CONSTRUCTION MATERIALS AND CONSTRUCTION TECHNOLOGY

Total: 198 hours
Theory: 72 hours
Practical: 126 hours

Course Description:
This course consists of two parts. The first part intends to provide basic knowledge on various construction materials. It includes sources, quality and selection of various construction materials like stones, bricks, aggregates, lime, cement, steel, glass, plastic etc. In addition, this course also helps the students in acquainting knowledge on the locally available construction materials so that apprentices can apply the concept of low-cost construction technique, especially in rural area.
Similarly, the second part of this course is designed to provide knowledge and skills on foundation of civil engineering works in building construction. This course emphasizes on basic concept and techniques of masonry work, concreting work, bar-bending work, and joining work of wood. Moreover, Sector wise occupational safety and health component is also included here.

Course Objectives:
After completion of this course, apprentice will be able to:

1. Enlist various construction materials used and available in Nepal;
2. Describe significance and uses of various construction materials;
3. Prepare various types of mortars;
4. Enforce occupational safety and health provisions in construction work;
5. Perform laboratory testing of various material;
6. Apply concrete batching, mixing, transportation and pouring techniques;
7. Construct stone, brick and hollow block masonry walls;
8. Apply timber measuring, marking and wooden joinery construction techniques; and
9. Perform bar-bending, bar-binding and for beams, columns, slabs and various RCC bands with stirrups considering development length.

Section A: Institute Based Training (15 Academic Weeks)
Part 1: Construction Materials
Module I: Construction Materials

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
1.	Identify various construction materials used in Nepal (traditional & modern construction materials)	**Construction materials:** ▪ Mud ▪ Stones ▪ Aggregate; Sand and Gravel ▪ Cement ▪ Water ▪ Lime ▪ Plastic ▪ Glass ▪ Asbestos Sheet ▪ Fiberglass/sheet ▪ Blocks	3	2	5

		▪ Bricks ▪ Steel ▪ Rebar ▪ Aluminium ▪ Timber ▪ Plywood ▪ Artificial wood ▪ Bamboo and cane ▪ Roofing materials (***Khar***, Straw, Slate, ***Khapada***, Tiles, Corrugated Galvanized Iron CGI sheet) ▪ Partition blocks/boards			
2.	Describe stone as construction material.	**Stones:** ▪ Introduction ▪ Source; River boulders, Stone Quarry ▪ Characteristics of good building stones ▪ Selection and use of stones for various construction according to shape ▪ Dressing, seasoning and stacking (Extraction and preparation for use)	2		2
3.	Describe aggregates as construction material.	**Aggregates:** ▪ Introduction ▪ Uses ▪ Classification; according to nature of formation, size, shape and texture ▪ Gradation of aggregate	2		2
4.	Describe bricks as construction material.	**Bricks:** ▪ Introduction ▪ Composition ▪ Manufacturing; Soil/mortar preparation, Molding, Drying, Burning ▪ Brick types and their uses ▪ Machine made and locally made bricks and their sizes	2		2
5.	Describe tiles as construction material.	**Tiles:** ▪ Introduction ▪ Soil preparation, Molding, Drying, Burning of tiles ▪ Types of tiles	1		1
6.	Describe Hollow block as a construction material.	**Hollow blocks:** ▪ Introduction ▪ Composition	1		1

		▪ Forms and sizes ▪ Types; Concrete, Clay ▪ Test (Concept only)			
7.	Describe lime as a construction material.	**Lime:** ▪ Introduction ▪ Types ▪ Uses ▪ Manufacturing process ▪ Setting time of lime ▪ Storage	2		2
8.	Describe cement as construction material.	**Cement:** ▪ Introduction ▪ Composition ▪ Manufacturing process ▪ Types ▪ Properties ▪ Setting time of cement ▪ Compressive strength, tensile strength and consistency ▪ Storage	2		2
9.	Describe asbestos as a construction material	**Asbestos:** ▪ Introduction ▪ Types of asbestos ▪ Properties ▪ Health hazards	1		1
10.	Describe glass as a construction material	**Glass:** ▪ Introduction ▪ Composition ▪ Classification ▪ Commercial forms	1		1
11.	Describe tar/bitumen/asphalt as construction materials.	**Tar/Bitumen/Asphalts:** ▪ Introduction ▪ Types ▪ Uses	0.5		0.5
12.	Describe paints/varnishes.	**Paints/Varnishes:** ▪ Definition ▪ Functions ▪ Classification and uses ▪ Composition ▪ Characteristics of good paints/varnishes	1.5		1.5
13.	Describe CGI sheet as a construction material.	**CGI sheet** ▪ Introduction ▪ CGI sheets ▪ Gauge of CGI sheet	1		1
14.	Describe reinforcing steel (Rebar) as construction materials	**Reinforcing steels:** ▪ Introduction ▪ Types	1		1

		▪ Properties ▪ Uses ▪ Commonly available reinforcement bar			
15.	Describe bamboo/cane.	**Bamboo/Cane:** ▪ Introduction ▪ Types ▪ Uses ▪ Common types used in constructional purposes	1		1
16.	Describe aluminium as a construction material	**Aluminium:** ▪ Introduction ▪ Types ▪ Uses	1		1
17.	Describe timber as a construction material.	**Timber:** ▪ Introduction ▪ Structure [cross section] of a tree ▪ Felling of trees ▪ Objective and methods of seasoning ▪ Timber defects and decaying ▪ Plywood and block board	2		2
	Sub-total I		**25**	**2**	**27**

Part II: Construction Technology

Module II: Occupational Safety and Health

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
1.	Use personal protective equipment (PPE).	**Personal protective equipment (PPE):** ▪ Introduction ▪ General provisions ▪ Types • Safety helmet • Clear or colored goggles • Protective gloves or gauntlets • Foot wares an appropriate type • Respiratory protective equipment • Safety harnesses • Life vests • Life preservers	1	1	2

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
		• Reflective devices ▪ Methods of using PPEs			
2.	Apply workplace safety measures.	**Workplace safety measures:** ▪ Introduction ▪ General provisions ▪ Fire prevention and firefighting ▪ Lighting ▪ Signaling ▪ Work at heights ▪ Work over water ▪ Prevention against falls of materials, persons and collapse of structures ▪ Housekeeping ▪ Prevention of unauthorized entry ▪ Safety sins and notices	1		1
3.	Apply tools/equipment safety measures.	**Tools and equipment safety measures:** ▪ Introduction ▪ General provision ▪ Hand tools ▪ Equipment ▪ Construction machines	1		1
4.	Enforce electrical safety measures.	**Electrical safety measures:** ▪ Introduction ▪ General provision ▪ Regular inspection and maintenance ▪ Testing of electrical installations, machines, equipment, devices, apparatus and earth leakage	1		1
5.	Apply health hazards safety measures.	**Health hazards safety measures:** ▪ Introduction ▪ General provision ▪ Hazardous substances ▪ Dangerous atmosphere ▪ Radiation hazards ▪ Heat stress, cold and wet conditions ▪ Noise and vibration ▪ Biological agents	1		1
6.	Apply simple first aid treatment.	**First aid treatment:** ▪ Introduction	1.5	2	3.5

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
		▪ General provision ▪ Importance ▪ First aid for: • Bleeding • Burns • Fractures • Sprains • Nose bleeds • Fort bite • Bee stings • Snake bite • Drowning • Cardiac arrest ▪ First aid kit includes • Bandages, roller bandages and tape • Sterile gauze • Antiseptic wipes and swabs • Absorbent compresses • Antibiotic cream • Burn ointment • Mask for breathing (rescue breathing/CPR) • Chemical cold pack • Eye shield and eyewash • First aid reference guide that includes local phone number ▪ First aid procedures			
7.	Ensure occupational health services.	**<u>Occupational health services:</u>** ▪ Introduction ▪ General provision ▪ Various health services	0.5		0.5
8.	Ensure welfare services.	**<u>Welfare services:</u>** ▪ Introduction ▪ General provision ▪ Drinking water ▪ Sanitary facilities ▪ Washing facilities ▪ Cloakroom ▪ Facilities for food and drinks ▪ Shelter ▪ Living accommodations	1		1

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
	Sub-total II		**8**	**3**	**11**

Module III: Mortars

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
1.	Prepare mud mortar.	**Mortar:** ▪ Definition ▪ Types **Mud mortar:** ▪ Importance ▪ Uses ▪ Essential ingredients ▪ Batching and mixing procedure ▪ Importance of occupation health and safety ▪ Uses of personal Protective Equipment (PPE)	1	1	2
2.	Prepare lime sand mortar.	**Lime sand Mortar:** ▪ Importance ▪ Uses ▪ Ingredients and their ratio ▪ Batching and mixing: • Water Cement Ratio; Preparation; Batching, Mixing, Transporting and Placing ▪ Batching and mixing procedure	1	1	2
3.	Prepare cements and mortar.	**Cement sand mortar:** ▪ Importance ▪ Uses ▪ Ingredients and their ratio ▪ Batching and mixing: • Water Cement Ratio; Preparation; batching, Mixing, Transporting and Placing ▪ Ratio of mortar for different works ▪ Curing processes ▪ Batching and mixing procedure	1	2	3
		Sub-total III	**3**	**4**	**7**

Module VI: Plain Cement Concrete

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
1.	Batch cements concrete ingredients.	**Cement Concrete:** ▪ Definition ▪ Types ▪ Ingredients and their ratio ▪ Grade of concrete (M15, M20, and M25) **Batching** ▪ Definition ▪ Importance ▪ Types ▪ Procedure	1	1	2
2.	Prepare cement concrete.	**Cement concrete preparing:** ▪ Types of mixing ▪ Advantages of machine mixing ▪ Workability and strength of concrete ▪ Procedure	0.5	1	1.5
4.	Place /compact concrete.	**Concrete placing:** ▪ Method of pouring concrete ▪ Concrete level marking (using pipe level) ▪ Methods of vibrations ▪ Types and use of vibrators	0.5	1	1.5
5.	Perform curing	**Curing:** ▪ Meaning and importance of curing ▪ Types of curing ▪ Duration of curing ▪ Effects of climate in curing	0.5	0.5	1.0
	Sub-total IV		**2.5**	**3.5**	**6**

Module V: Stone Masonry

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
1.	Identify stone masonry walls.	**Masonry:** ▪ Definition ▪ Types: Random Rubble, Rubble, Ashlar and Dry ▪ Application	1	1	2

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
2.	Dress the face/bond corner stone for rubble/ashlar masonry works.	**Dressing:** ▪ Definition ▪ Types of dressing: Chisel and hammer dressing ▪ Purpose of dressing works ▪ Requirement of good corner stone for random rubble/ ashlar masonry works ▪ Dressing procedure	0.5	4	4.5
3.	Identify different walls.	**Wall structure:** ▪ Introduction ▪ Types of wall; External wall, Internal wall, partition wall, Load bearing and non-load bearing wall, Retaining wall, Cavity wall, Boundary wall, Screen Wall	1	2	3
4.	Handle level pipe/spirit level/plumb bob/mason thread.	**Tools and equipment handling:** ▪ Importance and use of level pipes, spirit levels and plumb bob and mason thread ▪ Handling procedures	0.5	1.5	2.0
5.	Build rubble/ashlar stone masonry footing with seismic bands.	**Stone Masonry:** ▪ Definition ▪ Types ▪ Importance ▪ Uses ▪ Use of Corner, Bond, Face and Filler stones ▪ Leveling the wall ▪ Joints and thickness ▪ Use of vertical reinforcement ▪ Use of corner stitches ▪ Procedure for stone laying down	1	3	4
6.	Build L shaped rubble/Ashlar stone masonry wall in cement/ lime/mud mortar with seismic bands.	**L shaped rubble/ashlar masonry:** ▪ Types of mortar ▪ Leveling the wall ▪ Joints and thickness ▪ Strength of mortar ▪ Use of vertical reinforcement ▪ Use of corner stitches ▪ Strength of mortar	1	3	4

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
		▪ Procedure for stone laying down			
7.	Build T shaped rubble/Ashlar stone masonry wall in cement/ lime/mud mortar with seismic bands.	**T shaped rubble/ashlar masonry:** ▪ Joints and thickness ▪ Bonding of stones ▪ Use of vertical reinforcement ▪ Use of Dowel bars and stirrups ▪ Use of corner stitches ▪ Strength of mortar ▪ Procedure for stone laying down	1	4	5
8.	Build cross shaped rubble/Ashlar stone masonry wall in cement/ lime/mud mortar with seismic bands.	**Cross shape rubble/ashlar masonry:** ▪ Joints and thickness ▪ Bonding of stones ▪ Use of vertical reinforcement ▪ Use of Dowel bars and stirrups ▪ Use of horizontal bands ▪ Strength of mortar ▪ Procedure for stone laying down	0.5	5	5.5
		Sub-total V	**6.5**	**23.5**	**30**

Module VI: Brick and Block Masonry

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
1.	Identify brick masonry walls.	**Brick Masonry:** ▪ Definition ▪ Types of brick bond • Stretcher • Header • English • Flemish ▪ Brick bonding rules ▪ Brick bonding requirements ▪ Joints ▪ Application	1	1	2
2.	Cut the brick bats/closers.	**Brick bats:** **Footing:** ▪ Definition	1	1	2

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
		▪ Importance **Seismic Bands:** ▪ Importance ▪ Function of ▪ Types: Foundation band, Sill, Lintel band, Plinth band, Roof band and Gable band			
3.	Construct brick masonry footing with seismic bands.	**<u>Brick masonry footing:</u>** ▪ Definition of terms: Half bat, 3/4 bat, beveled closer, king closer, queen closer, mitered closer and bull nose ▪ Use of bats and closers ▪ Methods of preparing Half bat, 3/4 bat, beveled closer, king closer, queen closer, mitered closer, bull nose ▪ Procedure for brick laying down	0.5	3.0	3.5
4.	Build L-shaped brick/concrete block wall using stretcher bond in cement/lime/mud mortar with seismic band.	**<u>L shaped brick/block masonry:</u>** ▪ Importance and use of level pipes, spirit levels and plumb bob and mason thread ▪ Method of discontinue the joints in stretcher bond ▪ Use of horizontal bands ▪ Use of 3,4,5 method to get L shape ▪ Method of discontinue the joints in corner joint in stretcher bond ▪ Use of corner band ▪ Procedure for brick/block laying down	0.5	3.0	3.5
5.	Build T shaped brick/block wall using stretcher bond in cement/lime/mud mortar with seismic band.	**<u>T shaped brick/block masonry:</u>** ▪ Use of 3,4,5 method to get T shape ▪ Method of discontinue the joints in T joint in stretcher bond ▪ Use of horizontal bands ▪ Alternative layers in T shaped stretcher bond ▪ Procedure for brick/block laying down	0.5	3.0	3.5

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
6.	Build Crossed brick/block wall using stretcher bond in cement/lime/mud mortar with seismic band.	**Cross shaped brick/block masonry:** ▪ Use of 3,4,5 method to get Cross shape ▪ Method of discontinue the joints in cross joint in stretcher bond ▪ Use of horizontal bands ▪ Importance of crossed wall ▪ Procedure for brick/block laying down	0.5	3.0	3.5
7.	Build L-shaped brick wall using English bond in cement/ lime/ mud mortar with seismic band.	**L shaped English bond brick masonry:** ▪ Use of 3,4,5 method to get L shape ▪ Use of Queen closer ▪ Method of discontinue the joints in English bond ▪ Use of corner band and vertical bars ▪ Procedure for brick laying down	0.5	3.0	3.5
8.	Build T shaped brick wall using English bond in cement/ lime/ mud mortar with seismic band.	**T shaped English bond brick masonry:** ▪ Use of 3,4,5 method to get T shape ▪ Use of horizontal bands ▪ Alternative layers in T shaped English bond ▪ Procedure for brick laying down	0.5	3.0	3.5
9.	Build crossed brick wall using English bond in cement/lime/mud mortar with seismic band.	**Cross shaped English bond brick masonry:** ▪ Use of 3,4,5 method to get cross shape ▪ Use of horizontal bands ▪ Importance of crossed Wall ▪ Use of horizontal and vertical bands ▪ Procedure for brick laying down	0.5	3.0	3.5
10.	Build an L shaped brick wall using Flemish bond in cement/ lime/ mud mortar with seismic band.	**L shaped Flemish bond brick masonry:** ▪ Use of 3,4,5 method to get L shape ▪ Use of Queen closer ▪ Method of discontinue the	0.5	3.0	3.5

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
		joints in Flemish bond ▪ Use of corner band and vertical bars ▪ Procedure for brick laying down			
11.	Build T shaped brick wall using Flemish bond in cement/ lime/ mud mortar with seismic band.	**T shaped Flemish bond brick masonry:** ▪ Use of 3,4,5 method to get T shape ▪ Use of horizontal bands ▪ Alternative layers in T shaped Flemish bond ▪ Procedure for brick laying down	0.5	3.0	3.5
12.	Build crossed brick wall using Flemish bond in cement/lime/mud mortar with seismic band.	**Cross shaped Flemish bond brick masonry:** ▪ Use of 3,4,5 method to get cross shape ▪ Use of horizontal bands ▪ Importance of crossed Wall ▪ Use of horizontal and vertical bands ▪ Procedure for brick laying down	0.5	3.0	3.5
	Sub Total		**7**	**32**	**39**
Total (Sub-total I+ Sub-total II+ Sub-total III+ Sub-total IV+ Sub-total V + Sub-total VI)			**52**	**68**	**120**

Section B: Institute Based Training One Day Per Week (78 Days/13 Academic Weeks)

Part 1: Construction Technology
Module I: Bar Bending (Reinforcement Bar)

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
1.	Identify commonly available reinforcements.	**Commonly available reinforcement:** ▪ Needs of Reinforcement in construction, ▪ Types of steel reinforcements ▪ Strength of different steel reinforcements ▪ Identification of different reinforcements	0.5	1	1.5
2.	Identify/enumerate/handle	**Tools and equipment used bar**	0.5	1	1.5

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
	tools and equipment.	**bending:** ▪ Identification and enumeration of different tools and equipment ▪ Uses of tools and equipment ▪ Tools and equipment handling technique ▪ Maintenance and record keeping of tools			
3.	Measure lengths of different steel bars /calculate weights.	**Length and weight measurement:** ▪ Different measurement units used in steel fixing ▪ System of measurements ▪ Standard weights and standards sizes of steel bars ▪ Recoding method of measurement of steel bar and their corresponding weights	0.5	0.5	1.0
4.	Make a steel working/bar bending bench.	**Bar bending bench:** ▪ Work bench, its components and their dimensions ▪ Characteristics of a work bench for steel fixer ▪ Working area for a steel fixer and the position of work bench along with stacking of prepared steel	0.5	1	1.5
5.	Cut Rebar in given various lengths.	**Rebar cuttings:** ▪ Cutting techniques of steel bars using local techniques ▪ Measurement and marking techniques on steel bars of various sizes ▪ Cutting techniques using cutting machines ▪ Working team spirit with required numbers of coworkers in cutting steel bars ▪ Storage of cut steel bars systematically in separate groups ▪ Safety precautions	0.5	1	1.5

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
6.	Cut the binding wire bundle into required length for the purpose of binding steel bars.	**Binding wire cuttings:** ▪ Minimum size of purpose of binding the steel bars together ▪ Calculation of double lengths of cut wire to be used in binding ▪ Cutting techniques using cutting machines ▪ Alternative method of binding steel bars together ▪ Storage of cut binding wires in a proper place ▪ Safety precautions	1.0	0.5	1.5
7.	Straighten supplied Rebars into straights.	**Rebar straightening:** ▪ Concept of straightening folded bars ▪ Use of bending keys one opposite other in opposite direction to straighten ▪ Team working spirit ▪ Procedure ▪ Safety precautions	0.5	1	1.5
8.	Bend Rebars.	**Rebar bending:** ▪ Types of different bends used in steel re bars for construction ▪ Methods of calculation of bend lengths of different bends ▪ Checking of bent shape and sizes on a template made from steel props ▪ Techniques of bending steel re bars Safety precautions	0.5	1	1.5
9.	Interpret bar bending schedule.	**Bar bending schedule:** ▪ Purpose of bar schedule ▪ Elements of a bar schedule ▪ Bar schedule as a summary of structural steel ▪ Meaning of bar marks Shape of bends and their total lengths	0.5	1.0	1.5
10.	Interpret structural drawings.	**Structural drawing:** ▪ Plan, elevation, sections in structural drawing	0.5	1.0	1.5

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
		▪ Purpose of Bars marks in drawing ▪ Bars in sectional plan and elevations ▪ Spacing notation in drawing Types of bars used in various structural members			
11.	Bend Rebars for lapping in different positions in beam/ column/ slab.	**Rebar bending:** ▪ Necessity of lapping ▪ Lap lengths calculation of re bars for both tension and compression zone ▪ Use of bending key in making lap length ▪ Safety precaution Procedure	0.5	1.0	1.5
12.	Prepare stirrups of different size and shape.	**Stirrups preparing:** ▪ Functions of stirrups, ▪ Types of stirrups ▪ Shape and steel used for preparing stirrups ▪ Measuring steel bars and marking for bends ▪ Bending and finishing stirrups ▪ Safety precaution Procedure	0.5	1.0	1.5
13.	Bind stirrups on column/ beam Rebars.	**Stirrups binding:** ▪ Functions of stirrups, ▪ Calculation of spacing of stirrups on a column or a beam ▪ Read a structural drawing to see stirrups and their sizes and spacing ▪ Hooks of stirrups and their functions ▪ Safety precaution ▪ Procedure	0.5	1.0	1.5
14.	Fix cranked Rebars in beams.	**Rebar cranking:** ▪ Types of bars in a beam ▪ Functions of cranked bars ▪ Types of cranked bars, ▪ Hooks in main bars / u turn bend sin main bars ▪ Team work while placing cranked bars	0.5	1.0	1.5

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
		▪ Safety precaution ▪ Procedure			
15.	Prepare chairs and legs for columns.	**Chairs and legs preparing:** ▪ Functions of chairs in reinforcement ▪ Types and sizes of chairs ▪ Re bars in columns, ▪ Functions of column bar legs ▪ Safety precaution ▪ Procedure	0.5	1.0	1.5
16.	Fix Rebars in isolated footing/ strip/ combined/ mat foundation.	**Rebar fixing in footing:** ▪ Interpret structural drawing of strip, isolated, combined and mat foundation ▪ Covers for each member ▪ Handling of cut bars for different members. ▪ Working with team members in an understanding way ▪ Holding column bars centered and erected with shoring ▪ Safety precaution ▪ Procedure	0.5	1.0	1.5
17.	Fix Rebars in column.	**Rebar fixing in column:** ▪ Interpretation of a column structural drawing ▪ Interpretation of foundation plan ▪ Setting of center lines on ground ▪ Plumbing techniques ▪ Shoring with roles ▪ Safety precaution ▪ Procedure	0.5	1.0	1.5
18.	Erect column Rebars in a given position (lay out).	**Column Rebar erecting:** ▪ Column re bars preparation ▪ Handling of column re-bars ▪ Lay out ▪ Center line transfer ▪ Safety precaution ▪ Procedure	0.5	1.0	1.5
19.	Prepare Rebars for a beam.	**Beam Rebars preparing:** ▪ Interpretation of structural drawing of a beam	0.5	1.0	1.5

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
		▪ Spacing of stirrups ▪ Shape and size of stirrups ▪ Main bottom and top bars ▪ Safety precaution ▪ Procedure			
	Sub-total I		**10**	**18**	**28**

Module II: Carpentry (Woodwork)

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
1.	Identify/enumerate/handle tools /equipment.	**Tools and equipment handling:** ▪ Different tools and equipment used in carpentry ▪ Function of tools and equipment ▪ Care and maintenance of tools and equipment, ▪ Safety and precautions in handling tools and equipment ▪ Identification procedure of different tools and equipment	1	1	2
2.	Perform measuring/marking work.	**Measuring and marking:** ▪ Measurement system ▪ Conversion of units ▪ Marking system ▪ Identification of different measuring and marking tools and equipment ▪ Safety precaution ▪ Procedure of measuring and marking	0.5	1	1.5
3.	Perform sawing / slicing work.	**Sawing and slicing:** ▪ Sawing tools; Rip Saw, Back Saw, Cross-Cutting Saw and Key Saw. ▪ Parts of tools ▪ Safety precaution ▪ Procedure of sawing	0.5	1	1.5
4.	Perform planning / smoothing work.	**Planning and smoothing:** ▪ Definition ▪ Planning and smoothing tools; Jack Plane, Smoothing Plane, Block Plane.	0.5	1	1.5

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
		▪ Parts of tools ▪ Safety precaution ▪ Procedure of planning and smoothing			
5.	Perform nailing on wooden members.	**Nailing:** ▪ Importance of nailing and its function ▪ Size of nail ▪ Safety precaution ▪ Procedure of nailing	0.5	1.0	1.5
6.	Perform drilling work.	**Drilling:** ▪ Definition ▪ Drilling tools; Hand drill and Ratchet Brace. ▪ Parts of drilling tools ▪ Bits (different types) ▪ Safety precaution ▪ Procedure of drilling	0.5	1	1.5
7.	Perform boring work.	**Boring:** ▪ Definition ▪ Boring tools, Mortise Chisel, Paring Chisel ▪ Hammering tools ▪ Parts of boring tool ▪ Safety precaution ▪ Procedure of boring	0.5	1	1.5
8.	Perform holding work.	**Holding:** ▪ Definition ▪ Holding tools (Bench vice, Clamp vice) ▪ Parts of holding tools ▪ Safety precaution ▪ Procedure of holding	0.5	1	1.5
9.	Maintain basic tools.	**Tools maintenance:** ▪ Importance of maintenance ▪ Tools and materials for general maintenance (saw set, sharpening stone, emery paper, oil and cooling agent) ▪ Chisel sharpening procedure ▪ Sharpening of saw teeth ▪ Safety precaution ▪ Procedure of maintenance	0.5	2	2.5
10.	Prepare work piece.	**Work piece:** ▪ Definition ▪ Safety precaution	0	1	1

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
		▪ Procedure of preparing work piece			
11.	Make Tenon and Mortise joint / Butt joint / Lap joint / Dado joint/ Mitre joint / Dove tail joint	**Joints making:** ▪ Joints • Definition • Function ▪ Types; Butt joint, lap joint, Dado joint, Mitered joint, Tennon and mortise joint and dove tail joint ▪ Safety precaution ▪ Procedure of making joints	1	12	13
12.	Perform finishing work.	**Finishing:** ▪ Definition and function of: ▪ Glue ▪ Sand paper ▪ Putty ▪ Linseed oil ▪ Hardware [Nails, Screw, Hinge, Staple and Hasp] ▪ Procedure of finishing	0.5	1	1.5
13.	Perform polishing work.	**Polishing:** ▪ **Definition and function:** • Varnish • Shellac varnish • Enamel • Thinner • Procedure of polishing	0.5	1	1.5
	Sub-total II		**7**	**25**	**32**

Part 2: Construction Materials
Module III: Construction Materials Testing

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot.
1.	Conduct tests on aggregates: a. Sieve analysis of fine aggregate b. Sieve analysis of course aggregate c. Water absorption test d. Aggregate crushing value e. Aggregate impact value f. Aggregate abrasion	**Tests on aggregates:** ▪ Introduction ▪ Tests for • Sieve analysis of fine aggregate • Sieve analysis of course aggregate • Water absorption test • Aggregate crushing	1	2	3.0

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot.
	value	value • Aggregate impact value • Aggregate abrasion value ▪ Testing procedure			
2.	Conduct tests on brick: a. Compressive strength b. Water absorption test c. Efflorescence test d. Soundness	**Tests on brick:** ▪ Introduction ▪ Tests for • Compressive strength • Water absorption test • Efflorescence test • Soundness ▪ Testing procedure	0.5	1	1.5
3.	Conduct tests on cement: a. Fineness b. Soundness c. Consistency d. Initial and final setting time	**Tests on cement**: ▪ Introduction ▪ Tests for • Fineness • Soundness • Consistency • Initial and final setting time ▪ Field (Physical) test of cement ▪ Testing procedure	0.5	2	2.5
4.	Conduct tests on tar/ bitumen/ asphalt: a. Penetration test b. Ductility test c. Viscosity test	**Tests on tar/ bitumen/ asphalt:** ▪ Introduction ▪ Tests for • Penetration test • Ductility test • Viscosity test ▪ Testing procedure	0.5	1	1.5
5.	Conduct/observe on reinforcing steel (Rebar).	**Tests on Rebar:** ▪ Introduction ▪ Types of steel bars ▪ Test for • Tensile strength • Elongation • Ductility ▪ Testing procedure	0.5	2	2.5
	Sub-total III		**3**	**8**	**11**

Module IV: Plain Cement Concrete

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
1.	Batch cement concrete ingredients: a. Prepare 1:2:4 mix by volume b. Prepare 1: 1.5:3 mix by volume c. Prepare 1:1:2 mix by volume	**Cement concrete batching:** ▪ Cement concrete • Grade of concrete (M15, M20, and M25) ▪ Batching • Procedure	0.5	1.5	2
2.	Prepare Cement Concrete: a. Prepare M15 concrete by volume b. Prepare M20 concrete by volume c. Prepare M25 concrete by volume	**Cement concrete preparing:** ▪ Types of mixing ▪ Advantages of machine mixing ▪ Workability and strength of concrete ▪ Procedure	0.5	1.5	2
3.	Compact concrete: a. Compact manually b. Compact mechanically	**Compacting:** ▪ Method of pouring concrete ▪ Methods of vibrations ▪ Types and use of vibrators	0.5	1	1.5
4.	Perform curing: a. Cure column b. Cure beam c. Cure slab d. Cure masonry Wall	**Curing:** ▪ Duration of curing ▪ Effects of climate in curing ▪ Procedure	0.5	1.0	1.5
	Sub-total IV		**2**	**5**	**7**
Total (Sub-total I+ Sub-total II+ Sub-total III+ Sub-total IV)			**22**	**56**	**78**

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