST OF TOOLS & EQUIPMENT
Group – I and Group - II

S No.	NAME OF TOOLS / EQUIPMENT	QUANTITY
Trainees Tool Kit		
1.	Drawing Instrument Box with accessories.	25 + 1 sets
2.	Set square celluloid 45 (250x1.5mm)	25 + 1 sets
3.	Set square celluloid 60 (250x1.5mm)	25 + 1 sets
4.	French-curves (set of 20 celluloid)	25 + 1 sets
5.	Drawing Board (700 x 500) IS:1444	25 + 1 sets
6.	Tee-Square (700 mm blade) IS:1360	25 + 1 sets
7.	Mini Drafter	25 + 1 sets
General Equipment		
8.	Computer-Latest or latest minus one with Ethernet card & Internal modem	25 nos.
9.	Software: MS-Office - latest or latest minus one version of operating software Auto-CAD with power pack or latest version	25 licensed users
10.	Laser Jet printer Latest model – Print, Copy and Scan 1200x1200dpi, 16MB	1 no.
11.	UPS	As required (Individual or centralized)
12.	Chest of drawers	As required
13.	Trainees Locker	As required
14.	Drawing table for A1 sheet	25 + 1 sets
15.	Stools (Revolving type) Adjustable height	25 + 1 sets
16.	Trainer / Faculty Table	1 no.
17.	Trainer / Faculty Chair	1 no.
18.	Almirah / storage	As required
19.	Computer table	As required
20.	Chairs for trainees	25 nos.
21.	D.L.P Projector 2000 LUMEN OR HIGHER	1 no.
22.	Motorised Screen for Projector	1 no.
23.	White board 6FT. x 4FT.	1 no.
24.	Fire Fighting Equipment	As required
25.	First Aid Box	1 no.