

**MAHARASHTRA STATE BOARD OF VOCATIONAL EDUCATION EXAMINATION, MUMBAI**

1	Name of Course	<b>Certificate Course in Motor Vehicle Body Builder</b>				
2	Max no. of Students	25	<b>Course Code - 306208</b>			
3	Duration	1 year				
4	Course Type	Full Time				
5	No. of Days per week	6 days				
6	No. of hours per day	7 Hrs ( 3 Hrs Theory and 4 Hrs Practical )				
7	Space require	Theory Class Room – 200 sqft   Practical Lab – 1000 sqft Total – 1200 Sqft				
8	Entry qualification	S.S.C. Pass				
9	Objective of syllabus	To understand basic of sheet metal works, To understand body building of motor vehicle, To perform all types of work of motor vehicle body building				
10	Employment opportunities	work as body repairer and body maker in automobile workshop, service station, garage.				
11	Teachers Qualification	Diploma in Mechanical engg, Diploma in Automobile engg. or Equivalent and 2 yr Experience.				
12] Teaching Scheme – Training System Per Week						
		Theory	Practical	Total		
		18 Hrs	24 Hrs	42 Hrs		
13] Examination Scheme –						
Sr	Paper Code	Name of Subject	Theory/ Practical	Hours	Max Marks	Min Marks
1	30620811	Sheet Metal work	Theory - I	3 Hrs	100	35
2	30620812	Motor Vehicle body Building	Theory – II	3 Hrs	100	35
3	30620813	Workshop Calculation, Science and Drawing	Theory – III	3 Hrs	100	35
4	30620821	Sheet Metal work	Practical – I	3 Hrs	100	50
5	30620822	Motor Vehicle body Building	Practical – II	3 Hrs	100	50
6	30620823	Workshop Calculation, Science and Drawing	Practical - III	3 Hrs	100	50
				Total	<b>600</b>	<b>255</b>

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**Theory - I & Practical - I - Sheet Metal Work**

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1. 1. Safety precautions to be observed in the shop floor.
1. 2. Use of common hand tools used in the shop floor such as hammer, Chisel, Hacksaw, steel rule, dividers, Callipers, Punches, shears, blow lamp, protractor, vernier, centre punch, scribe, D.E spanner, ring spanner, torque wrench for U clamping, screw driver, bench vice, Grinding machine and box spanner -special types of fabrication spanners to suit the assembly conditions.
2. 3. Marking out as per Engineering Drawing.
3. 4. Simple fitting operation such as Chipping, Hacksawing, Filing, Drilling. Thread forming (tap and Die)
4. 5. Marking on sheets metal, shearing, Bending Notching, Punching for pillars, waist rail etc, Explain the body structure parts and materials
5. 6. Handling of different types of grinding machines such as modified Angular. Automatic and Flexible.
6. 7. Lighting and maintenance of forge by manual and power.
7. 8. Simple forging operation such as hammering square. Round. Flat. Hexagon, octagon, tempered sections and jumping.
8. 9. Hand forging operations such as cold and hot bending. Spreading, upsetting, drawing, shouldering, punching, drifting, forge welding and shrinking.
9. 10. Grinding of forged articles and hand tools.
10. 11. Simple heat treatment operations such as hardening, tempering, normalising, annealing, casehardening, Recambring process of leaf springs and pre – treatment of phosphating (in cold and hot process) Galvanising and sheradizing process.
11. 12. Riveting and riveted joints (hot and cold) practice on riveting by using pop rivet. Alluvium (solid) copper rivet MS rivet, tuber rivet and bifurcated rivet and its use

**TYPES OF RIVET GUNS.**

- 1 For Solid Rivet..
2. For pop rivet
  - (a) Manual type
  - (b) Pneumatic type

13. Simple welding (Gas &Electronic) includes brazing. Use of 'spot welding equipment in sheet metal.' Practice on gas cutting.

Tig and Mig welding.

Practice on arc welding types such as:-

- 1) 1) vertical downward 2)Vertical upward 3) horizontal welding positions and cutting practice
- Types of Electrodes, checking of good quality electrodes, cutting rods and metal sprays.
14. Marking out as per drawing and cutting off sheet metal by using hand liver shears and nibbling shears.
  15. Marking out and making sheet metal standard joints using standard tools.
  16. Soldering, Tinning and Brazing and simple sheet metal operations such as Bending. Rolling, shaping, flanging, edging, hollowing, reinforcement of sheet metal components.
  17. Allied forming and cutting operations such as folding flaring and tripaning.
  18. Annealing of copper, cutting, bending and soldering of copper tubes.
  19. Use of ferrous and non-ferrous sheet metal in making simple articles.
  20. Use of hand operated machines such as guillotine shearing machine. Grooving M/C, Folding M/C, Turning M/C, Wiring M/C, Beading M/C, Circle cutting M/C, Pillar type drilling M/C, Fly press Nibbling M/c, Flat cutting M/c with channels and angles and practice in bending square-tube and hat sections For roof stick and side pillar manually and pneumatioally.

Note 1. Tools and equipment required for basic training first year training will be the same as given in I.T.I syllabus of welder and sheet metal trade.

2. Introduction of F.R.P materials and method of fabricating of components and its salient feature.

## **Theory - II & Practical - II -Motor Vehicle body building**

1. 1. Instructions in safety precautions on the shop floor.
2. 2. Practice in use of machines utilised in Motor Vehicle Body Building work such as Power Hacksaw, Folding , Shearing, Punching , Notching, Pipe bending , Nibbling . Square tube bending . Power press. Press brakes and different types of Drilling machines.
3. 3. Cutting and shearing runner angles. Flats and channels to required dimensions.
4. 4. Straightening runner angles, flats and channels both by hand and by machine.
5. 5. Making components and sub-assembly mounted on chassis.
6. 6. Bending body angles , mudguard angle and wheel arch angle or tube
7. 7. Assembly and body angles and front and rear structure on main frame and welding.
8. 8. Cutting and providing gussets on joints and corners and reinforcing weak areas.
9. 9. Making and fitting sub-assemblies like foot steps, battery box. Luggage carrier, brackets, ladder, diesel tank brackets. Front and rear structure , bonnet structure and dash board structure.
10. 10. Marking and drilling angles, flats, channel and pipes at various stages.
11. 11. Marking Jigs and fixture for items like:-
  - a.) Handles b) Passengers seat frames c) Centre posts d) front and rear structure for different types of bodies e) Ladder f) wheel arch g) Body arch angle h) Body side kit j) assemble fixture k) Floor Assembly fixture
12. 12. Pipe bending of seat frames, various handles, portions, ladder frame and window frames.
13. 13. Balancing entire body structure. Method of mounting the body on chassis with suitability of chassis numbers. (Before taking body construction ) Method of checking alignment for the body structure with the help of lead screw jack levelling of chassis use of hoist
14. 14. Making fixing and aligning driver door, emergency door and other doors with hinges.
15. 15. Making and fixing drivers cabin frame and partition.
16. 16. Marking and cutting sheets to dimensions.
17. 17. Forming doom shapes at corners.
18. 18. Marking and cutting templates
19. 19. Cutting, Pressing, Bending and Forming panels for right/left side, rear , front and roof panels and bumper.
20. 20. Bending door frames and panelling.
21. 21. Forming of glass frames, front cowl, grillwork, route board frames. Inner mudguard and hanging mudguards.
22. 22. Fixing ornamental and ordinary beading and aluminium extrusions.
23. 23. Manufacturing of different components such as curtain box frames. Looking arrangements, driver door, wheel arch boxes battery box, route board, roof panel, bonnet , front grill, took boxes, first aid boxes. And steps etc..
24. 24. Panelling sheets on wooden structure or Tube structure.
25. 25. Final figments of seat, hand nests glasses, fan water carrier, brackets and other accessories as per Motor Vehicle Act. Stage inspection and final inspection and Roof leakage testing.
26. 26. Grinding of tool including drill bits
27. 27. Gas cutting of sheets
28. 28. Use of power operated machines such as pneumatic drilling riveting and tightening and power hammer
29. 29. Use of press tools
30. 30. Setting machines for production work. Roof leak test
31. 31. Spray painting (Metallic, Enamel , Wrinkle, Hammer tone finish Red Oxide and Etch Primer )

Note The operation/skill marked are desirable. This may be carried out where facilities are available in the Establishment

### Theory –III & Practical - III - Workshop Calculation, Science and Drawing

	W/S CAL. & SCIENCE
1.	Simple arithmetic addition, subtraction , Multiplication, Division of whole and partial number. Properties of metals and their importance in trade
2.	Fraction & decimals , conversion of fraction to decimals and vice versa/
3.	Properties of C.I. & its types, uses. properties of Non –ferrous metals and how its identifications.
4.	Properties of copper, Zinc , mild steel , aluminum etc.
5.	Properties of Brass steel , bearing metals, timber etc.
6.	Decimals, Division, multiplication
7.	Logarithm and how to find out mantisa & characteristics.
8.	Properties of C.I steel
9.	Work , power , energy
10.	Motion, velocity and problems.
11.	Volume, mass, density applied problems.
12.	Properties of metal and their applications
13.	Square roots, power conversion of decimal to British & vice versa
14.	Square roots, power conversion of decimal to British and Vice versa
15.	Multiplication power root of a number
16.	Problems on work , power & energy
17.	Ratio & percentages and problems
18.	Meaning to stress, strain, energy , elasticity
19.	Meaning of stress, strain, energy , elasticity
20.	Stress and its important factors example.
21.	Ration and proportions, ratio, fining forms and ratio proportions direct and indirect proportions
22.	Application of ratio and proportion to shop problems
23.	Mixed direct and indirect proportion problems
24.	Machines – basic principles , velocity ratio. mechanical advantages , efficient simple problems.
25.	Algebraic symbols & fundamental algebraic operations signs & symbols used in algebra, co-efficient , terms like terms and unlike terms
26.	Addition and subtraction , multiplication and division
27.	Logarithm and antilogarithms . Problems on logarithms
28.	Simple machines like winch pulley & compound axel etc. with examples.
29.	Factors and equation of algebric formula.
30.	Factors and equations-types of factorisations.
31.	Heat treatment of steel-hardening, appealing, tempering, normalizing, case hardening-standard and measurements-equations-simple simultaneous quadratic.
32.	Application construction and solution of problem by equations.
33.	Atmospheric pressure. pressuregauge gauge pressure & absolute pressure.
34.	Power & exponent & laws of exponent.
35.	Arithmetical operations involving logarithms in the computations.
36.	Problems related to trade using logarithm tables.
37.	Density of solid and liquids simple experiments and determination.
38.	Specific gravity principle of Archemedies.
39.	Relation between specific gravity and density. Simple experimental determination.
40.	Geometry- Fund-mental geometrical definitions angles and properties of angles, triangles and properties of triangles.
41.	Pythagoras theorem, properties of similar triangles.
42.	Revision of !st year topics.
43.	Revision of 1 <sup>st</sup> year topics.

44.	Rectangle, square, rhombus, parallelograms etc. and their properties.
45.	Circle and properties of circles Regular polygon.
46.	application of geometry to shop problem
47.	Heat & temp. thermometric scales their conversions.
48.	Temp. measuring instruments.
49.	quantity of specific heat of solids liquids & gases.
50.	Heat loss and heat gain with simple problem
51.	Mensurations, plain figures-triangles, square rectangles, parallelogram.
52.	Plain figures-trapezium, regular polygons, circle, hollow circles.
53.	Plain figures segment and sector of circle, ellipse fillets.
54.	Solid figures- prism, cylinder, pyramid, cone.
55.	Solid figures-frustum of cones sphere, spherical segment.
56.	Material weight and cost problems related to trade.
57.	Trigonometry, Trigonometrical ratios use of trigono table.
58.	Finding height and distance trigonometrically
59.	Area of triangle by trigonometry.
60.	Application of trigonometry to shop problems.
61.	Application of trigonometry to shop problems.
62.	Triangle of forces. Parallelogram of forces.
63.	Composition and resolution of forces.
64.	Representation of forces by vectors. Simple problem on lifting tackles like jib cranes, wall crane and solution of problem with the aid of vectors.
65.	Simple problems on strength and crank lever.
66.	Center of gravity-simple experimental determination stable-unstable and neutral equilibrium simple explanation.
67.	Friction-co-efficient of friction.
68.	Simple problem related to friction.
69.	Magnetic substances neutral and artificial magnets.
70.	Bausch principle of electricity. Method of magnetization & uses of magnets,.
71.	Basic principle of electricity.
72.	Use of fuses, conductors switches, insulator etc.
73.	Simple electric circuits. Simple calculations.
74.	Ohm's law-simple calculations-electrical insulation materials.
75.	Graphs-Abscissa & ordinates, graphs of straight line, related to 2 sets of varying quantities.
76.	Further practice on logarithm.
77.	Shop problems on estimation of material, time taken for machining a job elementary time and motion study.
78.	Shop problems on estimation of material, time taken for machining a job, elementary time and energy.
79.	Transmission of power by belt pulley and gear drive.

	<b>ENGINEERING DRAWING</b>
1.	Reading of simple drawing , Engineering drawing & its importance and instruments used in drawing
2.	i) Making of Title blocks as per IS 465 1988 ii) Various sizes of drawing sheets iii) Various types of pencils & sharpening methods. iv) Types of lines & their application as Per SP 46: 1988
3.	use of drawing tools simple geometrical construction
4.	Geometrical construction regular polygons circles

5.	Geometrical construction of polygon inscribed circles
6.	Curves and types of curves & their application and method of drawing curves
7.	Geometrical construction, cycloid, hyperbola parabola curves, ellipse.
8.	Free hand sketch of lines, polygons, ellipse etc.
9.	Free hand sketch of basic tools and simple geometrical const. cone, pyramid, frustum / prism etc. / sphere
10.	Construction of scale diagram, division of odd parts of scale with drawing instruments by sketch
11.	Letters and its types and drawing of letters
12.	Methods of ellipse. How to draw by drawing the instruments.
13.	Simple dimensions with techniques and location of parts as per dimensions, angle, taper
14.	Transforming of various measurement, linear, Angular, Circular etc.
15.	Pictorial drawing Isometric drawings of simple block
16.	Oblique views of simple geometrical construction
17.	Isometric drawing on simple blocks
18.	Isometric drawing on completed jobs
19.	Free hand sketches of trade related hand tools cutting tools, measuring tools
20.	Free hand sketches of trades related hand tools m measuring tools
21.	orthographic drawing application of both first angle and third angle methods in representing the drawing for simple & complex machine blocks given for exercise with dimensions
22.	Orthographic drawings application of both first angle and third angle. Methods in representing the drawing for simple and complex machine blocks given for exercises with dimensions
23.	Standard method of sectioning as per IS-696. Exercises for different sectional views on the given orthographic drawing of machine parts, castings etc.
24.	Standard method of sectioning as per IS 696. Exercise for different sectional views on the given orthographic drawing of machine parts, casting etc.
25.	Inter conversion of Isometric to orthographic drawings and vice-versa. Related problems such as V blocks-simple stepped blocks, block oriented by various machining operations etc.
26.	Interconversion of isometric, oblique drawings to orthographic drawings and vice-versa. Related problems such as V-blocks simple stepped blocks, block oriented by various machining operations etc.
27.	Free hand sketch of sectional tools.
28.	Interconversion of isometric, oblique drawing to orthographic drawings and vice-versa. Related problems such as V block simple stepped blocks, blocks oriented by various machining operations.
29.	Surface development of simple geometrical solids like cube, rectangular block, cone, pyramid, cylinder, prism etc.
30.	Interpenetrating of solids and conventional application of intersectional curves on drawings.
31.	Screw thread their standard forms as per I.S. external and internal thread conventions on the feature for drawings as per I.S.I.
32.	Sketches for bolts nuts screw and other screw screwed members
33.	Standard rivet forms as per ISI
34.	Riveted joints.
35.	Riveted joints butt
36.	Sketches of keys, cutter & pin joint.
37.	Sketches of keys, cotter and pin joints.
38.	Sketches for simple pipe unions with simple pipe line drawings.
39.	Concept of preparation of assembly drawing and detailing simple assembly and their details of trade related tools/jobs/exercises with dimensions from the given sample or model. Tool post for the lathe with screw and washer.

40.	Concept of preparation of assembly drawing and dove tailing. Simple assemblies and their details of trade related tools /jobs the exercises with dimensions from the given sample or models. Tool post for the lathe with washer and screw.
41.	Details and assembly of Vee block with clamps.
42.	Detail assembly of shaft and pulleys
43.	Details and assembly of vee blocks with clamps.
44.	Details and assembly of bush bearing.
45.	Types of curves. How to draw.
46.	Details and assembly of simple coupling.
47.	Details and assembly of a simple hand vice.
48.	Blue print reading simple exercises related to missing lines.
49.	Blue print reading simple exercises related to missing views.
50.	Simple exercises related to missing symbols.
51.	Simple exercises related to missing sections.
52.	Simple exercises to missing dimensions.
53.	Hand drawing for in-dictating switches, buttons control m/c. tool axis's quadrant point value.

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