

CURRICULUM FOR SIX MONTH CERTIFICATE COURSE
FOR
COMMUNITY DEVELOPMENT THROUGH POLYTECHNIC SCHEME
IN
AUTOMOBILE REPAIRING / AUTO MECHANIC

UNDER DEVELOPMENT

Prepared By
CURRICULUM DEVELOPMENT CELL

**INSTITUTE OF RESEARCH, DEVELOPMENT TRAINING, U.P., KANPUR-
208002**

SIX MONTH CERTIFICATE COURSE
IN
AUTOMOBILE REPAIRING / AUTO MECHANIC

Sl. No.	Module	Name of Module	Duration
1.	Module 1	BASICS OF PETROL & DIESEL ENGINES	12 Weeks
2.	Module 2	BASICS OF TRANSMISSION, SUSPENSION , STEERING SYSTEMS & BRAKES	12 Weeks

MAIN FEATURES OF THE CURRICULUM

1. Title of the Course : Certificate course in **AUTOMOBILE REPAIRING / AUTO MECHANIC**
2. Duration of the Course : Six Month
3. Type of the Course : Full Time Institutional
4. Entry Qualification : Passed 10th class or its equivalent.

Module-1: BASICS OF PETROL & DIESEL ENGINES Practical	Theory
<p>Familiarization with the hand tools, machinery and type of work done in the trade. Safety precautions in the use of hand tools and equipment on shop floor. Safety equipment and its use. Use of jacks, hoist and horses in the shop. Selection of materials for gaskets, packing and locking devices and their uses in the trade. Familiarization with working of four stroke petrol and Diesel engines. Identification of differences between Petrol & diesel Engine. Identification of difference between two stroke and four stroke engine.</p>	<p>Introduction to the trade and general precautions to be observed in the trade in storing and handling fuels, brake fluids, lubricants, acids, refrigerants, dust and asbestos. Description of safety equipment, its purpose and use. Elementary First Aid. Types of materials used in packing and gaskets, Fastening devices General description, working principle, classification and characteristics of Petrol & Diesel engines. Working principle of two stroke petrol engine. Difference between petrol and diesel engines. Difference between two stroke and four-stroke engines.</p>
<p>Identifying various petrol & Diesel engines auxiliaries. Practice on starting and stopping of the engine. Adjusting speeds in idling and running conditions. Running the engine and checking temperature, fuel, oil pressure and speed. Testing engine compression and vacuum with gauges. Torquing & detorquing of cylinder head bolts.</p>	<p>Precautions in starting, running and stopping a petrol & diesel engine. Brief description of engine auxiliaries and function of various gauges used with the engine., concept of torque, clamping force, torque wrench-use and care method of torquing, and detorquing.</p>

<p>Dismantle 2-stroke petrol engine. Examine its parts their materials and other working details. Measurement of cylinder bore. Assemble and start the engine.</p>	<p>Engine details – types, functions, materials and maintenance of, cylinder heads, cylinder liners, Piston, piston rings, crank shaft, cam shaft, vibration damper and fly wheel.</p>
<p>Dismantle 4-stroke petrol engine. Examine inner details of moving parts, their materials and other working details. Assemble and start the engine.</p>	<p>Valve and valve operating system, valve timing diagram, camshaft and timing gears, Importance of correct tappet clearance and timing.</p>
<p>Familiarization with ignition system of Petrol engine. Clean spark plugs, adjust gaps and refit. Servicing air cleaner. Carry out minor adjustments on carburetor.</p>	<p>Ignition system of petrol engines, purpose of induction coil, flywheel magneto, distributor and spark plug. Working principle of carburetor and its adjustments. Importance of correct air fuel mixture on the engine performance. Introduction to Multi Point Fuel Injection (MPFI) System</p>
<p>Practice on starting and stopping of diesel engine. Running engine on stand and checking speed, temperature, and oil pressure. Compression testing of cylinders. Dismantle 4-stroke diesel engine. Examine inner details of moving parts, their materials and other working details. Measure cylinder wears and piston clearance. Decarbonise the cylinder head. Assemble</p>	<p>General description, working principle and constructional details of Diesel engines. Precautions while starting, running and stopping diesel engine. Precautions while dismantling diesel engine and engine assembly procedure.</p>

and start the engine	
Identifying main parts of fuel injection and mounting of fuel Injection pump to the engine. Injector overhauling & testing. Replacing fuel filter elements and air cleaners.	Functions and types of Fuel feed systems in diesel engines. Various components of fuel feed system and their functions. Common troubles in fuel feed systems and remedies, Types, purpose and application of fuel injection pump. Details of In - line fuel Injection pump and Injectors.
Flushing of cooling system in engine. Dismantling and assembling oil pump, servicing oil filters, changing oil in engine.	Engine cooling systems. Functions and types of lubrication systems. Various components of lubrication system and their functions. Types of lubricants and their properties. Common troubles in lubrication systems and remedies.

TOOLS, MACHINERY, EQUIPMENTS etc. for a batch of 16 trainees

SI No	Item	Qty	SI No	Item	Qty
02	Steel rule 15 cm. English and metric	17 Nos	22	Hacksaw frame adjustable for 30 cm blade	4 nos.
03	Screw driver 20 cm. x 9 mm blade	17 Nos	23	Engineer's Stethoscope	1 no.
04	Screw driver 30 cm x 9 mm blade	17 Nos	24	Hand vice 37mm	2 nos.
05	Spanner D E set of 12 pieces (6mm to 32 mm)	17 Nos	25	File assorted (8 types)	16 Nos
06	Pliers combination 15 cm	17 Nos	26	Drill Twist (assorted)	10 nos.
07	Hand file 20 cm. Second cut	17 Nos	27	Taps and Dies complete set in a box BA, BSW, BSF American & metric with handle	2 sets each
08	Centre punch 10 mm dia x 100 mm	17 Nos	28	Hand reamer adjustable 10.5 to 11.25 mm, 11.25 to 12.75 mm, 12.75 to 14.25 mm and 14.25 to 15.75 mm	1 set
09	Chisel cold flat 20 mm	17 Nos	29	Dial indicator to read 0.01 mm	1 no.
10	Ring spanner set of 12 pieces (6mm to 32 mm.)	17 Nos	30	Micrometer outside 0-25 mm, 25-50 mm, 50-75mm, 75-100 mm	1 each
11	Feeler gauge 20 blades (metric)	17 Nos	31	Micrometer inside 25-50, 50-75, 75-150 mm with extension rod.	1 each
12	Steel tool box with lock & key (folding type) size	17 Nos	32	Mallets (wooden/plastic)	1 nos.

	400x200x150mm .				
13	Allen Key set of 12 pieces (2 mm to 14 mm)	04 Sets	33	Piston ring filer	2 sets
14	Philips Screw Driver Type set of 5 pieces 100 mm to 300 mm	04 Sets	34	Spanner, ring offset set of 6 (S A E)	2 sets.
MEASURING INSTRUMENTS AND GENERAL SHOP TOOLS			35	Spanner, adjustable 20 cm.	1 no.
			36	Spanner for spark plugs 14 mm	2 nos.
15	Steel Rule 30 cm, English and metric	2 nos.	37	Spanners socket of 8 with handle, T bar and ratchet	1 set.
16	Engineer's square 15 cm. Blade	2 nos.	38	Chain and Pulley block 3000 kg. Capacity	1 no.
17	Divider spring joint 15 cm.	2 nos.	39	Horses	4 nos.
18	Prick punch 15 cm	2nos.	40	Screw jack 1 ton capacity double lift	2 nos.
19	Chisels Cross cut 200 mm x 6 mm	2 nos.	41	Oil can 0.5 liter cap	1 no.
20	Ball peen Hammer 0.5 kg	2 nos.	42	Cleaning Tray 45 x 30 cm.	8 nos.
21	Scriber 15 cm with scribing block universal	1 each	43	Torque wrench set of 3 Nos	1 set.

No	Item	Qty	SI No	Item	Qty
44	Work bench each 250 x120x60 with 4 bench vices12 cm jaw	2 nos.	71	Battery 12 V	2 Nos.
45	Pullers screw powered 2 mm with bearing puller attachment	1 no.	72	Vernier Caliper 250 or 200 mm inside, outside & depth	1 No.
46	Vice grip pliers	1no.	73	DMM Auto range	2 Nos.
47	Circlip pliers Expanding and contracting type 15 cm and 20 cm each	8 sets	74	Petrol Injector	2 Nos.
48	Inspection lamp with guard and wandering lead of 100 ft.	1 no.	75	Petrol Fuel pump of MPFI system	2 Nos.
49	Distributor	2 no.	76	Hydrometer	2 Nos.
50	Carburetor (two different types)	2 nos	77	Piston Ring compressor	1 no.
51	Crow bar	2 each	78	Valve spring lifter	1 no.
52	Hollow punch set of seven pieces 6 mm to 15 mm	1 set	79	Fuel injection pump one with pneumatic governor , one with R Q governor and one with R.S.V. governor	1 each
53	Cleaning tray- Aluminum 45 x 30 cm	8 nos.	80	Fuel feed pump	1 no.
54	Valve spring Compressor	1 no.	81	Injectors	2 nos.

55	Tool valve grinding, suction type (consumable tool)	6 nos.	GENERAL INSTALLATION		
56	Valve seat cutting tools complete with guides and pilot bar(all angles) in a box	1 set	82	Petrol engine (4 strokes, Multi Cylinder) of different makes in running condition. (3nos. with MPFI System &1 Nos. with Carburettor)	4 nos.
57	Cylinder bore gauge capacity 50 to 150 mm	1 no.	83	Petrol engine (2 stroke) of different makes in running condition	2 nos.
58	Fuel feed pump	1 no.	84	Diesel engine (4 stroke, Multi Cylinder) of different makes in running condition	4 nos.
50	Bearing puller screw powered/hydraulic with attachments Max spread 80, 200 and 300 mm	1 each	85	Cut model of 4 stroke petrol engine on stand	1 no.
60	Hammer Copper 1 kg with handle	1 no.	86	Cut model of 2 stroke petrol engine on stand	1 no
61	Surface Plate 60 x 60 cm	1 no.	87	Cut model of 4 stroke diesel engine on stand	1 no.
62	'V' Block 75 x 38 mm pair with Clamps	2 nos.	88	Drilling machine bench to drill up to 12 mm dia	1 no.
63	Spanner off set double ended set of 7 pieces.(6 mm -17 mm)	1 set	89	Electric pedestal grinder with two 18 cm wheel	1 no.
64	Valve key inserter	1 no.	90	Nipple forming tool to form nipple on high pressure pipe lines 6.8 and 10 mm dia	1no.
65	Compression testing gauge to read 0 to 115 kg/sq cm	1 no.	91	Portable electric drill 6 mm	1 No.
66	Vacuum gauge to read 0 to 760 mm of Hg.	1 no.	92	Spark plug cleaner and tester similar to Bosch / champion	1 no.
67	Piston Ring compressor & Ring Expander	Each 1	93	Battery charger 6v- 18 v	1 no
68	Tachometer - to read upto 5000 rpm		94	Injector testing set (hand operated)	1 no.
69	Triple leg grip puller with bearings attachment screw/hydraulic powered max. spread 80, 160, 250, 450 mm	1 no.	95	Injector dismantling jig with mounting bench	1 no.
70	Pliers water pump multifix 250 mm Long	1 no.	96	Engine cranker with 12V and 24 V Ac to DC Power supply system	1 No.

NOTE : All the tools and equipment etc should be Latest available in the Market

Workshop furniture		Qty
1	Suitable Work Tables with vices	As required
2	Stools	17 Nos
3	Discussion Table	1 No
4	Tool Cabinet	2 Nos
5	Trainees locker	2 Nos
6	Fire fighting equipment, first aid box etc	As required
7	Book shelf (glass panel)	1 No.
8	Storage Rack	As required
9	Storage shelf	As required

Module-2: BASICS OF TRANSMISSION, SUSPENSION , STEERING SYSTEMS & BRAKES COURSE CONTENT	
Practical	Theory
Safety precautions in handling asbestos. Dismantling a clutch assembly from the engine, clean and inspect parts for wear and damage. Changing pressure plate and flywheel. Testing the of clutch springs for uniform tension, assembling of pressure plate and spring, adjusting the fingers and aligning clutch with flywheel.	Description of single plate and multi-plate clutches functions of different parts of the clutch assembly. Material for linings.
Cleaning, assembling gearshift mechanism, changing oil in the gearbox. Studying different types of oil seals and bearings used in the gearboxes.	Purpose of the gearbox, different types of power flow layouts (Front wheel drive, Rear wheel drive etc), gear ratios and function of a sliding mesh gearbox and its draw backs. Lubrication system in a gearbox. Description and advantage of (1) constant mesh gearbox, (2) synchromesh gearbox. Function of the gear shifter rod. Type of lubricating oil used in gearboxes.
Studying the gear ratios in the gearbox. Removing, cleaning and refitting ‘U’ joints, propeller shaft drive. Dismantling of an old final rear axle assembly, clean and inspect parts, cut packing and gaskets. Remove crown wheel, pinion and bearings, clean parts. Check tooth contact in the crown and pinion and adjust backlash. Assemble rear axle assembly and study its functioning.	Working of propeller shaft, ‘U’ joints and a rear axle. Description and function of final drive (differential). Tooth contact and backlash adjustment in rear axle assembly.
Removing and refitting a leaf spring as an assembly in a vehicle, changing rubber bushes of shock absorbers and independent front suspension. Lubrication of suspension units.	General description of conventional suspension system, Leaf spring & shock absorber, Wheels, tyres and tube sizes, applications, care & maintenance
Removing and refitting steering boxes from vehicle, checking and topping up oil in steering box. Checking and adjusting steering wheel play and backlash.	Types and functions of steering gear boxes. Layout of steering assembly and linkages, function of each part. Lubrication of linkages and steering gear box.
Checking and correcting the steering geometry with instruments,	Steering geometry: Ackerman steering, castor, camber, king pin inclination, toe, toe-out on turns, description and purpose, common steering troubles and remedy.
Identification of Pneumatic valves, Components, parts of Air compressor and to draw the symbols. Construction of circuits using single acting cylinder, Double acting cylinder and direction control valve. Construction of circuits for pneumatic power press, pneumatic hammer	Introduction to Pneumatics, Pneumatic Symbols, block diagrams, Compressed Air Theory, Production, Purification and Distribution Construction and applications of directional control valve, pressure control valve and flow control valve with accessories

using double acting cylinder, directional control valve and flow control valve.	
Dismantling and assembling of 4 / 3 way directional control valve Dismantling and assembling of flow control valve Dismantling and assembling of Single acting, Double acting and double acting double rod cylinders Dismantling and Assembling of Pressure Control valve Tracing and drawing the hydraulic circuits for the following machines Hydraulic Power hack saw machine	Direction control valves – types, construction and functions Pressure Control valves - types, construction and functions Flow control valves- types, construction and functions Construction of circuits using single acting cylinders, double acting cylinders with direction control valves and flow control valve on the trainer kit
Checking and adjusting hand brakes and pedal play in foot brakes. Dismantling wheel brake assembly– removing old lining and fitting new lining on the brake shoe.	Types of braking systems. Layout of Mechanical & hydraulic brake systems. Description and advantages of vacuum assisted hydraulic brakes. Master Cylinders – types including the tandem master cylinder, special features ,Construction , functions , common troubles and remedy. Drum brakes and disc brakes
Removing & cleaning of brake drums. Fittings new cups and brake hose pipes – re-assembling. Adjusting all four wheel brakes and testing for brake concern.	Brake linings –types and materials. Relining the brake shoes – precautions to be observed.
Bleeding of vacuum assisted hydraulic brakes – Removing and refitting of vacuum boosters – repairing of pipelines – adjusting the brakes in vacuum assisted hydraulic brakes. Locating air leaks in the brake lines and rectification	Layout of air brake system – Major components in the system, description and purpose of each part, their care and maintenance. Troubles in Air brake assembly and their remedy. Brake testing – efficiency of brakes Introduction to anti-lock braking system (ABS).

TOOLS, MACHINERY, EQUIPMENTS etc. for a batch of 16 trainees

SI No	Item	Qty	SI No	Item	Qty
01	Hammer ball peen 0.75 kg.	17 Nos.	24	Box spanner set with 'I' handle speed wrench, ratchet handle, extension rods complete in a box metric /UNF/BSF/BSW.	1 Set Each
02	Steel rule 15 cm, English and metric	17 Nos.	25	Bearing puller armed type	1 No.
03	Screw driver 20 cm X 9 mm, Blade (Plastic handle)	17 Nos.	26	Universal wheel puller	1 No.

04	Screw driver 30 cm X 9 mm, Blade	17 Nos.	27	Copper drift 10 mm. & 15 mm. Dia.	1 Each
05	Spanner D.E. set of 6 mm. To 32 mm. Set of 12	17 Nos.	28	Hollow punches set of 5	1 Set
06	Pliers combination 15 cm.	17 Nos.	29	Oil gun with flexible pipe	1 No.
07	Hand file 20 cm. Second cut	17 Nos.	30	Oil can 0.5 litre capacity	1 No.
08	Centre punch 10 mm x 100 mm	17 Nos.	31	Circlip pliers expanding and contracting type	1 Each
09	Chisel cold flat 20 cm	17 Nos.	32	Spring balance (0.25 kg.)	1 No.
10	Ring spanner set of 12 (6 to 32 mm)	17 Nos.	33	Torque wrench set of 3 Nos.	1 set
11	Feeler gauge 20 blade	17 Nos.	34	Grease gun hand operated	1 No.
12	Steel tool box with lock and keys	17 Nos.	35	Surface gauge with dial test Indicator to read 0.01 mm With magnetic base	1 No.
13	Allen Key set of 12 pieces (2 mm to 14 mm)	04 Sets	36	Hand operated grease gun (high pressure)	1 No.
14	Philips Screw Driver Type set of 5 pieces 100 mm to 300 mm	04 Sets	37	Puncture repair kit (hot patch kit)	1 No.
MEASURING INSTRUMENTS AND GENERAL SHOP TOOLS			38	Tyre lever (in pairs) 50 cm. Dunlop type	2 Nos.
15	Multi-plate Clutch assembly with flywheel	2 Nos.	39	Tyre Pressure gauge to read up to 30 kg. (Pencil type)	2 Nos.
16	Single plate Clutch assembly	2 Nos.	40	Tyre pressure gauge (wall)	1 No.
17	Propeller shaft with universal joints assembly	2 Nos.	41	Hot patch clamp	2 Nos.
18	Cut-Section model of a sliding mesh gear box	1 No.	42	Plastic mug and bucket	2 Nos.
19	Cut-Section model of a synchromesh gear box	1 No.	43	Wheel spanner (universal) boss type	2 Nos.
20	Cut-Section model of differential assembly	1 No.	44	Steering wheel puller	1 No.
21	Rear axle assembly complete with drive shafts and brake drums (full floating, semi floating type and ¼ floating)	1 Each	45	Spring balance	1 No.
22	Micrometer outside 0-25 mm, 25-50 mm, 50-75 mm, 75-100 mm	1 Each	46	Drop arm puller	1 No.
23	Drain plug spanner	1 No.	47	Adjustable spanner 15 cm. long maxim. opening 25 cm.	1 No.
44	Puncture repair equipment and Vulcanising unit 230 V, 50 W	1 No.	60	Conventional front axle assembly and I.S.F. wheel	1 No.

	electrical/ steam			assembly	
45	Pullers screw powered two arm grip with bearing puller attachment maximum	1 No.	61	Horses props	4 Nos.
46	Triple leg grip puller with bearing attachment hydraulic powered maximum spread 80mm., 160 mm., 250 mm. & 450mm.	1 No. each	62	Shock absorbers	
47	Inspection lamp with wire guard and insulated handle and 3 core flux wire 7 mm x 35 mm	1 No. each	63	Motor vehicle in running condition	1 No.
48	Vice grip pliers	4 Nos.	64	Chassis of heavy commercial motor vehicle, with all accessories in working condition	1 No.
49	Tray for clearing 45 x 30 cm	2 Nos.	65	Pneumatic operated wrench with all accessories	1
50	Bench vices	8 Nos.	66	Air Compressor-stationary, compression load 8 bar, Suction Capacity 200 liters/min, reservoir 200 liters	1 sets.
51	Coil spring compressor for suspension spring	1 No.	67	Brake spring pliers	1 No.
GENERAL INSTALLATION			68	Brake pipe flaring tool	1 No.
52	Chain sling alloy steel double leg 10 mm Having 3 meter long each pair link and 2 slip hooks	1 No.	69	Vacuum assisted hydraulic brake assembly	1 No.
53	Tripod axle stand adjustable 1500 kg Capacity	8 Nos.	70	Air brake assembly	1 No.
54	Portable crane hydraulically operated with swiveling & self alignment hook lifting capacity 1 ton.	1 No.	71	Brake lining riveting machine (foot operated)	1 No.
55	Arbor press 2 tones capacity	1 No.			
56	Leaf springs	4 Nos.	72	Hydraulic brake assembly. (Brake pedal, booster, Tandem master cylinder, wheel cylinder, brake drum – mock up assembly)	
			73	Models/ wall charts of braking system (Hydraulic & Pneumatics)	1 Each
57	Hydraulic jack- high (trolley type) 2000 kg. Capacity	2 Nos.			
58	Lifting jack screw type 1000/1500 kg.	1 No.			
59	Hydraulic jack 5 ton	1 No.			

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1	Suitable Work Tables with vices	As required
2	Stools	17 Nos
3	Discussion Table	1 No
4	Tool Cabinet	2 Nos
5	Trainees locker	2 Nos
6	Fire fighting equipment, first aid box etc	As required
7	Book shelf (glass panel)	1 No.
8	Storage Rack	As required
9	Storage shelf	As required