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

COMPETENCY BASED CURRICULUM

INDUSTRIAL AUTOMOTIVE MANUFACTURING TECHNICIAN

(Duration: Two Years)

CRAFTSMEN TRAINING SCHEME (CTS)

(Flexi-MoU)

NSQFLEVEL- 4

SECTOR – AUTOMOTIVE

Directorate General of Training

INDUSTRIAL AUTOMOTIVE MANUFACTURING TECHNICIAN

(Designed in 2024)

Version: 1.0

CRAFTSMEN TRAINING SCHEME (CTS)

Under Flexi-MoU

NSQF LEVEL- 4

Developed By

Centurion University of Technology and Management

HIG-4, Jaydev Vihar, Opp. Pal Heights, Bhubaneswar, Khurda,

Odisha- 751013

&

Government of India

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE

EN-81, Sector-V, Salt Lake City,

Kolkata – 700 091

www.cstaricalcutta.gov.in

CONTENTS

1. COURSE INFORMATION

Flexi-MoU is one of the pioneer programmes under DGT on the basis of the MoU in between DGT and Industrial Training Partner (ITP) for propagating vocational training to allow industries to take advantage of various schemes for conducting training programme in higher employment potential courses according to needs of industries. The concept of Flexi- MoUs was introduced in June-July 2014. DGT and CUTM have decided to sign this memorandum of understanding to provide an opportunity to the youth to acquire skills related to Industrial Automotive Manufacturing Technician through specially designed "Learn and Earn" approach consisting a mix of theoretical and On-the-Job Training (OJT) components and hence improve their employability potential and to contribute in the overall growth of Steel industry by creating a pool of skilled resources.

During the two years' duration of the programme, a candidate is trained on professional skills and knowledge, Engineering Drawing, Workshop Calculation and Science and Employability skill related to job role. In addition to this a candidate is entrusted to undertake project work and extra curricula activities to build up confidence. The broad components covered during the course are given below:

FIRST YEAR:

In the first year, the contents covered are safety aspects related to trade, familiarization with Safety, automobile systems, working style, industrial behavior, team work, components, different vehicles engine, chassis, and basic automobile manufacturing process such as basic assembling, fitting operation (marking, filling, sawing, chiseling, drilling tapping & grinding), basic brazing /welding operation using Gas, MIG, TIG & ERW (but joint, lap joint, T-joint), basic blanking & stamping operations (sheet metal work), basic surface preparation painting work, basic vehicle assembly and basic vehicle inspection & testing process. This year also covers practical training (Vehicle Type Specific) starting with practice with tools & measuring instruments viz. Vernier calliper, micrometer, height gauge, dial gauge, slip gauge, feeler gauge, go-no go gauges etc. This is followed by on job training in practice in press shop (blanking & stamping), fabrication & weld shop, paint shop, casting, machine shop, and different assembly lines including line inspection and final testing.

SECOND YEAR:

In the second year of course, the training covers with installation of specific vehicle interior components (body and Chassis) assembling engine, power train components, suspension and brake assembly. This is followed by installation of Final line assembly and under different parts of body components. The final year course also covers automobile pollution, testing and measures to control vehicular pollution, function of automation in manufacturing & automation components. Learner also learns the Quality control and inspection & testing process in an automotive / automobile company which includes on-line stage inspection to final inspection & testing of completely assembled vehicles.

2.1 GENERAL

The Directorate General of Training (DGT) under Ministry of Skill Development and Entrepreneurship offers a range of vocational training courses catering to the need of different sectors of economy/labor market. DGT is futuristic in preparing the prospective Indian workforce in building skills and capabilities as per the needs of the industry. In this quest, it has changed the paradigm of growth to a job-oriented training by partnering with industry to be an enabler of responsible, sustainable and inclusive growth. Towards this objective, DGT signed this MOU with Industrial Training Partner (ITP).

Industrial Automotive Manufacturing Technician trade under CTS (Flexi-MoU) is of two years' duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory and Practical) imparts professional skills and knowledge, while Core area (Employability Skills) impart requisite core skill, knowledge and life skills. After passing out of the training programme, the trainee is awarded National Trade Certificate (NTC) by DGT under Flexi-MoU which is recognized worldwide.

Industrial Training Partner (ITP) shall conduct courses at the Industry Partner's location. On the job training will be conducted inside the Plant premises. It will also ensure the eligible trainees take up Apprenticeship / higher education in suitable streams and shall also guide the students to become Entrepreneurs. Industrial Training Partner (ITP) will strictly follow the policy guidelines for Flexi-MoU as in place from time to time. No deviation for the same would be permitted. Admission and Exam for trades run under Flexi-MoU at training locations of Industrial Training Partner. Theory content is provisioned to be 25% and practical content is provisioned to be 75%.

Trainees broadly need to demonstrate that they are able to:

- Read and interpret technical parameters/documents, plan and organize work processes, identify necessary materials and tools.
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations.
- Apply professional skill, knowledge and employability skills while performing jobs.
- Check the job/assembly as per drawing for functioning identify and rectify errors in job/assembly.
- Document the technical parameters related to the task undertaken.

2.2 PROGRESSION PATHWAYS

- Can join industry as Automotive Manufacturing Technician/ Automotive Assembly Line Technician and will progress further as Senior Industrial Automotive Manufacturing Technician/ Automotive Assembly Line Technician, Supervisor and can rise up to the level of Manager.
- Can become Entrepreneur in the related field.
- 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.
- Can join Advanced Diploma (Vocational) courses under DGT as applicable.

2.3 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during period of two-years:

S No.	Course Element	Notional Training Hours	
		1st Year	2nd Year
1	Professional Skill (Trade Practical)	330	330
2	Professional Knowledge (Trade Theory)	300	300
3	Employability Skills	120	60
4	On the job Training	810	870
5	Mandatory OJT/Group Project	240	240
	Total	**1800**	**1800**

2.4 ASSESSMENT AND CERTIFICATION

The trainee will be tested for his skill, knowledge and attitude during the period of course through formative assessment and at the end of the training programme through summative assessment as notified by the DGT from time to time.

a) The Continuous Assessment (Internal) during the period of training will be done by Formative Assessment Method by testing for assessment criteria listed against learning

outcomes. The training institute has to maintain individual *trainee portfolio* as detailed in assessment guideline. The marks of internal assessment will be as per the formative assessment template provided on www.bharatskills.gov.in.

b) The final assessment will be in the form of summative assessment. The All-India Trade Test for awarding NTC will be conducted by Controller of examinations, DGT as per the guidelines. The pattern and marking structure is being notified by DGT 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

For the purposes of determining the overall result, weightage of 100% is applied for six months and one-year duration courses and 50% weightage is applied to each examination for two years courses. The minimum pass percent for Trade Practical and Formative assessment is 60% and for all other subjects is 33%. There will be no grace marks.

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 (Occupational Safety and Health Environment) and self-learning attitude are to be considered while assessing competencies.

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

Evidences and records of internal (Formative) assessments are to be preserved until forthcoming 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.	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment. • 60-70% accuracy achieved while undertaking different work with those Demanded by the component/job. • A fairly good level of neatness and consistency in the finish. • Occasionalsupport in completing the project/job.
(b)Weightage in the range of above 75%-90% to be allotted during assessment	
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.	• Good skill levels in the use of hand tools, machine tools and workshop equipment. • 70-80% accuracy achieved while undertaking different work with those demanded by the component/job. • A good level of neatness and consistency in the finish • Little support in completing the project/job.
(c)Weightage in the range of above 90% to be allotted during assessment	
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.	• High skill levels in the use of hand tools, machine tools and workshop equipment. • Above 80% accuracy achieved while undertaking different work with those demanded by the component/job. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

Assembly of Diesel / CNG / EV / Petrol Engine; Assembler, Stationary Petrol Engine assembles stationary petrol engine with finished components, tunes engine and tests performance. Checks condition and cleaning of various engine parts such as crankshaft, camshaft, connecting rod, pistons, tappets, valves, valve guides, spring etc. and measures appropriate parts to assess serviceability, reconditioning or replacement as necessary. Scrapes bearings, grinds valves, files piston rings, assembles pistons with connecting rods and fits camshaft, crankshaft, fly wheel, cylinder block, piston assemblies, valves etc. according to design in order of sequence using hoisting device, stand, special tools and other implements ensuring necessary movement and clearances as specified. Sets valve timing, meshes timing wheels on cam and crankshafts and fastens cylinder head with gasket on cylinder block. Assembles and fits fuel pumps lubrication and fuel pipes, sparking plugs etc. Fits distributor according to ignition timing and makes electrical connections with battery, ignition coil, plugs cut out, etc. Fits radiator, fan pulleys, water pump, etc. Sets tappets and starts engine. Tunes engine and runs it for prescribed number of hours. May test engine horse power, solder nipples, anneal pipes etc. May suggest alterations in fittings.

Mechanical Sub-Assembly Technician; Mechanical Sub-Assembly Technician assembles together the mechanical subsystems. The individual at work is responsible for assembling mechanical modules from moulded, welded or forged components to produce the final mechanical sub assembly of the product.

Reference NCO-2015:

a. 8211.0101 - Mechanical Sub-Assembly Technician
b. 8211.1200 - Assembler, Automobile
c. 8211.0500 - Assembler, Stationary Petrol Engine
d. 8211.0600 - Assembler, Stationary Diesel Engine
e. 8212.0400 - Assembler, Electrical Accessories

Reference NCO:

i. ASC/N9505
ii. ASC/N9506
iii. ASC/N9507
iv. ASC/N9508
v. ASC/N9509
vi. ASC/N9510
vii. ASC/N9511
viii. ASC/N9512
ix. ASC/N9513
x. ASC/N9514
xi. ASC/N9515
xii. CSC/N9401
xiii. CSC/N9402
xiv. ASC/N9516
xv. ASC/N9517
xvi. ASC/N9518
xvii. ASC/N9519
xviii. ASC/N9520
xix. ASC/N9521

4. GENERAL INFORMATION

Name of the Trade	**INDUSTRIAL AUTOMOTIVE MANUFACTURING TECHNICIAN (Flexi MoU)**
NCO–2015	8211.0101, 8211.1200, 8211.0500, 8211.0600, 8212.0400
Mapped NOS	ASC/N9505, ASC/N9506, ASC/N9507, ASC/N9508, ASC/N9509, ASC/N9510, ASC/N9511, ASC/N9512, ASC/N9513, ASC/N9514, ASC/N9515, CSC/N9401, CSC/N9402, ASC/N9516, ASC/N9517, ASC/N9518, ASC/N9519, ASC/N9520, ASC/N9521
NSQF Level	Level-4
Duration of Craftsmen Training (Instructional Hours)	Two year (3600 Hours)
Entry Qualification	Passed 10th class examination or its equivalent.
Minimum Age	18 years as on first day of academic session.
Unit Strength (No. Of Student)	20
Space Norms	192 Sq.m.
Power Norms	17 KW
Instructors Qualification for	
(i) Industrial Automotive Manufacturing Technician Trade	B.Voc/ Degree in Automobile / Mechanical Engg. (with specialization in Automobile) from AICTE/ UGC recognized Engineering College/ university with one-year experience in the relevant field. **OR** Three years Diploma in Automobile/ Mechanical (specialization in automobile) from AICTE recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. **OR** Ex-serviceman from Indian Armed Forces with 15 years of service in related fields as per equivalency through DGR. Candidates should have undergone methods of Instruction of course with minimum 02 years of experience in technical training institute of Indian Armed Forces.

	OR NTC/NAC in the related trades with 3 years' experience in the relevant field. **Essential Qualification:** Relevant National Craft Instructor Certificate (NCIC) in any of the variants under DGT. ***NOTE: Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications. However, both of them must possess NCIC in any of Its variants.***
(ii) Workshop Calculation and Science	B.Voc./Degree in Engineering from AICTE/UGC recognized Engineering College/University with one-year experience in the relevant field. **OR** 03 years Diploma in Engineering from AICTE/recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. **OR** NTC/NAC in any one of the engineering trades with three years' experience. **<u>Essential Qualification:</u>** National Craft Instructor Certificate (NCIC)in relevant trade **OR** NCIC in RoDA or any of its variants under DGT
(iii) Engineering Drawing	B.Voc./Degree in Engineering from AICTE/UGC recognized Engineering College/University with one-year experience in the relevant field. **OR** 03 years Diploma in Engineering from AICTE/ recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. **OR** NTC/NAC in any one of the Electrical groups (Gr-II) trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with three years' experience.

	Essential Qualification: National Craft Instructor Certificate(NCIC)in relevant trade **OR** NCIC in RoDA/D'man (Mech/Civil) or any of its variants under DGT.
(iv) Employability Skill	MBA/BBA/Any Graduate/ Diploma in any discipline with Two years' experience with short-term ToT Course in Employability Skills (Must have studied English/Communication Skills and Basic Computer at 12th/Diploma level and above) **OR** Existing Social Studies Instructors in it is with short term ToT Course in Employability Skills
(v) Minimum age for Instructor	21 years
List of Tools and Equipment	As per Annexure-I

5. LEARNING OUTCOME

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

LEARNING OUTCOME

FIRST YEAR

1. Recognize & comply safe working practices, Environment regulation and housekeeping. (NOS: ASC/N9505)
2. Identify different types of vehicles and Different components used in vehicles and perform on job training in various shops & conveyor systems. (NOS: ASC/N9506)
3. Develop skill to work on transmission system functions of an automobile. (NOS: ASC/N9507)
4. Illustrate brake system and diagnose and repairer brake system problems. (NOS: ASC/N9508)
5. Recognize vehicle body parts& components, their functions and assemble components on actual manufacturing lines. (NOS: ASC/N9509)
6. Illustrate suspension system & components, can conduct inspection. (NOS: ASC/N9510)
7. Identify elements of vehicle manufacturing process and make components in Blanking & Stamping shop, Casting and Machine shop. (NOS: ASC/N9511)
8. Recognize and interpret vehicle Heating Ventilation Air- Conditioning (HVAC) system, components &functioning. (NOS: ASC/N9512)
9. Apply welding and conduct inspection of weld joints to find welding defects. (NOS: ASC/N9513)
10. Perform surface preparation, painting and check dry film thickness (DFT) using Elcometer and analyse painting defects. (NOS: ASC/N9514)
11. Interpret different vehicle assembling processes and perform components assembling work. (NOS: ASC/N9515)
12. Read and apply engineering drawing for different application in the field of work. (Mapped NOS: CSC/N9401)
13. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (Mapped NOS: CSC/N9402)

SECOND YEAR

14. Plan and perform assembling of vehicle interior components. (NOS: ASC/N9516)
15. Perform installation of power train, suspension and brake system components using appropriate hand & power tools. (NOS: ASC/N9517)
16. Plan, organize and perform work and assemble Final line assembly components on

vehicle. (NOS: ASC/N9518)

17. Recognize the function of automation in vehicle assemble & material handling, perform installation of electrical and electronics components in vehicle and check for functionality after installation. (NOS: ASC/N9519)
18. Assemble the components designed to control pollution in vehicle and Conduct Emission test as per standard procedure. (NOS: ASC/N9520)
19. Perform different types of quality control & inspection process on assembly line and tester line and conduct final inspection & testing. (NOS: ASC/N9521)
20. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)
21. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: CSC/N9402)

6. ASSESSMENT CRITERIA

Learning Outcomes	Assessment Criteria
FIRST YEAR	
1. Recognize & comply safe working practices, Environment regulation and housekeeping. (NOS: ASC/N9505)	Identify safety symbols and hazards.
	Demonstrate the use of fire extinguishers.
	Apply elementary first aid.
	Demonstrate how to rescue a person and perform artificial respiration.
	Follow the correct disposal procedure for waste materials.
	Use personal protective equipment.
	Demonstrate cleanliness and procedure to maintain it.
	Identify trade tools and machinery.
2. Identify different types of vehicles and Different components used in vehicles and perform on job training in various shops & conveyor systems. (NOS: ASC/N9506)	Identify basic components of an automobile.
	Illustrate principles behind components of an automobile systems work.
	Identify different types of Vehicle Identification Number/Chassis No. / Engine no.
	Apply different manufacturing processes involved in producing automobiles.
	Show different stages of assembly/ sub-assembly/final assembly.
	Apply Plant and personal safety
	Operate manufacturing equipment / perform basic maintenance and repairs.
3. Develop skill to work on transmission system functions of an automobile. (NOS: ASC/N9507)	Identify different parts of Transmission system.
	Demonstrate manufacturing processes involved in producing the various components of the transmission system.
	Identify Types of Transmission.
	Dismantle /reassemble the transmission system.
	Diagnose transmission problems.
	Perform transmission repair.
4. Illustrate brake system and diagnose and repairer brake system problems. (NOS: ASC/N9508)	Identify the components of brake system.
	Disassemble the brake system and show different components involved.
	Reassemble the brake system.
	Maintain brake system such as checking brake fluid levels/ inspecting

	brake pads for wear/ cleaning brake components.
	Diagnose brake system problems by performing diagnostic tests.
	Overhaul Wheel cylinders & Drum brake/disc brakes.
	Check disc/drum run out, Fit new cups and brake hoses / pipes assemble, adjust all wheel brakes and test for brake concern.
5. Recognize vehicle body parts & components, their functions and assemble components on actual manufacturing lines. (NOS: ASC/N9509)	Identify the different components of the vehicle body such as doors/hoods/ fenders/ roofs/ body panels.
	Disassemble assemble the vehicle body to show different components involved.
	Remove body panels/ doors/ hoods/ fenders.
	Reassemble the vehicle body.
	Inspect the vehicle body such as checking for rust and damage/ dents and scratches.
	Repair the vehicle body for rust / damage/dents / scratches.
6. Illustrate suspension system & components, can conduct inspection. (NOS: ASC/N9510)	Identify different components of the suspension system.
	Carry out inspection for wear & tear.
	Overhaul independent suspension / rigid suspension.
	Diagnose suspension system problems by performing diagnostic tests.
7. Identify elements of vehicle manufacturing process and make components in Blanking & Stamping shop, Casting and Machine shop. (NOS: ASC/N9511)	Identify different casting techniques.
	Create various automotive parts by applying the process of melting/pouring metal into molds.
	Apply forging process to create crankshafts/connecting rods/ suspension components.
	Apply Forming for metal working techniques.
	Fitting various automotive parts together.
	Perform Blanking process for metal cutting.
	Use stamping press tools and dies press forming to create various automotive parts such as body panels and chassis components.
8. Recognize and interpret vehicle Heating Ventilation Air- Conditioning (HVAC) system, components & functioning. (NOS: ASC/N9512)	Identify Air Conditioning components.
	Conduct performance test on A/c unit.
	Replace an Engine drive belt.
	Check heating system, compressor rotation test, air gap check, Refrigerant recovery evacuating.
	Replenish compressor oil level.
	Perform HVAC troubleshooting/ diagnosis and repair for No cooling or warm air, Cool air comes out only intermittently.

9. Apply welding and conduct inspection of weld joints to find welding defects. (NOS: ASC/N9513)	Identify and interpret welding symbols / drawing.
	Perform welding different types of joints such as lap joints/T-joints/ corner joints.
	Inspect welding joints using visual/ DP / MP tests.
	Follow safety precaution and regulations governing welding operations.
	Avoid hazards associated with welding operations.
10. Perform surface preparation, painting and check dry film thickness (DFT) using Elcometer and analyse painting defects. (NOS: ASC/N9514)	Prepare a vehicle's surface before applying paint.
	Mask off areas of the vehicle that should not be painted, such as trim pieces and glass.
	Practice different paint application techniques, such as using a spray gun, airbrush, or roller.
	Take painted surface DFT at various locations using Elcometer.
	Apply safety practices and regulations governing painting operations.
11. Interpret different vehicle assembling processes and perform components assembling work. (NOS: ASC/N9515)	Identify different types of bolts / fasteners to join different parts of the vehicle together.
	Install electrical components such as batteries/ starters/ alternators/ other electrical systems.
	Read and interpret electrical diagrams /schematics.
	Assemble and install the suspension/steering components.
12. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)	Read & interpret the information on drawings and apply in executing practical work.
	Read & analyze the specification to ascertain the material requirement, tools and assembly/ maintenance parameters.
	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
13. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	Solve different mathematical problems
	Explain concept of basic science related to the field of study

(NOS: CSC/N9402)	
SECOND YEAR	
14. Plan and perform assembling of vehicle interior components. (NOS: ASC/N9516)	Remove old seats and install new ones.
	Install the instrument cluster/ center console/ audio system/ other interior components.
	Connect electrical wiring and secure the dashboard to the vehicle's body.
	Attach the door panel to the door frame and adjust it for proper fitment. Cut and trim the carpet properly to fit the vehicle's interior and secure it to the floor.
	Install components in the vehicle; viz Harness & controls and other electrical items viz. Junction box/ Switches/ Relays/ all internal wiring, Pedal Assembly/ Insulator or Fire wall, Air duct, heater duct, heater, Head liner, Weather-strip, Horn, Stop switch, Front/ rear shock absorber, shift cable, Washer tank, Front/ rear seat belt, Installation of components in the vehicle along with familiarization of tools conveyor system and automation.
15. Perform installation of power train, suspension and brake system components using appropriate hand & power tools. (NOS: ASC/N9517)	Install pistons/ connecting rods/ crankshafts/ camshafts/ other components.
	Apply appropriate skills to torque bolts/ adjust timing/install gaskets and seals.
	Integrate the engine and transmission into a single unit, which is called the power train.
	Installing shock absorbers/ struts/ control arms.
	Install Brake tube & filler neck/ Fuel pipe, fuel tank, canister/ Rear axle, stabilizer bar/ Knuckle, tie rod/ Exhaust System is &Tyre/ front/rear seat & bumper.
16. Plan, organize and perform work and assemble Final line assembly components on vehicle. (NOS: ASC/N9518)	Install Rear pillar trim, trunk lid latch components in the vehicle
	Install Console bracket, carpet, trunk room trim
	Install License plate lamp, radiator, hose
	Install Seat belt, centre pillar trim
	Install Heat hose, steering shaft
	Install Air-conditioner components, A/c gas, Parking brake, garnish
	Install Glove box, battery tray, seat belt, anchor cover, garnish
	Install Air cleaner, front/rear seat
	Install Battery cable, silencer
	Install Rear combination lamp, sun visor/Front grille, drip moulding

	Install Front turn signal lamp, console box, Front/rear glass, roof moulding, Combination meter
17. Recognize the function of automation in vehicle assemble & material handling, perform installation of electrical and electronics components in vehicle and check for functionality after installation. (NOS: ASC/N9519)	Installation of electrical components in vehicle assembly line.
	Demonstrate Function of automation equipment in vehicle assembly line.
	Demonstrate function of automation equipment in material handling
	Demonstrate function of automation equipment in testing
18. Assemble the components designed to control pollution in vehicle and Conduct Emission test as per standard procedure. (NOS: ASC/N9520)	Install components in the vehicle along with familiarization of tools, conveyor systems and Automation.
	Electronic control systems
	Catalytic convertors.
	Measure emmision.
	Demonstrate Emission standards / Test procedures
19. Perform different types of quality control & inspection process on assembly line and tester line and conduct final inspection & testing. (NOS: ASC/N9521)	Test Vehicle on plant tester line.
	Check Wheel alignment.
	Inspect Toe in adjustment.
	Perform Head lamp beam adjustment.
	Conduct Drum test.
	Perform Brake test /Emission test/ Shower test/ Road test/ Final Inspection/ID plate punching
20. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)	Read & interpret the information on drawings and apply in executing practical work.
	Read &analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters.
	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to

	carry out the work.
21. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: CSC/N9402)	Solve different mathematical problems
	Explain concept of basic science related to the field of study

SYLLABUS – INDUSTRIAL AUTOMOTIVE MANUFACTURING TECHNICIAN (FLEXI-MoU)			
FIRST YEAR			
Duration	**Reference Learning Outcomes**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Professional Skill 20 Hrs. Professional Knowledge 15 Hrs. On the job training 55 Hrs.	Recognize & comply safe working practices, Environment regulation and housekeeping.	1. Interpret importance of trade training and identify List of tools & Machinery used in the trade. 2. Develop Safety attitude of the trainee by educating them to use Personal Protective Equipment (PPE) such as safety glasses, gloves, earplugs, and safety shoes, to protect them from potential hazards. 3. Identify and interpret First Aid Method and basic training. 4. Execute Safe disposal of waste materials like cotton waste, metal chips/burrs etc. 5. Proper handling and disposal of hazardous materials, such as oil, coolant, battery acid etc. 6. Identify Safety signs for Danger, Warning, caution & personal safety message. 7. Apply preventive measures for electrical accidents & steps to be taken in such accidents. 8. Use of Fire extinguishers. 9. Practice and understand	All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. • Soft Skills, its importance and Job area after completion of training. • Importance of safety and general precautions observed in the in the industry/shop floor. • Introduction of First aid. Operation of electrical mains and electrical safety. Introduction of PPEs. • Response to emergencies e.g.; power failure, fire, and system failure. • Importance of housekeeping & good shop floor practices. Introduction to 5S concept & its application. • Occupational Safety & Health: Health, Safety and Environment guidelines, legislations & regulations as applicable. • Basic understanding on Hotwork, confined space work and material handling equipment.

		precautions to be followed while working in fitting jobs and in assembly line. 10. Safe use of tools and equipment used in the trade to prevent accidental injury. 11. Apply proper lifting techniques to minimize physical strain.	• Emergency and evacuation procedures to be followed in the assembly line. • Safety signs and norms.
Professional Skill 35 Hrs. Professional Knowledge 25 Hrs. On the job training 60 Hrs.	Identify different types of vehicles and Different components used in vehicles and perform on job training in various shops & conveyor systems.	12. Identify basic components of an automobile, including the engine, transmission, suspension, brakes, and electrical systems. 13. Study the principles behind how each of these systems work and how they interact with each other. 14. Identify different types of Vehicle, Vehicle Identification Number, Chassis No. & Engine no. 15. Identify and apply different manufacturing processes involved in producing automobiles, such as casting, forging, stamping, machining, painting and welding. 16. Interpret different stages of assembly, including sub-assembly, final assembly, and quality control. 17. Interpret and apply Plant and personal safety. 18. Identify and select	• Knowledge about automobile industry • Basic automotive terms and familiarisation to various types of vehicles • Study the principles behind how the engine, transmission, suspension, brakes, and electrical systems work and how they interact with each other. • Basics of Vehicle manufacturing process • Basics of Blanking process • Basics of Stamping process • Basics of Welding process • Basics of Painting process • Basics of Assembly process • Basics of Vehicle Inspection and testing process • Introduction to Tools and equipment used in vehicle manufacturing • Conveyors types • Spot Welding guns • Stamping presses • Pneumatic tools • Electric tools • Sealant application guns • Special tools and

		different components in the vehicle. 19. Familiarize with the different types of manufacturing equipment used in the automotive industry. 20. Operate manufacturing equipment and perform basic maintenance and repairs. 21. On the job training in various production shops to get acquainted to the vehicle manufacturing process. 22. Hands on training on conveyor line and sub assembly.	equipment • Study how automobiles are assembled on the production line.
Professional Skill 20 Hrs. Professional Knowledge 15 Hrs. On the job training 25 Hrs.	Develop skill to work on transmission system functions of an automobile.	23. Identify and select different parts of Transmission system. 24. Recognize manufacturing processes involved in producing the various components of the transmission system. 25. Identify Types of Transmission. 26. Dismantle and reassemble the transmission system. 27. Practice transmission repair and maintenance tasks. 28. Diagnose transmission problems by performing diagnostic tests.	• Transmission system and inspection explanation on parts and system. • Types of transmission [manual transmission & transaxle]. • Using of scan tool to check for error codes, performing a transmission fluid analysis, and conducting a road test to check for symptoms.
Professional Skill 45 Hrs. Professional	Illustrate brake system and diagnose and repairer brake	29. Identify the components of brake system, such as brake pads, rotors, calipers, and brake lines	• Components of brake system, such as brake pads, rotors, calipers, and brake lines and understand their

Knowledge 30 Hrs. On the job training 75 Hrs.	system problems.	and understand their function. 30. Disassemble and assemble the brake system to learn about its function and the different components involved. (removing and replacing brake pads, rotors, and calipers.) 31. Perform maintenance of the brake system, such as checking brake fluid levels, inspecting brake pads for wear, and cleaning brake components. 32. Diagnose brake system problems by performing diagnostic tests, 33. Check and adjust parking brake, and service brakes. 34. Overhaul – master cylinder, Wheel cylinder & caliper pistons, wheel drum. 35. Bleed vacuum assisted hydraulic brakes 36. Overhaul Wheel cylinders & Drum brake/disc brakes. 37. Check fail safe system & rectify defects 38. Remove & clean brake drums. 39. Check disc/drum run out, Fit new cups and brake hoses / pipes assemble, adjust all wheel brakes and test for brake concern.	function. • Forces & momentum acting on vehicle, brake slip, braking force co-efficient, time element of braking operation. • Classification of brake systems, factors affecting the braking distance. • Comparison between hydraulic drum brake & disc brake system. • Working Principle of brake components brake booster, and master cylinder, caliper assembly, wheel cylinder & different braking force control valves • Brake linings & pads • Brake Faults diagnostics and adjustments • Introduction to Anti-lock braking system (ABS). • Learn about the different types of brake systems, such as disc brakes and drum brakes, and how they function. • About the different brake system designs used in different types of vehicles.

Professional Skill 25 Hrs. Professional Knowledge 15 Hrs. On the job training 50 Hrs.	Recognize vehicle body parts & components, their functions and assemble components on actual manufacturing lines.	40. On the job training on the actual manufacturing lines and identifying various components their function assembly and fitment procedure. 41. Identify the different components of the vehicle body, such as doors, hoods, fenders, roofs, and body panels. 42. Disassemble and assemble the vehicle body to learn about its function and the different components involved. (removing and replacing body panels, doors, hoods, and fenders.) 43. Inspect and repair of the vehicle body, such as checking for rust and damage, and repairing dents and scratches.	**Structure of Vehicle Body** • Structure of car vehicle body. • Component installation in power train and its explanation. • Engine classification, mountings, transmission, driveshaft, propeller shaft, Differential, Clutch and Various joints Suspension components Construction of various components in power train.
Professional Skill 35 Hrs. Professional Knowledge 15 Hrs. On the job training 100 Hrs.	Illustrate suspension system & components, conduct inspection.	44. Identify different components of the suspension system, such as springs, shock absorbers, struts, and control arm and understand their function. 45. Carry out inspection for wear & tear. 46. Overhauling of independent suspension and rigid suspension. 47. Differential working and dismantling and re-fit. 48. Perform a wheel alignment by adjusting the suspension system to	• Suspension system and inspection, explanation on parts and system • Define sprung and un-sprung weight • Define live and dead axle • Define rigid and independent axle • Learn about the different types of suspension systems, such as independent suspension and solid axle suspension, and how they function. • The different suspension system designs used in different types of vehicles.

		ensure proper tire wear and handling. 49. Diagnose suspension system problems by performing diagnostic tests, such as checking for worn or damaged components, and checking for proper suspension function.	
Professional Skill 45 Hrs. Professional Knowledge 45 Hrs. On the job training 150 Hrs.	Identify elements of vehicle manufacturing process and make components in Blanking & Stamping shop, Casting and Machine shop.	50. Identify different casting techniques such as sand casting, die casting, and investment casting. 51. Apply the process of melting and pouring metal into molds to create various automotive parts. 52. Interpret forging process and practice on shape metal using heat and pressure to create various automotive parts such as crankshafts, connecting rods, and suspension components. 53. Apply Forming for metal working techniques such as bending, rolling, and shaping sheet metal. 54. Practice these techniques by creating various automotive parts such as body panels and trim. 55. Plan and apply machining operation such as milling, turning, and drilling by creating various automotive parts such as engine components and	• Casting: Understanding the different types of casting processes, such as sand casting and die casting, and their advantages and disadvantages. Knowledge of materials used for casting, such as aluminum and steel, and the factors that affect casting quality, such as porosity and shrinkage. • Forging: Understanding the different types of forging processes, such as open-die forging and closed-die forging, and their advantages and disadvantages. Knowledge of the materials used for forging, such as steel and titanium, and the factors that affect forging quality, such as grain structure and internal defects. • Forming: Understanding the different types of forming processes, such as rolling and extrusion, and their advantages and disadvantages. Knowledge

		transmission parts. 56. Perform fitting by participating in assembly line work, process of fitting various automotive parts together. 57. Apply Blanking process for metal cutting techniques such as shearing and punching to create various automotive parts such as brackets and supports. 58. Use stamping press tools and dies press forming to create various automotive parts such as body panels and chassis components.	of the materials used for forming, such as metals and plastics, and the factors that affect forming quality, such as surface finish and dimensional accuracy. • Machining: Understanding the different types of machining processes, such as turning and milling, and their advantages and disadvantages. Knowledge of the materials used for machining, such as metals and composites, and the factors that affect machining quality, such as surface roughness and dimensional accuracy. • Fitting: Understanding the process of fitting components together, including the use of fasteners and adhesives. Knowledge of the factors that affect the quality of fitting, such as alignment and clearance. • Blanking process: Understanding the process of blanking, including the use of stamping presses to cut or punch flat shapes from sheet metal. Knowledge of the materials used for blanking, such as steel and aluminum, and the factors that affect blanking quality, such as burr formation and

			dimensional accuracy. • Stamping press tools and dies: Understanding the design and function of stamping press tools and dies, including the different types of dies, such as blanking dies and forming dies. Knowledge of the factors that affect die life and performance, such as die material and lubrication.
Professional Skill 15 Hrs. Professional Knowledge 10 Hrs. On the job training 35 Hrs.	Recognize and interpret vehicle Heating Ventilation Air- Conditioning (HVAC) system, components &functioning.	59. Identify Air Conditioning components. 60. Conduct performance test on A/c unit. 61. Check charged state of Refrigerant. 62. Inspect and adjust an engine drive belt. 63. Replace an Engine drive belt. 64. Check heating system, compressor rotation test, air gap check, Refrigerant recovery evacuating. 65. Charging of a/c system. Replenishing compressor oil level. 66. HVAC troubleshooting, diagnosis and repair for No cooling or warm air, Cool air comes out only intermittently.	• AC system layout & components explanation. • Location of various AC components in Vehicle. • Auto AC Diagnosis & repair of ac system. • Recharging ac refrigerant using recovery machine. • Compressor oil (lubricant) property and quantity. • Ac system performance inspection HVAC legislation. • Vehicle heating, Ventilation & cooling systems, basic air- conditioning principles, air- conditioning capacity, air- conditioning refrigerant, Humidity • Description and function of fixed orifice, Control devices.
Professional Skill 25 Hrs. Professional Knowledge	Apply welding and conduct inspection of weld joints to find welding defects.	67. Identify and interpret welding symbols and drawing. 68. Basics of automotive welding process.	• Welding processes: about the different types of welding processes used in the automotive industry. • Welding materials:

15 Hrs. On the job training 80 Hrs.		69. Carry out welding training and understanding of different types of welding. 70. Practice welding different types of joints, such as lap joints, T-joints, and corner joints. 71. Inspect welding joints using visual, DP & MP tests. 72. Safety practices and regulations governing welding operations. 73. Avoid hazards associated with welding operations.	different types of materials used in welding, such as steel, aluminum, and magnesium, and the specific welding techniques required for each material. • Welding quality control: different methods of welding quality control, including visual inspection, non-destructive testing (NDT), and destructive testing. • Welding defects: common welding defects, such as porosity, cracking, and incomplete fusion, and how to prevent and correct them.
Professional Skill 25 Hrs. Professional Knowledge 15 Hrs. On the job training 50 Hrs.	Perform surface preparation, painting and check dry film thickness (DFT) using Elcometer and analyse painting defects.	74. Prepare a vehicle's surface before applying paint. 75. Mask off areas of the vehicle that should not be painted, such as trim pieces and glass. 76. Practice different paint application techniques, such as using a spray gun, airbrush, or roller. 77. Inspect the painted panel note down the defects. 78. Take painted surface DFT at various locations using Elcometer. 79. Apply safety practices and regulations governing painting operations.	• Terminology for painting • Sealant application guns • Paint equipment and parameters • Painting defects • Paint inspection & thickness measurement

Professional Skill 40 Hrs. Professional Knowledge 40 Hrs. On the job training 130 Hrs.	Interpret different vehicle assembling processes and perform components assembling work.	80. Basic understanding of automotive Assembly process in plant. 81. Identify different types of bolts and fasteners to join different parts of the vehicle together. 82. Install electrical components, such as batteries, starters, alternators, and other electrical systems. 83. Read and interpret electrical diagrams and schematics. 84. Use torque wrenches and other tools to ensure that bolts and fasteners are tightened to the correct specifications. 85. Understand the process of assembling of interior components of the vehicle, such as seats, dashboard, console, and other interior systems. 86. Assemble and install the suspension and steering components of the vehicle, including shock absorbers, struts, ball joints, and steering linkages. 87. Hands On training on different Assembly processes in workshop.	• Various assembly processes • Pneumatic tools and electrical tools • Torque wrenches • Types of assembly conveyors • Filling and testing equipment • Vehicle Inspection and testing • Tester line equipment • Testing parameters.
ENGINEERING DRAWING: 30 HRS.			
Professional Knowledge ED- 30 Hrs.	Read and apply engineering drawing for different	Introduction to Engineering Drawing and Drawing Instruments – Conventions Sizes and layout of drawing sheets Title Block, its position and content	

	application in the field of work.	Drawing Instrument Lines- Types and applications in drawing Free hand drawing of – Geometrical figures and blocks with dimension Transferring measurement from the given object to the free hand sketches. Free hand drawing of hand tools and measuring tools. Drawing of Geometrical figures: Angle, Triangle, Circle, Rectangle, Square, Parallelogram. Lettering & Numbering – Single Stroke. Dimensioning Types of arrowhead Leader line with text Position of dimensioning (Unidirectional, Aligned) Symbolic representation – Different symbols used in the related trades. Concept and reading of Drawing in Concept of axes plane and quadrant Concept of Orthographic and Isometric projections Method of first angle and third angle projections (definition and difference) Reading of Job drawing of related trades.
WORKSHOP CALCULATION AND SCIENCE: 30 HRS		
Professional Knowledge WCS- 30 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	**Unit, Fractions** Classification of unit system Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units Measurement units and conversion Factors, HCF, LCM and problems Fractions - Addition, substraction, multiplication & division Decimal fractions - Addition, subtraction, multilipication & division Solving problems by using calculator **Square root, Ratio and Proportions, Percentage** Square and suare root Simple problems using calculator Applications of pythagoras theorem and related problems Ratio and proportion Ratio and proportion - Direct and indirect proportions Percentage Precentage - Changing percentage to decimal and fraction **Material Science** Types metals, types of ferrous and non ferrous metals

		Physical and mechanical properties of metals **Mass, Weight, Volume and Density** Mass, volume, density, weight and specific gravity, numerical related to L,C,O section only Related problems for mass, volume, density, weight and specific gravity **Speed and Velocity, Work, Power and Energy** Speed and velocity - Rest, motion, speed, velocity, difference between speed and velocity, acceleration and retardation Speed and velocity - Related problems on speed & velocity Work, power, energy, HP, IHP, BHP and efficiency **Heat & Temperature and Pressure** Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point of different metals and non-metals Concept of pressure - Units of pressure, atmospheric pressure, absolute pressure, gauge pressure and gauges used for measuring pressure **Basic Electricity** Introduction and uses of electricity, electric current AC, DC their comparison, voltage, resistance and their units **Mensuration** Area and perimeter of square, rectangle and parallelogram Surface area and volume of solids - cube, cuboid, cylinder, sphere and hollow cylinder Finding the lateral surface area, total surface area and capacity in litres of hexagonal, conical and cylindrical shaped vessels **Levers and Simple machines** Simple machines - Effort and load, mechanical advantage, velocity ratio, efficiency of machine, relationship between efficiency, velocity ratio and mechanical advantage Lever & Simple machines - Lever and its types **Trigonometry** Measurement of angles Trigonometrical ratios Trigonometrical tables
MANDATORY OJT/GROUP PROJECT (240 Hours)		
Note: The duration of Professional skills (Trade practical) and Professional knowledge (Trade theory) are indicative only. The Training Institute has the flexibility to adopt suitable training duration for effective training.		

MANDATORY OJT/GROUP PROJECT – FIRST YEAR		
DURATION: 240 HOURS		
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**
Professional skills 45 Hrs.	Generate Diagnostic report using appropriate tools and equipment while observing related safety precautions.	• Demonstration on use of fire extinguisher. • Identification of Read customer complaint job card, Interpret service manual data, circuit diagram and Laying out results in the standard format • Perform stripping of wires and joining wires using soldering Iron • Construction of simple electrical circuits • Checking of a electrical Circuit, Voltage drop, Current, Resistance, continuity test for open and short circuit using Multimeter. • Identify and location of fuse box, Checking of fuses, jumper wires, fusible links, and circuit breakers. • Check electrical circuit with a test lamp. • checking of Battery Performance. • Use of Oscilloscope and interpretation of Waves forms • Connect the scan tool with vehicle data link connector and study the scan tool operations.
Professional skills 30 Hrs.	Analyze electronic components of vehicle	• Test power and signal connectors for continuity • Test different type of Diodes • Carryout NPN & PNP Transistors for its functionality • Construct and test simple logic circuits OR, AND & NOT and Logic gates using switches. • Start petrol engine and Check the warning lights of Instrument cluster
Professional skills 45 Hrs.	Diagnose and Rectify errors in Electronic Ignition system	• Identify and locate the components of MPFI System • Trace out the Engine control system electrical circuit • Carryout removal and installation of Engine Control Module (ECM) (follow the Exercise of procedure for registration of ignition key) • Register for ECM replacement procedure. • Register for Fuel Injector Petrol vehicle
Professional skills 90 Hrs.	Perform on board diagnosis using scan	• Identify the terminal arrangement of ECM connector • Perform On board diagnosis using scan tool -

	tool, Testing of sensors	Connecting of scan tool with data link connector, Reading of diagnostic trouble code, Reviewing of Engine freezing data and live data's, Deletion of error code memory • Inspect On-Vehicle for Crankshaft Position sensor (CKP) performance, Removal and Installation of Crank position sensor (CKP) and test the circuit. • Inspect On-Vehicle for Cam Position sensor (CMP) performance, Removal and Installation of Cam position sensor (CMP) and test the circuit • Inspect On-Vehicle for Manifold Absolute pressure sensor (MAP) performance, Removal and Installation of Manifold absolute pressure sensor (MAP)and test the circuit • Inspect On-Vehicle for Coolant Temperature Sensor (CTS) performance, Removal and Installation of Coolant Temperature sensor (CTS) and test the circuit • Inspect On-Vehicle for Throttle Position sensor (TPS) performance, Removal and Installation of Throttle body assembly and test the circuit • Inspect On-Vehicle for Accelerator Pedal Position sensor (APP) performance, Removal and Installation of Accelerator pedal position sensor (APP) and test the circuit • Inspect On-Vehicle for Knock sensor performance, Removal and Installation of Knock sensor and test the circuit • Inspect On-Vehicle for Inlet Air Temperature sensor (IAT) performance, Removal and Installation of Inlet air temperature sensor (IAT) and test the circuit • Inspect On-Vehicle for Boost pressure sensor (BPP) performance, Removal and Installation of Boost Pressure sensor (BPP) and test the circuit • Inspect On-Vehicle for Heated oxygen sensor (HO2) performance, Removal and Installation of Heated oxygen sensor and test the circuit • Inspect On-Vehicle for Air-Fuel Ratio sensor performance, Removal and Installation of Air-Fuel Ratio sensor and test the circuit • Inspect On-Vehicle for vehicle speed sensor performance, Removal and Installation of vehicle

		speed sensor and test the circuit • Trace and Test AC pressure switch circuit. • Trace and test of Distributor type Electronic ignition system circuit. • Trace and test of Distributor less (waste spark) ignition system circuit • Trace and test of Direct spark ignition (coil on plug) system circuit.
Professional skills 30 Hrs.	Perform Testing of actuators.	• inspect fuel pump relay, starting motor control relay, main relay and fuel heater relay • Trace and test of Actuators idle air control valve circuit • Trace and test of Fuel injectors circuit • Trace and test of Positive crank case ventilation valve (PCV) circuit • Trace and test of Evaporative canister purge control valve • circuit Trace and test of Radiator cooling fan circuit • Trace and test of Engine oil pressure circuit • Trace and Test of Engine Immobilizer system.

SYLLABUS – INDUSTRIAL AUTOMOTIVE MANUFACTURING TECHNICIAN (FLEXI MoU)			
SECOND YEAR			
Duration	**Reference Learning Outcomes**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Professional Skill 65 Hrs. Professional Knowledge 50 Hrs. On the job training 245 Hrs.	Plan and perform assembling of vehicle interior components.	88. Remove old seats and install new ones. 89. Adjust the seats for proper positioning and secure them to the vehicle's floor. 90. Practice assembling the dashboard including install the instrument cluster, center console, audio system, and other interior components. 91. Connect electrical wiring and secure the dashboard to the vehicle's body. 92. Install the door handle, window controls, and speaker systems. 93. Attach the door panel to the door frame and adjust it for proper fitment. 94. Remove the old carpet and install new carpet. 95. Cut and trim the carpet properly to fit the vehicle's interior and secure it to the floor. 96. Install trim pieces, such as the headliner, sun visors, and door trim. 97. Align and secure trim pieces pieces properly to the vehicle's body. 98. Install components in the vehicle; viz Harness &	• Harness & controls and other electrical items viz. Junction box, Switches, Relays, Dash board instruments and complete all internal wiring. • Pedal Assembly, • Insulator or Fire wall • Air duct, heater duct, heater, • Head liner, Weather-strip, • Horn, Stop switch. • Front/ rear shock absorber, shift cable, Washer tank. • Front/ rear seat belt. • Installation of components in the vehicle along with familiarization of tools conveyor system and automation.

		controls and other electrical items viz. Junction box, Switches, Relays, and complete all internal wiring, Pedal Assembly, Insulator or Fire wall, Air duct, heater duct, heater, Head liner, Weather-strip, Horn, Stop switch, Front/ rear shock absorber, shift cable, Washer tank, Front/ rear seat belt, Installation of components in the vehicle along with familiarization of tools conveyor system and automation.	
Professional Skill 45 Hrs. Professional Knowledge 35 Hrs. On the job training 100 Hrs.	Perform installation of power train, suspension and brake system components using appropriate hand & power tools.	99. Practice assembling engines, including installing pistons, connecting rods, crankshafts, camshafts, and other components. 100. Apply appropriate skills to torque bolts, adjust timing, and install gaskets and seals. 101. Integrate the engine and transmission into a single unit, which is called the powertrain. 102. Assemble the exhaust system, including the installation of the exhaust manifold, catalytic converter, muffler, and other exhaust components. 103. Assemble transmissions, including installing	Powertrain Assembly • Introduction to powertrain systems • Engine components and functions • Engine operation and principles • Types of engine designs and configurations • Transmission components and functions • Transmission operation and principles • Driveshaft and differential components and functions • Powertrain integration and installation • Powertrain testing and diagnostics Suspension Assembly • Introduction to suspension systems • Suspension types and

		gears, bearings, shafts, and other components. 104. Practice assembling suspension components, including installing shock absorbers, struts, control arms, and other components. 105. Align suspension components, and adjust ride height. 106. Assemble brake components, including installing brake calipers, rotors, pads, and other components. 107. Bleed the brake system, adjust the brake pads, and ensure proper brake operation. 108. Installation of following components in the vehicle; • Brake tube & filler neck • Fuel pipe, fuel tank, canister • Rear axle, stabilizer bar Knuckle, tie rod • Exhaust System is &Tyre front/rear seat & bumper. 109. Familiarization of tools, conveyor systems and automation.	designs • Springs and shock absorbers • Control arms and steering components • Wheel alignment and balance • Suspension maintenance and repair • Suspension testing and diagnostics Brake Assembly • Introduction to brake systems • Brake types and designs • Brake components and functions • Hydraulic system operation and principles • Brake pad and rotor materials and characteristics • Brake system maintenance and repair • Brake testing and diagnostics Industry Trends and Emerging Technologies Future trends in automotive manufacturing
Professional Skill 65 Hrs. Professional Knowledge 60 Hrs.	Plan, organize and perform work and assemble Final line assembly components on vehicle.	Install following components in the vehicle; 110. Rear pillar trim, trunk lid latch 111. Console bracket, carpet, trunk room trim 112. License plate lamp,	• Rear pillar trim, trunk lid latch • Console bracket, carpet, trunk room trim, License plate lamp, radiator, hose • Seat belt, centre pillar trim • Heat hose, steering shaft

On the job training 205 Hrs.		radiator, hose 113. Seat belt, centre pillar trim. 114. Heat hose, steering shaft Air-conditioner components, A/c gas, Parking brake, garnish 115. Glove box, battery tray, seat belt, anchor cover, garnish 116. Rear combination lamp, sun visor 117. Air cleaner, front/rear seat 118. Battery cable, silencer 119. Front grille, drip moulding 120. Front turn signal lamp, console box, Front/rear glass, roof moulding, Combination meter 121. Familiarization of tools, conveyor systems and automation	• Air-conditioner components, A/c gas, Parking brake, garnish • Glove box, battery tray, seat belt, anchor cover, garnish • Rear combination lamp, sun visor, Air cleaner, front/rear seat, Battery cable, silencer • Front grille, drip moulding • Front turn signal lamp, console box, Front/rear glass, roof moulding, Combination meter, Installation of components in the vehicle along with familiarization of tools, conveyor systems and automation.
Professional Skill 35 Hrs. Professional Knowledge 15 Hrs. On the job training 40 Hrs.	Recognize the function of automation in vehicle assemble & material handling, perform installation of electrical and electronics components in vehicle and check for functionality after installation.	122. Install electrical components in vehicle assembly line. 123. Installation of electronic components in vehicle assembly line 124. Demonstrate Function of automation equipment in vehicle assembly line. 125. Demonstrate function of automation equipment in material handling. 126. Demonstrate function of automation equipment in testing.	• Basics of Electrical and Electronic, Current voltage and resistance, Ohm's Law • Types of Electrical Materials. • Direct Current and Alternating current. • Function of current • Heat generation action • Chemical & Magnetic Action • Parallel and Series connections Function and working principal of electrical components in vehicle assembly line, Alternator, Distributor,

			Wiper Motor • Wiring Harness and Connectors • Function and working principle of electronic components in vehicle assembly line • Electronic Control Module • Sensors and actuators • Air Bags, ABS & EBD • Electronic power steering • Function of automation equipment in vehicle assembly line, material handling • Function of automation equipment in testing
Professional Skill 45 Hrs. Professional Knowledge 30 Hrs. On the job training 135 Hrs.	Assemble the components designed to control pollution in vehicle and Conduct Emission test as per standard procedure.	127. Install components in the vehicle along with familiarization of tools, conveyor systems and Automation. 128. Install Electronic control systems. 129. Install Catalytic convertors. 130. Apply measurement techniques and hands on training on measurement. 131. Demonstrate Emission standards & Test procedures.	• Importance of pollution and emission control in automobile Vehicular emission • Factors influencing motor vehicle emission • Electronic control systems • Catalytic convertors • Evaporative emission control • Influence of engine variables on emissions • Pollutant formation in SI & CI Engines • Control of Emissions from SI & CI Engines • Measurement techniques • Emission standards & Test procedures
Professional Skill 75 Hrs. Professional Knowledge	Perform different types of quality control & inspection process on assembly line	132. Test Vehicle on plant tester line. 133. Check Wheel alignment. 134. Inspect Toe in adjustment.	• Different types of quality control processes used in automotive manufacturing shop • Statistical Process Control

50 Hrs. On the job training 145 Hrs.	and tester line and conduct final inspection & testing.	135. Perform Head lamp beam adjustment. 136. Conduct Drum test. 137. Brake test. 138. Emission test 139. Shower test 140. Road test 141. Final Inspection 142. ID plate punching	(SPC) • Functions of various departments in quality control procedures • Product development department • Production department • Quality Department • Marketing Department • Inspection Process • Final Audit Tests • Vehicle Identification Number (VIN)
ENGINEERING DRAWING: 30 HRS.			
Professional Knowledge ED- 30 Hrs.	Read and apply engineering drawing for different application in the field of work.	Reading of Electrical, Electronic & Mechanical Sign and Symbols used in Automobile. Sketches of Electrical, Electronic & Mechanical components used in Automobile. Reading of Electrical wiring diagram and Layout diagram used in Automobile. Drawing of Electrical circuit diagram used in Automobile. Drawing of Block diagram of Instruments & equipment of trades	
WORKSHOP CALCULATION AND SCIENCE: 30 HRS.			
Professional Knowledge WCS-30 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	**Friction** Friction - Advantages and disadvantages, simple problems related to friction Friction - Lubrication **Estimation and Costing** Estimation and costing - Simple estimation of the requirement of material etc., as applicable to the trade Estimation and costing - Problems on estimation and costing	
MANDATORY OJT/GROUP PROJECT (240 Hours)			
Note: The duration of Professional skills (Trade practical) and Professional knowledge (Trade theory) are indicative only. The Training Institute has the flexibility to adopt suitable training duration for effective training.			

MANDATORY OJT/GROUP PROJECT – SECOND YEAR		
DURATION: 240 HOURS		
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**
Professional Skill 60 Hrs.;	Recognize Electric vehicle components and Compare Performance of EV and IC engine vehicles.	• Identify and test different types of diodes. • Practice using digital meters such as power analyzer AC DC clamp meters, Lux meters. • Test and identify different types of transistors. • Identify and study performance of Electric vehicles, in comparison to IC engine vehicles. • Identifyn and study of basic components of EV • Identify various gauges/ instrument on dashboard of an electric vehicle and identify differences in instrumentation panel with IC engine vehicle. • Basic motor power calculation. • Selection, sizing and characteristic of motor. • Hands on practice of electric transmission. • Identification of components specific to EV and how they are in comparison to IC engine- based vehicle. • Calculation of motor effort. • Check the proper voltage, various practical work related to chopper circuit. • Testing of amplifier, output torque, efficiency testing at different condition. • Practice on Identifying Proximity sensor, Parking sensor, crash sensor, Rain and Light Sensor. • Remove and install power door lock and tracing the circuit. • Practice of safety precautions and procedures to be observed while working with EV Kit and measurement of insulation resistance and current.
Professional Skill 60 Hrs.;	Diagnose, repair and perform maintenance of automobile electrical components & general vehicle	• Familiarization of electrical and electronics components motor controller, DC to 3 phase conversion on vehicle. • Hands on removing and fitting basic mechanical, electrical and trim components. • Practice on Instrumentation and signaling system.

	architecture.	• Practice on Gauges & Meters: Mandatory & additional gauges, Engine/ Motor temperature gauge, Charging gauge, Speedometer, Tachometer diagnostics . • Perform fault diagnosis on electrical wiring harness.
Professional Skill 45 Hrs.;	Identify and develop Battery Pack Components, monitor and check performance of high voltage rechargeable energy storage system and Battery Management System.	• Develop Battery Pack with Series Parallel Configuration. • Identify different cell chemistries. • Identify different cell geometries. • Identification of various sensors installed - Battery Temperature Mapping. • Verify cell performance against supplier data sheet. • Conduct Voltage, Current and Temperature Measurement with BMS. • Configuration of BMS with software application. • Balance cells with external circuits. • Verify SoC mapping for charging and discharging Use Data to map Battery SoH.
Professional Skill 45 Hrs.;	Perform battery testing, charging and cycling operations.	• Connecting battery to a charger for battery charging, Inspecting & testing a battery after charging. • Perform safe storage, handle, and dispose of high voltage battery systems. • Replace defective Cell pack. • Check battery assembly sensors for proper functioning. • Diagnose, repair, and test high voltage battery systems. • Diagnose, repair, and testing of EV battery controls. • Measure and Diagnose the cause(s) of excessive Key-off battery drain (parasitic draw) and do corrective action.
Professional Skill 30 Hrs.;	Selecting, operating and troubleshoot Electric Vehicle Charging Ecosystem.	• Identify Type of Charger and Voltage Levels. • Operate Standard Chargers Determine Charging Time under various conditions. • Requirement of charging inputs for different types of chargers. • Diagnosis and remedy for Charger not responding, Charger not delivering expected current. • Practice on Single phase AC, 3 phase AC fast charging and DC fast charging.

SYLLABUS (CORE SKILLS)
Employability Skills (Common for all CTS trades) (120Hrs.+ 60Hrs.)

Learning outcomes, assessment criteria, syllabus and tool list of core skill subjects which are common for a group of trades, provided separately in www.bharatskills.gov.in / www.dgt.gov.in

ANNEXURE-I

List of Tools and Equipment			
INDUSTRIAL AUTOMOTIVE MANUFACTURING TECHNICIAN (for batch of 20 candidates)			
Sl. No.	**Name of the Tools and Equipment**	**Specification**	**Quantity**
1.	Double ended spanner set	6-32 mm	5 set
2.	Ring spanner set	6-32 mm	5 set
3.	Tubular spanners	8,10,12,14,16,17 mm	5 nos.
4.	Socket spanners	6-32 mm with T bar and ratchet	5 set
5.	Allen keys	4-12 mm in steps of 2mm	5 set
6.	Screw driver (flat)	20 cmx 9 mm blade	5 set
7.	Screw driver(flat)	30 cmx 9 mm blade	5 set
8.	Screw driver (Philips type)	100-300 mm set of 5 pieces	5 set
9.	Hammer ball peen	0.75 kg	5 set
10.	Mallet hammer		5 set
11.	Hammer Nylon		5 set
12.	Nose plier straight	15 cm	5 set
13.	Combination plier	15 cm	5 set
14.	Cir clip plier external & contracting	6”	5 set
15.	Circlip plier external & contracting	7”	5 set
16.	Feeler gauge	20 blades metric	5 set
17.	Adjustable spanner	20 cm	5 set
18.	Sparkplug spanner	12,14,17 mm	5 set
19.	Knife Edge		5 set
20.	Pneumatic/ Impact wrench		5 set
21.	Battery impact		5 set
22.	Socket set		5 set
23.	Screw Bit set		20 nos.
24.	Torque wrench	0-50 NM	8 no.
25.	Digital Multi-meter		2 no.
26.	Tap pet adjuster		8 no.
27.	Puller Set		8 nos.
28.	Impact screwdriver for flat and Philips type		8 set
29.	Pneumatic tyre inflator		2 set
30.	Measuring Jars	Different capacity	1 Set
31.	2 post lift	3-ton capacity	4 nos.

32.	Desktop computers for Basic training		8 nos.
33.	Engine (Petrol 1ZZFE) for dismantling and assembly		8 nos.
34.	Engine (Diesel 2KD) for dismantling and assembly		5 nos.
35.	Transmission for assembly and disassembly training		5 nos.
36.	Transaxle for assembly and disassembly training		5 nos.
37.	4-Wheeler vehicle	Monocoque and Frame	4+4 nos.
38.	Streeting for assembly and disassembly training		5 nos.
39.	Toe-Measuring Gauge		1 no.
40.	Vane pump & starter assembly and disassembly training		5 nos.
41.	Differential set for assembly and disassembly training		5 nos.
42.	Wheel balancer		1 no.
43.	Exhaust gas Analyzer		1 no.
44.	Car Washer		1 no.
45.	Brake Bleeding Equipment		1 no.
46.	Air compressor	200 liters capacity	1 no.
47.	Battery Tester & battery charger		2 nos.
48.	Hydro meter		3 no.
49.	Hydraulic Press		1 no.
50.	TRG – Turning Radius gauge		1 no.
51.	CCK – Caster, camber & kingpin angle inclination set		1 no.
52.	Green Power Jump starter		1 no.
53.	Battery Charger		1 no.
54.	Battery Tester		1 no.
55.	MPFI petrol engine with Fault simulation board		1 no.
56.	Multi Scan Tool To scan Engine, ABS & EBD, AT, SRS, Body Control and immobilizer		1 no.
57.	Oscilloscope with test leads		1 no.
58.	OBD scanner		1 no.
59.	Horses and wheel choke		4 nos.
60.	Screw jack		1 each
61.	Two post car lift	capacity 4000 kg	1 no.

ABBREVIATIONS

CTS	Craftsmen Training Scheme
ATS	Apprenticeship Training Scheme
CITS	Craft Instructor Training Scheme
DGT	Directorate General of Training
MSDE	Ministry of Skill Development and Entrepreneurship
NTC	National Trade Certificate
NAC	National Apprenticeship Certificate
NCIC	National Craft Instructor Certificate
LD	Locomotor Disability
CP	Cerebral Palsy
MD	Multiple Disabilities
LV	Low Vision
HH	Hard of Hearing
ID	Intellectual Disabilities
LC	Leprosy Cured
SLD	Specific Learning Disabilities
DW	Dwarfisms
MI	Mental Illness
AA	Acid Attack
PwD	Person with disabilities