



National Diploma Level-5 in Construction Material Supervisor



National Certificate Level -5 in Construction Material Supervisor

CURRICULUM



**NATIONAL VOCATIONAL AND TECHNICAL TRAINING COMMISSION (NAVTTTC)
GOVERNMENT OF PAKISTAN**



National Diploma Level-5 in Construction Material Supervisor



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1. Introduction

Materials which are used for construction purposes are known as the engineering materials or building materials or construction materials. A wide range of building materials are available for the construction of rural buildings and structures. The proper selection of materials to be used in a particular building or structure can influence the Safety, original cost, maintenance, ease of cleaning, durability and, of course, appearance. Usually, construction materials are classified into natural construction material (Water, Mud, Stone, Sand, Wood, Leaves, Lime, Fiber and etc.) and artificial construction material (cement, Brick, Tiles, Glass, Metals, Plastic and etc.). It is necessary for the Civil Engineers/Civil Technologist/Lab Engineers/Lab Assistant to have knowledge about materials, properties and their standard testing methods.

Construction Materials Testing have significant role in the life of every human being, though one may not truly sense its importance in our daily routine. Thus, the importance of civil engineering may be determined according to its usefulness in our daily life. Therefore, industry expectations for skilled workforce are also dynamic which can only be managed through setting relevant competency standards in collaboration with the leading industries. Being familiar of this fact, National Vocational & Technical Training Commission (NAVTTTC) developed competency standards for Construction Material Testing Technology under National Vocational Qualifications Framework (NVQF). These competency standards have been developed by a Qualifications Development Committee (QDC) and validated by the Qualifications Validation Committee (QVC) having representation from the leading Construction, Real States & Builder industry of the country.

2. Purpose of the Qualification:

The purpose of this qualification is to set high professional standards for construction Materials Testing technology sector. The specific objectives of developing these qualifications are as under:

- Improve the professional competence of the trainees
- Provide opportunities for recognition of skills attained through non-formal or informal pathways
- Improve the quality and effectiveness of training and assessment for construction Materials Testing industry
- Enable the existing workforce to capacitate themselves in new technologies and methods



3. Overall objectives of training program

The Construction Material Supervisor qualification of level 5 consists of both the theoretical and practical details and having the following Occupations

- | | |
|--|---------|
| 1. Building Materials Sampler | Level 2 |
| 2. Highway Materials Testing Sampler | Level 2 |
| 3. Building Materials Assistant | Level 3 |
| 4. Highway Materials Testing Assistant | Level 3 |
| 5. Building Materials Technician | Level 4 |
| 6. Highway Quality Control Inspector | Level 4 |
| 7. Bridge Inspector (NDT) | Level 4 |
| 8. Public Health Quality Control Inspector | Level 4 |
| 9. Construction Plants Operator | Level 4 |
| 10. Field Testing Lab Assistant | Level 3 |
| 11. Field Testing Lab Technician | Level 4 |

It includes the following qualifications as well:

- | | |
|---|---------|
| 1. Certificate in Construction Materials Sampler | Level 2 |
| 2. Certificate in Construction Materials Assistant | Level 3 |
| 3. Certificate in Construction Materials Technician | Level 4 |
| 4. Diploma in Construction Materials Supervisor | Level 5 |



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4. Date of Validation

The level 5 of National qualification on construction Materials Supervisor has been validated by the Qualifications Development Committee (QDC) members on **06-12-2021 to 10-12-2021** and will remain valid for 10 years

5. Entry level of trainees

The entry for D.A. E National Diploma level 5, in Construction Material Supervisor are

1. A person having National Vocational Certificate level 4, in Construction Material Supervisor for entry into level 5.

6. Minimum qualification for teachers

- B. Tech in Civil Technology 4 Years
- B.Sc. / B.E. in Civil Engineering 4 Years
- D. A. E. in Civil Technology with 3 Years teaching experience
- Must be able to communicate effectively

Medium of instruction

English, and Urdu.

7. Duration of the course:

The proposed curriculum is composed of **145 modules** that will be covered in **3617 Learning hours**. Duration of the course is proposed to be Three years. The total weightage for technical modules is 3617 hours. A total of 1183 hours have been reserved for allied subjects i.e. Islamic studies, English, Mathematics, Physics and Chemistry.

The details of technical modules are given as under:

Level - 2 = 6 months.

Level - 3 = 6 months.



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Level - 4 = 1 Year.

Level - 5 = 1 Year.

The overall distribution of contact hours and Credit Hours is given below:

Total.	3617 hours. & 361.7 Credits
Theory.	847 hours (23.42 %)
Practical.	2770 hours (76.58 %)

The distribution of contact hours and credit hours in each level is given below:

Level - 2 = 6 months (16 weeks)

Total.	610 hours. & 61 Credits
Theory.	115 hours (18.85 %)
Practical.	495 hours (81.15 %)

Level - 3 = 6 months (16 weeks)

Total.	607 hours. & 60.7 Credits
Theory.	121 hours (19.93 %)
Practical.	486 hours (80 .07%)

Level - 4 = 1 Year (16 weeks + 16 Weeks)

Total.	1200 hours. & 120 Credits
Theory.	234 hours (19.5 %)
Practical.	966 hours (80.5 %)

Level - 5 = 1 Year (16 weeks + 16 Weeks)

Total.	1200 hours. & 120 Credits
Theory.	377 hours (31.42 %)
Practical.	823 hours (68.58 %)



8. Description and structure of the course

Following is the structure of the course:

National Qualification Certificate in Construction Material Supervisor Level 5 Part-1

11.16 Calibration Techniques

Module Code	Name of Subjects	Category	Level	Contact Hour			Credit
				Th	Pr	Total	
11.16.1	Perform Standard Calibration of PH	Core	5	8	18	26	2.6
11.16.2	Perform Standard Calibrations of weighing balance	Core	5	10	33	43	4.3
11.16.3	Perform Standard Calibrations of pressure gauge	Core	5	10	33	43	4.3
Total				28	84	112	11.2

11.17 Plant Supervision

Module Code	Name of Subjects	Category	Level	Contact Hour			Credit
				Th	Pr	Total	
11.17.1	Supervise the Operations of Batching Plants	Core	5	17	33	50	5
11.17.2	Supervise the Operations of Asphalt concrete Plants	Core	5	18	36	54	5.4
11.17.3	Supervise the Operations of Aggregate Crushing Plants	Core	5	17	39	56	5.6
Total				52	108	160	16

11.18 Safety Management

Module Code	Name of Subjects	Category	Level	Contact Hour			Credit
				Th	Pr	Total	
11.18.1	Evaluate Air Pollution	Generic	5	15	21	36	3.6
11.18.2	Determine Noise Pollution	Generic	5	9	15	24	2.4
11.18.3	Manage Safety at Construction Site	Generic	5	9	27	36	3.6
Total				33	63	96	9.6



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11.19 Inspection Techniques

Module Code	Name of Subjects	Category	Level	Contact Hour			Credit
				Th	Pr	Total	
11.19.1	Conduct Geotechnical Site Investigations	Core	5	9	21	30	3
11.19.2	Supervise sampling, inspections and testing at construction sites	Core	5	11	27	38	3.8
11.19.3	Plan & conduct the inspection of construction materials, products & processes.	Core	5	8	36	44	4.4
11.19.4	Assess construction faults in buildings	Core	5	4	12	16	1.3
11.19.5	Develop maintenance plan for roads	Core	5	7	9	16	1.9
Total				39	105	144	14.4

11.20 Hydraulics Engineering

Module Code	Name of Subjects	Category	Level	Contact Hour			Credit
				Th	Pr	Total	
9.20.1	Determine Hydrostatic pressure	Core	5	15	27	42	4.2
9.20.2	Apply Hydro kinematic Principles	Core	5	21	33	54	5.4
Total				36	60	96	9.6
Total of Level-5 (Part-I)				188	420	608	60.8

National Qualification Certificate in Construction Material Supervisor Level 5 Part-2

11.21 Lab Management

Module Code	Name of Subjects	Category	Level	Contact Hour			Credit
				Th	Pr	Total	
11.21.1	Plan and organize the laboratory work.	Core	5	10	18	28	2.8
11.21.2	implement Laboratory Quality control Procedures	Core	5	18	30	48	4.8
11.21.3	Analyze Data and report results	Core	5	27	45	72	7.2
11.21.4	Apply quality system and continuous improvement processes	Core	5	10	18	28	2.8
Total				65	111	176	17.6



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11.22 Inspection and Testing of Concrete Structures

Module Code	Name of Subjects	Category	Level	Contact Hour			Credit
				Th	Pr	Total	
11.22.1	Perform NDT by rebound hammer and Rebar Detector test	Core	5	3	12	15	1.5
11.22.2	Perform Ultrasonic pulse velocity and Penetration Test (Windsor Probe)	Core	5	5	9	14	1.4
11.22.3	Perform NDT Pull out Test and Profometer test	Core	5	2	12	14	1.4
11.22.4	Perform rebound hammer test and Rebar Detector test (NDT) for RCC Bridge	Core	5	2	10	12	1.2
11.22.5	Perform Ultrasonic pulse velocity test and Penetration test by Windsor probe for concrete Bridge	Core	5	3	9	12	1.2
11.22.6	Perform Pull out test and Profometer test on RCC Bridge	Core	5	3	10	13	1.3
11.22.7	Perform Flat Jack Test and Impulse Radar Test	Core	5	5	21	26	2.6
11.22.8	Perform Stress rupture Test and Creep Test on pipes	Core	5	3	7	10	1
11.22.9	Perform Full Notch Creep Test and Small-scale steady-state test	Core	5	3	7	10	1
11.22.10	Conduct Tensile Test, Compression Test and Leakage Detection Test	Core	5	3	6	9	0.9
11.22.11	Conduct hydraulic pressure test and 3 edge bearing test on RCC pipes	Core	5	3	6	9	0.9
Total				35	109	144	14.4

11.23 Inspection and Testing of Steel Structures

Module Code	Name of Subjects	Category	Level	Contact Hour			Credit
				Th	Pr	Total	
11.23.1	Perform Hardness Test on metals using Rockwell Method	Core	5	3.5	7.5	11	1.1
11.23.2	Perform Hardness Test on metals using Brinell Method	Core	5	2	7	9	0.9
11.23.3	Conduct Impact test on metals	Core	5	3	9	12	1.2
11.23.4	Conduct Bend test on metals	Core	5	4.5	7.5	12	1.2
11.23.5	Conduct Tensile Test on Metals Using Young's Modulus Apparatus	Core	5	4.5	7.5	12	1.2
11.23.6	Conduct Tensile Test on Metals Using UTM	Core	5	4.5	7.5	12	1.2
11.23.7	Conduct Torsion Tests on metals	Core	5	4.5	7.5	12	1.2
11.23.8	Perform Radiographic and Ultrasonic Testing on Steel Bridges	Core	5	3	9	12	1.2
11.23.9	Perform Dye Penetrant Inspection or Liquid Penetrant Inspection (LPI) on Steel Bridges	Core	5	3	9	12	1.2



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11.23.10	Perform Magnetic Particle Inspection on Steel Bridges	Core	5	4	6	10	1
11.23.11	Perform Eddy Current Testing on Steel Bridges	Core	5	2.5	4.5	7	0.7
11.23.12	Perform Visual Inspection on Steel Bridges	Core	5	2	5	7	0.7
Total			41	87	128	12.8	

11.24 Entrepreneurial Skills

Module Code	Name of Subjects	Category	Level	Contact Hour			Credit
				Th	Pr	Total	
11.24.1	Investigate micro business opportunities	Generic	5	6	9	15	1.5
11.24.2	Develop a micro business proposal	Generic	5	8	9	17	1.7
11.24.3	Develop a marketing plan	Generic	5	6	12	18	1.8
11.24.4	Develop and review a business plan.	Generic	5	6	12	18	1.8
11.24.5	Organize finances for the micro business	Generic	5	6	12	18	1.8
11.24.6	Manage human resources	Generic	5	4	6	10	1
11.24.7	Market products and services	Generic	5	4	12	16	1.6
11.24.8	Monitor and review business performance	Generic	5	4	12	16	1.6
11.24.9	Negotiate for resolving business issues	Generic	5	4	12	16	1.6
Total				48	96	144	14.4
Total of Level-5 (Part-II)				189	403	592	59.2
Grand Total of Level 5				377	823	1200	120



9. Overview of the Curriculum.

Construction Material Testing Technology Level-5 Part-I

S#	Clusters of Competencies	Numbers of Module	Theory	Practice	Duration
11.16	Calibration Techniques	3	28	84	112
11.17	Plant Supervision	3	52	108	160
11.18	Safety Management	3	33	63	96
11.19	Inspection Techniques	5	39	105	144
11.20	Hydraulics Engineering	2	36	60	96
Total		16	188	420	608

Construction Material Testing Technology Level-5 Part-II

S#	Clusters of Competencies	Numbers of Module	Theory	Practice	Duration
11.21	Lab Management	4	65	111	176
11.22	Inspection and Testing of Concrete Structures	11	35	109	144
11.23	Inspection and Testing of Steel Structures	12	41	87	128
11.24	Entrepreneurial Skills	9	48	96	144
Total		36	189	403	592
Grand Total of Level 5		52	377	823	1200
Grand Total		148	957	2643	3600



10. Scheme of Studies

National Qualification Diploma in “Construction Material Supervisor” level-5, Part-1

Code	Name of Subjects	Category	Contact Hour			Credit	Periods per week		
			Th	Pr	Total		Th	Pr	Total
11.16	Calibration Techniques	Technical	28	84	112	11.2	2	5	7
11.17	Plant Supervision	Technical	52	108	160	16.0	4	6	10
11.18	Safety Management	Technical	33	63	96	09.6	2	4	6
11.19	Inspection Techniques	Technical	39	105	144	14.4	2	7	9
11.20	Hydraulics Engineering	Technical	36	60	96	09.6	3	3	6
		Allied							
		Allied							
Total			188	420	608	60.8	13	25	38

National Qualification Diploma in “Construction Material Supervisor” level-5, Part-2

Code	Name of Subjects	Category	Contact Hour			Credit	Periods per week		
			Th	Pr	Total		Th	Pr	Total
11.21	Lab Management	Technical	65	111	176	17.6	4	7	11
11.22	Inspection and Testing of Concrete Structures	Technical	35	109	144	14.4	3	7	10
11.23	Inspection and Testing of Steel Structures	Technical	41	87	128	12.8	3	5	8
11.24	Entrepreneurial Skills	Generic	48	96	144	14.4	3	6	9
		Allied							
Total			189	403	592	59.2	13	25	38



11. Detail of Modules

National Diploma of Level-5 Part-I in Construction Material Supervisor

11.16. Calibration Techniques

11.16.1 Perform Standard Calibration of pH meter

Objective: This module covers the skills and knowledge required to perform calibration of pH in accordance with the reference standards and procedure.

Duration: 26 Hours

Theory: 8 Hours

Practice: 18 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Prepare items for calibration	Trainee will be able to: • Select the pH mode • Adjust the temperature control at 25°C • Identify hazards and use appropriate personal protective equipment (PPE), safety equipment and procedures • Confirm pH meter meets the laboratory's specification requirements and complies fully with the calibration procedure • Assemble and set up specified reference	• Define calibration • Define accuracy • Define precision • Define PPE • State what does pH stands for • Define pH • Enlist uses of pH meter • State how to measure pH value Practical activity: • Measure the accuracy of pH	Theory-2Hrs Practice-3Hrs Total- 5Hrs	Balance Thermometer Thermocouple pH meter	Class room and lab



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	standards • Verify performance of reference standards and measuring pH meter prior to use and adjust or calibrate as necessary	meter • Measure the precision of pH meter			
LU2. Perform calibration	Trainee will be able to: • Startup pH meter • Rinse the electrode with deionized water • Dry it with the piece of tissue • Place the electrode in the sample to be tested • Allow the display to stabilize before taking reading • Remove the electrode from the buffer • Record all calibration data accurately and legibly • Compare data with specifications • Return to store out-of-calibration equipment	• Define wastewater • Explain basic calibration principles • Differentiate between soft and hard water • Differentiate between drain and canal water • Explain procedure of calibration Practical activity: • Perform pH testing for tap water, wastewater, soft drinks, drain water and canal water • Calculate the least count of pH meter • Calculate the standard deviation	Theory-2Hrs Practice-9Hrs Total-11Hrs	Balance Thermometer Thermocouple pH meter	Class room and lab



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LU3. Perform calibration checks	Trainee will be able to: Perform individual pH tests without variance • Confirm readings are the result of a valid measurement and record data as required • Adjust pH meter under test to bring readings within specification and record data where required • Analyse resulting test data to detect trends or inconsistencies	• Define mean, mode and median • Define ranges and standard deviations Practical activity: • Determine mean, mode and median of pH value • Determine ranges and standard deviations of pH value • Compute the statistical analysis of quality control data	Theory-2Hrs Practice-3Hrs Total- 5Hrs	Incubator/oven /fridge Digestion block iological safety cabinet Fume cupboard.	Class room and lab
LU4. Document the calibration	Trainee will be able to: • Prepare and issue a final report on the job/item • Record the results of each pH test/calibration • Ensure confidentiality of workplace information • Attach calibration labels, quality control tags and tamper resistant seals • Store pH equipment/measurement standards and results	• Describe periodic calibration of pH testing • Explain commonly used reference materials and working standards Practical activity: • Measure the pH and prepare a final report of calibration	Theory-2Hrs Practice-3Hrs Total- 5Hrs	Incubator/oven /fridge Digestion block iological safety cabinet Fume cupboard.	Class room and lab

11.16.2 Perform Standard Calibration of Weighing Balance



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Objective: This module covers the skills and knowledge required to perform calibration of Weighing balance in accordance with the reference standards and procedure.

Duration: 43 Hours

Theory: 10 Hours

Practice: 33 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Prepare items for calibration	Trainee will be able to: • Select the weighing balance • Identify hazards and use appropriate personal protective equipment (PPE), safety equipment and procedures • Confirm all measuring equipment meets the laboratory's specification requirements and complies fully with the calibration procedure • Assemble and set up specified reference standards and associated equipment prior to weighing balance testing • Verify performance of reference standards and measuring equipment prior to use and adjust or calibrate as necessary	• Define weighing balance • State the use of weighing balances in construction • Explain principle of weighing balance • Describe precision and accuracy of measuring tools and equipment • Define least count/ resolution of weighing balances • State types of calibration Practical activity: • Measure the accuracy of weighing balance • Measure the precision of weighing balance	Theory-2Hrs Practice-6Hrs Total 8Hrs	Weighing balance thermometer thermocouple incubator/oven /fridge digestion block biological safety cabinet fume cupboard.	Class room and lab
LU2. Perform calibration	Trainee will be able to:	• Explain the calibration of	Theory-3Hrs	Weighing balance	Class



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	• Startup weighing balance according to operating procedures • Start with zeroing the weighing balance without any load • Set the loads of first test point • Wait for stabilization • Record the indication • Apply more loads on increasing test points • Check maximum load applied • Start decreasing the loads on decreasing test points • Check the accuracy/calibration of weighing balance • Return to store out-of-calibration equipment	weighing balance • Enlist the steps for calibration • Describe types of weighing balances used in construction • State the calibration interval • State the calibration standards for weighing balances Practical activity: • Perform calibration of weighing balance of empty containers for soils and aggregates • Perform calibration of weighing balance of brick and wood samples • Perform calibration of weighing balance for coarse and fine aggregate samples • Calculate the least count of weighing balance	Practice-12Hrs Total-15Hrs	thermometer thermocouple incubator/oven /fridge digestion block biological safety cabinet fume cupboard.	room and lab
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LU3. Perform calibration checks	Trainee will be able to: • Perform individual tests without variance according to the documented procedure to ensure repeatability of measurement • Confirm readings of weighing balance are the result of a valid measurement and record data as required • Adjust weighing balance under test to bring readings within specification and record data where required • Analyse resulting test data to detect trends or inconsistencies	• Define mean, mode and median • Define ranges and standard deviations of measuring instruments • Describe reliability of measuring instrument Practical activity: • Determine mean, mode and median of weighing balance • Determine ranges and standard deviations of weighing balance • Compute the statistical analysis of quality control data	Theory-3Hrs Practice-9 Hrs Total- 12Hrs	Weighing balance thermometer thermocouple incubator/oven /fridge digestion block biological safety cabinet fume cupboard.	Class room and lab
LU4. Document the calibration	Trainee will be able to: • Prepare and issue a final report on the job/item • Record the results of each test/calibration • Ensure confidentiality of workplace information • Attach calibration labels, quality control	• State the periodic calibration of weighing balance • Explain commonly used reference materials and working standards Practical activity: • Measure the reading of	Theory-2Hrs Practice-6Hrs Total- 8Hrs	Weighing balance thermometer thermocouple incubator/oven /fridge digestion block biological safety cabinet	Class room and lab



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	tags and tamper resistant seals • Store test equipment/measurement standards and results	weighing balance and prepare a final report of calibration		me cupboard.	
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11.16.3 Perform Standard Calibration of Pressure Gauge

Objective: This module covers the skills and knowledge required to perform calibration of Pressure gauge in accordance with the reference standards and procedure.

Duration: 43 Hours

Theory: 13 Hours

Practice: 30 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Prepare items for calibration	Trainee will be able to: • Select the pressure gauge • Identify hazards and use appropriate personal protective equipment (PPE), safety equipment and procedures • Confirm the pressure gauge meets the laboratory's specification requirements and complies fully with the calibration procedure • Assemble and set up specified reference standards and associated equipment prior to pressure gauge testing • Verify performance of reference standards and measuring equipment prior to use and adjust or calibrate as necessary	• Define pressure gauge • State the use of pressure gauge • Enlist the types of pressure gauges • State the calibration interval for pressure gauges Practical activity: • Measure the accuracy of pressure gauge • Measure the precision of pressure gauge	Theory-2Hrs Practice-6Hrs Total 8 Hrs	balance thermometer thermocouple viscosity meter flow meter (including digital)	Class room and lab
LU2. Perform calibration	Trainee will be able to: • Startup equipment according to operating procedures	• State how does the pressure gauge works • State the difference between	Theory-3Hrs Practice-9Hrs Total-.12Hrs	balance thermometer thermocouple viscosity meter	Class room and lab



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	• Set the pointer to read zero on the scale before applying any pressure on the gauge • Apply the full range pressure on the gauge • Adjust the linkage • Reduce the pressure to zero and check the pointer reading • Check the pressure gauge reading at 0, 50% and maximum scale reading • Note down the readings of the gauge on a calibration sheet • Draw a graph of the gauge readings and the applied readings • Compare data with specifications and/or previous records to identify non-compliant equipment • Return to store out-of-calibration equipment	gauge and absolute pressure Practical activity: • Perform pressure gauge for consolidation and hydrostatic testing • Calculate the least count of pressure gauge		flow meter (including digital)	
LU3. Perform calibration checks	Trainee will be able to: • Perform individual tests without variance according to the documented procedure to ensure repeatability of measurement • Confirm readings are the result of a valid measurement and record data as required • Adjust pressure gauge under test to bring	• Define mean, mode and median • Define ranges and standard deviations Practical activity: • Determine mean, mode and median of pressure gauge	Theory-3Hrs Practice-9Hrs Total- 12Hrs	pressure gauge incubator/oven /fridge digestion block biological safety cabinet fume cupboard.	Class room and lab



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	readings within specification and record data where required Analyse resulting test data to detect trends or inconsistencies	- Determine ranges and standard deviations of pressure gauge - Compute the statistical analysis of quality control data			
LU4. Document the calibration	Trainee will be able to: - Prepare and issue a final report on the job/item - Record the results of each test/calibration - Ensure confidentiality of workplace information - Attach calibration labels, quality control tags and tamper resistant seals - Store pressure gauge equipment/measurement standards and results	- State the periodic calibration of pressure gauge Practical activity: - Measure the reading of pressure gauge and prepare a final report of calibration	Theory-2Hrs Practice-9Hrs Total- 11Hrs	pressure gauge incubator/oven /fridge digestion block biological safety cabinet fume cupboard.	Class room and lab



11.17: Plant Supervision

11.17.1 Supervise the Operations of concrete Batching Plants

Objective: This module covers the skills and knowledge required to Monitor the Concrete Batching Plant, Carryout Pre-Operation checks on Concrete Batching plant, Analyze Raw Materials for cement concrete, Produce Concrete with Batching Plant, Perform post-operation checks for concrete batching plant.

Duration: 50 Hours

Theory: 17 Hours

Practice: 33 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Carryout pre-Operation checks on Concrete Batching plant	Trainee will be able to: - Follow standard ratio amongst ingredients for cement concrete. - Turn on concrete batching plant - Insert the desired formula on the control panel - Compute the weight error in plant if any - Remove the error as needed	- Define concrete ratio - Describe methods of mixing concrete - Explain the working principles of Concrete Batching Plants Practical Activity Perform complete calibration of the concrete batching plant	Theory-04Hrs Practice-06Hrs Total- 10Hrs	water, cement, silica fume, sand, and aggregate Duster Grease Lubricating oil Bathing plant	Class Room Lab



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LU2. Analyze Raw Materials for cement concrete.	Trainee will be able to: • Collect samples from aggregate stacks • Perform grading of aggregate • Collect cement sample • Collect water samples • Record test results	• Explain methods of taking samples of aggregates • Describe grading of aggregates • Describe the operational procedures of Concrete Batching Plant Practical Activity Analyze raw materials for cement concrete by performing relevant tests – cement, aggregates and water.	Theory-04 Hrs Practice-09 Hrs Total- 13 Hrs	water, cement, silica fume, sand, and aggregate Duster Grease Lubricating oil Sampling kits, Equipment for cement testing Equipment for aggregate testing Equipment for water testing	Class Room Lab
LU3. Produce Concrete with Batching Plant	Trainee will be able to: • Check required raw materials • Inspect the conveyer belts • Monitor batching operations • Check the loss of raw material • Organize workflow for delegated tasks • Produce concrete by operation of plant • Prepare the Raw Materials Consuming summary sheet • Prepare batching materials production	• Define batching and its types • Explain post operation procedure for concrete batching plant. Practical Activity • Prepare Summary for production at Batching Plant operations.	Theory-04 Hrs Practice-06 Hrs Total- 10 Hrs	water, cement, silica fume, sand, and aggregate Duster Grease Lubricating oil Batching plant Water tanks	Class Room Lab



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	summary sheet				
LU4. Perform post-operation checks for concrete batching plant	Trainee will be able to: • Prepare for post operation procedures of concrete batching plant. • Carryout post-operation checks for batching plant. • Adopt PPEs • Perform strength test on cube. • Perform strength test on Cylinder • Perform Slump Test • Record test result	• Explain the post operation Checks the operational properties for Batching Plant. • Explain strength cube test • Explain strength test on cylinder • Explain slump test Practical Activity Perform the following test of concrete: 1. Strength test on cube 2. Strength test on Cylinder 3. Slump test.	Theory-05 Hrs Practice-12 Hrs Total- 17 Hrs	balance Concrete Batching plant thermocouple Slump cone apparatus Sampling equipment for concrete and its ingredients Water tank Moulds- cube, cylinder, Compression testing machine Curing chambers	Class Room Lab



11.17.2 Supervise the Operations of Asphalt Concrete Plants

Objective: This module covers the skills and knowledge required to monitor the Asphalt Concrete Plant, Carryout Pre-Operation checks on Asphalt Concrete plant, Analyze Raw Materials for Asphalt Concrete, Produce with concrete Asphalt Concrete Plant, operations checks and Perform Quality control Tests for Asphalt Concrete.

Duration: 54 Hours

Theory: 18 Hours

Practice: 36 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Monitor the Asphalt Concrete Plant	Trainee will be able to: • Check availability of materials • Turn the batch plant ON/OFF • Observe the Operational procedure • Check batching plant automatic and manual mode • Observe the Control panel of the plant	• Define bitumen, asphalt and tar • Explain the working of Asphalt Concrete Plant (Automatic and Manual) type. • Explain the working principles of Asphalt Concrete Batching Plants Practical Activity Estimate required raw materials and check control panel of asphalt concrete plant.	Theory-03Hrs Practice-03 Hrs Total- 6 Hrs	Crushed rock, gravel or slags sand, and aggregate Duster Grease Lubricating oil Asphalt concrete plant	Class Room Lab



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LU2. Carryout pre-Operation checks on Asphalt Concrete plant	Trainee will be able to: • Follow standard ratio amongst ingredients for asphalt concrete. • Turn on Asphalt plant and adopt PPEs • Insert the desired formula on the control panel • Compute the weight error in plant if any • Remove the error as needed • Monitor the temperature of the asphalt Plant	• Explain Calibration of the Asphalt Batching Plant. • Explain procedure to calculate weight error Practical Activity Perform all pre-operation checks on asphalt concrete plant.	Theory-03Hrs Practice-03 Hrs Total- 06 Hrs	crushed rock, gravel or slags sand, and aggregate Duster Grease Lubricating oil Asphalt concrete plant Aggregate gradation apparatus	Class Room Lab
LU3. Analyze Raw Materials for Asphalt Concrete	Trainee will be able to: • Collect samples from aggregate stacks • Perform grading of aggregate • Collect Asphalt sample • Record raw materials quantity	• Describe the pre operation tests of raw materials for Asphalt Concrete Plant • Define grading of aggregates • Describe procedure of taking asphalt sample Practical Activity Analyze raw material for asphalt concrete by performing tests and collect required raw material quantity.	Theory-03Hrs Practice-06 Hrs Total- 09 Hrs	crushed rock, gravel or slags sand, and aggregate Duster Grease Lubricating oil Asphalt concrete plant	Class Room Lab



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LU4. Produce concrete with Asphalt Concrete Plant	Trainee will be able to: • Check required raw materials • Inspect the conveyor belts • Monitor batching operations • Check the loss of raw material • Set goals for better production • Organize workflow for delegated tasks • Produce asphalt concrete by operation of asphalt plant. • Prepare the Raw Materials Consuming summary sheet • Prepare batching materials production summary sheet	• Explain how to monitor batching operations. • Explain the sequence of operations of asphalt plant. • Describe raw material consuming summary sheet and materials production summary sheet Practical Activity Plan complete workflow for delegated tasks and produce asphalt concrete by operation of asphalt plant.	Theory-03Hrs Practice-06 Hrs Total- 09 Hrs	crushed rock, gravel or slags sand, and aggregate Duster Grease Lubricating oil Asphalt concrete plant	Class Room Lab
LU5. Perform post Operations checks and Perform Quality control Tests for Asphalt Concrete	Trainee will be able to: • Identify sample • Adopt PPEs • Perform binder content test. • Perform Ductility test. • Softening point test. • Flash and Fire point test. • Float test. • Record test results	• Explain post operation quality control tests of asphalt concrete. • Explain binder content test • Explain ductility test • Explain softening point test • Explain flash and fire point test • Explain float test	Theory-06Hrs Practice-18 Hrs Total- 24 Hrs	crushed rock, gravel or slags sand, and aggregate Duster Grease Lubricating oil balance Asphalt Batching plant Binder contents test	Class Room Lab



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		Practical Activity Perform following tests of asphalt concrete: 1. Binder contents test. 2. Ductility test. 3. Softening point test. 4. Flash and Fire point test. 5. Float test. 6. Record test results		apparatus. Ductility test apparatus. Softening point test apparatus. Flash and Fire point test apparatus. Float test apparatus. Water tank Sampling kits,	
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11.17.3 Supervise the Operations of Crushing Plants

Objective: This module covers the skills and knowledge required to Monitor the Aggregate Plant, Carry out pre-Operation checks of Aggregate Crushing plant, Produce stone crush by Crushing Plant, Carryout post-operation checks for crushing plant.

Duration: 56 Hours

Theory: 17 Hours

Practice: 39 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Monitor the Aggregate Plant	Trainee will be able to: • Check the availability of materials • Turn the crushing plant ON/OFF • Observe the Operational procedure. • Check for pre-operation. • Observe the Control panel of the crusher.	• Explain the working of Aggregate Crushing Plant (Automatic and Manual) type Practical Activity 1- Perform pre-operation checks and calibration of Aggregate Crushing Plant.	Theory-03 Hrs Practice-09 Hrs Total- 12 Hrs	Water Limestone, Ballast, Quarry Stone Gravels Rocks Crushed Duster Lubricating oil	Class Room Lab
LU2. Carry out pre-Operation checks of Aggregate Crushing plant	Trainee will be able to: • Turn on crushing plant and adopt PPEs • Observe the Operational procedure of the plant • Feed desired speed as per quality of stone	• Explain PPEs. • Explain operational procedure of plant • Explain all pre-operation checks of plant. Practical Activity • Prepare Summary for	Theory-05 Hrs Practice-09 Hrs Total- 14 Hrs	Water Limestone, Ballast, Quarry Stone Gravels Rocks Crushed	Class Room Lab



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	• Check the quality of raw material • Inspect the Crusher jaws • Inspect the conveyer belts	• production at crushing Plant. • Perform pre-operation checks of aggregate crushing plant.		Duster Lubricating oil	
LU3. Produce stone crush by Crushing Plant	Trainee will be able to: • Check required raw material s • Inspect the conveyer belts • Check the loss of raw material • Set goals for better crushing • Organizing workflow for delegated tasks • Monitor crushing operations • Monitoring employee productivity • Prepare the Raw Materials Consuming summary sheet • Prepare batching materials production summary sheet	• Explain the working principles of Aggregate Crushing Plants Practical Activity • Plan a workflow of different task to produce stone crush by crushing plant. • Prepare Summary for consumable raw materials at crushing Plant.	Theory-05 Hrs Practice-09 Hrs Total- 14 Hrs	Water Limestone, Ballast, Quarry Stone Gravels Rocks Crushed Duster Lubricating oil	Class Room Lab
LU4. Carryout post-operation checks for crushing plant.	Trainee will be able to: • Prepare for post operation procedures of crushing plant. • Carryout post-operation checks for	• Describe the operational procedures of Aggregate Crushing Plant Practical Activity	Theory-04 Hrs Practice-12 Hrs Total- 16 Hrs	Water Limestone, Ballast, Quarry	Class Room Lab



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	crushing plant. • Adopt PPEs • Perform aggregate crushing strength / value test. • Record test results	• Perform aggregate crushing strength/value test and record the results		Stone Gravels Rocks Crushed Duster Lubricating oil	
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11.18 Safety Management

11.18.1 Evaluate Air Pollution

Objective: This module covers the skills and knowledge required to analyze sources of air pollution, analyze methods of detection/measurement of air pollution, evaluate environment quality standards in ambient air, analyze methods to control air pollution and evaluate pathological effects of air pollution on human life

Duration: 36 Hours

Theory: 15 Hours

Practice: 21 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Analyze sources of air pollution	- Identify air pollutants - Identify sources of air pollutants - Gather information about emission of pollutants - Compile data in a presentable form	- Define air pollution - Enlist different air pollutants - Describe emission of air pollutants. - Describe sources of air pollution Practical Activity - Practice to prepare a list of sources of air pollution	Theory-02Hrs Practice-03Hrs Total- 05Hrs	Pencil Charts Eraser Air quality meter Air beam	Class room + Lab
LU2. Identify methods to detection of air	- Prepare sampling sites - Select the source of air pollution - Identify instruments for detection	- Enlist methods of detection of air pollution - Enlist sources of air pollution	Theory-03Hrs Practice-03Hrs Total- 06Hrs	Pencil Charts Eraser Air quality meter	Class room + Lab



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pollution	- of air pollution - Operate instrument - Measure air pollutants - Record result and assemble it	- Describe instruments for detection of air pollution Practical Activity - Measure air pollutants at different sites in different sources of air pollution		Air beam	
LU3. Measure air pollution from chimneys	- Identify instrument to measure smoke from chimney - Operate the instrument - Measure air pollution - Record the readings - Collect the data and assemble it on note pad	- Describe instrument for determining air pollution from chimneys - Describe working procedure of instrument Practical Activity - Measure quantity of air pollutant in a chimney.	Theory-03Hrs Practice-03Hrs Total- 06Hrs	Pencil Charts Eraser Air quality meter Air beam	Class room + Lab
LU4. Measure air pollution of automobiles	- Identify instrument to measure smoke - Operate the instrument - Measure pollution - Record the readings and assemble it on note pad	- Describe instrument for determining air pollution from automobile - Describe working procedure of instrument Practical Activity - Practice to measure air pollutant in automobiles	Theory-02Hrs Practice-03Hrs Total- 05Hrs	Pencil Charts Eraser Air quality meter Air beam	Class room + Lab



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LU5. Measure air pollution from different industries	• Select industries producing smoke • Identify the instrument for detection of industries smoke • Operate instruments to measure smoke • Record and save the results data	• Describe instrument for determining air pollution from industries • Describe working procedure of instrument Practical Activity • Practice to measure quantity of air pollutant in different industries	Theory-03Hrs Practice-03Hrs Total- 06 Hrs	Pencil Charts Eraser Air quality meter Air beam	Class room + Lab
LU6. Evaluate environment quality standards in ambient air	• Identify instruments • Collect environment quality standards (EQS) in ambient air for different areas • Compare the site readings with EQS • Record and save the results data	• Define environment quality standards (EQS) • Enlist few environment quality standards (EQS) for air Practical Activity • Measure pollutants in air and evaluate it by comparing with environment quality standard for of air	Theory-02Hrs Practice-03Hrs Total- 05 Hrs	Pencil Charts Eraser Air quality meter Air beam	Class room + Lab



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LU7. Maintain a safe work environment	• Use PPEs and apply safe work practices • Rehabilitate sampling site and Minimize generation of wastes • Collect waste material • Dispose waste Material • Check serviceability of equipment before storage	Practical Activity • Practice to maintain a safe work environment at your institute.	Theory-0Hrs Practice-03Hrs Total- 03Hrs	Pencil Charts Eraser Air quality meter Air beam	Lab
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11.18.2 Determine Noise Pollution

Objective: This module covers the skills and knowledge required to measure the noise pollution, compare the standards and control noise pollution.

Duration: 24 Hours

Theory: 9 Hours

Practice: 15 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Measure the noise pollution	- Select site - Select sources producing noise - Identify instruments for recording noise - Operate the sound level meter - Record the readings - Collect data and assemble it on notepad	- Define noise pollution - Enlist sources of noise pollution - Enlist various method for measuring noise pollution. - Name different equipment used to measure noise Practical Activity: - Identify and select a noise producing source and measure noise pollution	Theory-02Hrs Practice-03 Hrs Total- 05 Hrs	Sound level meter Pencil Charts Eraser Noise dosimeter	Class room + Lab
LU2. Measure the noise at construction site	- Use noise dosimeter - Operate Noise dosimeter - Record the readings - Collect data and assemble it on notepad	- Define noise from construction works. - Enlist sources of noise at construction site - Define sound intensity Practical Activity: - Measure noise pollution at construction site	Theory-02Hrs Practice-03Hrs Total- 05 Hrs	Sound level meter Pencil Charts Eraser Noise dosimeter	Class room + Lab



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LU3. Measure the noise of traffic	• Select optimum sound level meter • Operate optimum sound level meter • Record the readings • Collect data and assemble it on notepad	• Define noise from traffic • Enlist sources of noise from traffic • Define sound level meter Practical Activity: • Measure noise pollution of nearby road	Theory-02Hrs Practice-03Hrs Total- 05 Hrs	Sound level meter Pencil Charts Eraser Noise dosimeter	Class room + Lab
LU4. Compare the standards noise pollution	• Collect World Health Organization (WHO) guidelines • Compare the recorded readings with WHO • Identify the readings that lies within WHO	• State acceptable limit of noise according to WHO • Describe control measure for noise pollution Practical Activity: • Compare the data of noise pollution measured at road and construction site with WHO standard	Theory-03Hrs Practice-03Hrs Total- 06 Hrs	Sound level meter Pencil Charts Eraser Noise dosimeter	Class room + Lab
LU5. Maintain a safe work environment	• Use PPEs and apply safe work practices • Rehabilitate sampling site and Minimize generation of wastes • Collect waste material • Dispose waste Material	Practical Activity: Maintain a safe work environment	Theory-0Hrs Practice-03Hrs Total- 03 Hrs	Sound level meter Pencil Charts Eraser Noise dosimeter	Lab



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	• Clean the equipment • Check serviceability of equipment before storage				
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11.18.3 Manage Safety at Construction Site.

Objective: This module covers the skills and knowledge required to comply with regulatory and organizational requirements for occupational health and safety at construction site.

Duration: 36 Hours

Theory: 9 Hours

Practice: 27 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Evaluate hazards and risk at work place	- Identify physical hazards at work place - Check noise level at work place - Check adequacy of ventilation at work place - Examine the illumination level at work place - Examine the storage of hazardous materials as per MSDS. - Analyze adequacy of available access at work place for movement of workers & materials. - Adopt immediate preventive / corrective measures	- Describe Process of hazard analysis for construction work. - Identification of safety risks that affect the health, safety and environment for self and others working in the vicinity, tackle it if within limit or report to appropriate authority - State procedure for storing hazardous materials Practical Activity - Identify hazards and risk at construction site and prepare a report for	Theory-02Hrs Practice-06Hrs Total- 08Hrs	Safety Helmets Safety goggles Hand gloves Safety Shoes (Assorted size) Ear Plug Face mask Fire Extinguishers First aid Kit Stretcher Safety harness Safety Belts Various hand / power tools Fire Buckets. Blankets Chain Hoist Hooks / Anchors Slings Safety net	Class room + Lab



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		authority for corrective measures			
LU2. Ensure safe work practice at site	• Ensure safe use of tools and tackles by the workers as per applicability. • Ensure appropriate use of Personal Protective Equipment (PPE) • Ensure that health and safety plan is followed by all subordinates. • Implement safe handling and stacking methods at workplace / store • Confirm that all required signs are posted, and bulletin boards are maintained in clear and legible condition. • Ensure all un-protected openings are adequately guarded or barricaded. • Encourage workers to identify unsafe or unhealthful workplace conditions and report the every near-miss.	• Identification of unsafe act and unsafe conditions • Implementation of Safety regulations: Clean Air Act, Building code, National Electrical and Fire Safety Codes, Waste management rules, Occupational Safety and Health Standards, Pakistan Environment Protection Act 1997 etc Practical Activity Implement safe work practice at construction site	Theory-02Hrs Practice-06Hrs Total- 08 Hrs	Safety Helmets Safety goggles Hand gloves Safety Shoes (Assorted size) Ear Plug Face mask Fire Extinguishers First aid Kit Stretcher Safety harness Safety Belts Various hand / power tools Fire Buckets. Blankets Chain Hoist Hooks / Anchors Slings Safety net	Class room + Lab
LU3. Report and Investigate the accident at construction site.	• Check there is no immediate risk of danger at work place. • Ensure that victim of accident received the first aid.	• Describe Reporting procedures in cases of breaches or hazards for site safety, accidents,	Theory-02Hrs Practice-06Hrs Total- 8Hrs	Safety Helmets Safety goggles Hand gloves Safety Shoes (Assorted size)	Class room + Lab



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	- Report to the manager. - Secure the accident site by shutting down or blocking the area. - Collect the information about the incident before the witnesses begin to forget details. - Trace the lacking in work procedure and deficiencies in safety measures. - Analysis by step-by-step recounting of the incident and to root cause of accident. - Develop the incident report along with corrective measures to avoid future accident.	and emergency situations as per guidelines Explain responsibility for identifying site accidents or injuries Practical Activity Report and Investigate the accident at construction site		Ear Plug Face mask Fire Extinguishers First aid Kit Stretcher Safety harness Safety Belts Various hand / power tools Fire Buckets. Blankets Chain Hoist Hooks / Anchors Slings Safety net	
LU4. Develop emergency response protocol / procedures	- Collect detail drawing of the building/construction site. - Analysis the physical conditions, work practices, procedures and processes to ascertain the hazards and associated risks level. - Propose emergency exit, escape route and assembly point. - Prepare the marking scheme for work	- Procedure to maintain emergency response - Explain tolerance levels for site environment to monitor levels of dust, air pollution, noise pollution, etc. - Explain emergency safety control measures and	Theory-02Hrs Practice-06Hrs Total- 08Hrs	Safety Helmets Safety goggles Hand gloves Safety Shoes (Assorted size) Ear Plug Face mask Fire Extinguishers First aid Kit Stretcher Safety harness Safety Belts	Class room + Lab



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	area and walking area in the lab floor. - Select the positions for fire alarm, fire extinguishers, smoke detector, Safety signs, safety signals and fire hydrants etc. - Draw emergency response plans. - Establish emergency response lead team. - Conduct emergency response drill for assessing the deficiencies and review the emergency response plan & procedures.	actions to be taken under emergency situation Describe the classification of fire and use of fire protection devices. Practical Activity Prepare emergency response procedures		Various hand / power tools Fire Buckets. Blankets Chain Hoist Hooks / Anchors Slings Safety net	
LU5. Implement the emergency response procedures.	- Carry out special tool box talks which require discussion on highly critical safety related matters, hazardous site conditions pertaining to particular work etc. - Ensure effective adherence to response to emergency procedures / protocols - Train workers about hazards, methods to prevent harm and the awareness of HSE standards so they can perform	- Develop the OHSE personal records such as Health records, Incident reports, Accident reports, OHSE-related training. - Appropriate personal protective equipment to be used. - State process for implementing emergency response procedures	Theory-1Hrs Practice-03Hrs Total- 04Hrs	Safety Helmets Safety goggles Hand gloves Safety Shoes (Assorted size) Ear Plug Face mask Fire Extinguishers First aid Kit Stretcher Safety harness Safety Belts Various hand / power tools	Class room + Lab



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	their work safely. • Conduct the emergency related drills; fire drill, evacuation drill earthquake drill, basic life support/CPR, first aid and Spillage control drills etc. • Implement control measures to reduce risk & meet legal requirement as per organizational policies.	Practical Activity Implement emergency response processes.		Fire Buckets. Blankets Chain Hoist Hooks / Anchors Slings Safety net	
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11.19. Inspection Techniques

11.19.1 Conduct Geotechnical Site Investigations

Objective: This module covers the skills and knowledge required to prepare for onsite operations, arrange excavation of boreholes, test pits and/or trenches, conduct site sampling, conduct testing, finalize site operations, maintain Records and maintain a safe work environment.

Duration: 30Hours

Theory: 9 Hours

Practice: 21 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Prepare for onsite operations	Trainee will be able to: - Identify the job, location, work instructions, appropriate sampling and test procedures and safety requirements - Identify site hazards and identify appropriate personal protective equipment (PPE) and safety procedures - Record description of the job to be undertaken, compare with specification and report any variations - Arrange for the collection,	- Enlist methods of onsite operations - Explain procedure to interpret maps, site plans and drawings accurately Practical activity - Identify the site hazards and arrange for collection, checking, stowing and transport of all tools, equipment and materials required at the site	Theory-1 Hrs Practice-3 Hrs Total- 4 Hrs	PPEs Site exploration tools Site Exploration investigation equipment	Classroom and site area



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	checking, stowing and transport of all tools, equipment and materials required at the site • Ensure site access requirements,				
LU2. Arrange excavation of boreholes/test pits / trenches	Trainee will be able to: • Identify the sampling/testing location • Excavate to the sampling and testing depth, • Excavate materials from different strata and keep them separate • Identify materials and record changes of strata, test results and other relevant information • Terminate the excavation at the appropriate depth and record the reason for termination	• Enlist basic in situ tests and site measurements, including location and depth. • Define excavation • Explain procedure to record test results • Explain selection of materials Practical activity • Perform excavation of boreholes, test pits and/or trenches on site • Record termination of excavation on site and give reason for it	Theory-2 Hrs Practice-3 Hrs Total- 5 Hrs	PPEs Site exploration tools Site Exploration investigation equipment	Classroom and site area



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LU3. Conduct site sampling.	Trainee will be able to: • Prepare and check sampling equipment and materials • Take disturbed and undisturbed samples • Label and record samples • Recognize and record details of site conditions	• Name safety relevant tools, tackles, & requirement as per applicability. • Define disturbed and undisturbed samples • Explain procedure to record and label samples • Explain methods to identify record details of site conditions Practical activity • Obtain disturbed and undisturbed soil sample, label and record it and mention the site conditions	Theory-2 Hrs Practice-3 Hrs Total- 5 Hrs	PPEs Site exploration tools Site Exploration investigation equipment	Classroom and site area
LU4. Conduct testing.	Trainee will be able to: • Prepare and conduct pre-use checks of test equipment • Perform, or assist with performing, tests in accordance with test methods or workplace procedures • Record test data • Recognize obvious errors or atypical data and take appropriate corrective actions	• Explain procedure to conduct re-use check of test equipment • Explain testing procedures Practical activity Conduct bearing capacity and moisture content tests in lab	Theory-1 Hrs Practice-3 Hrs Total- 4 Hrs	PPEs Site exploration tools Site Exploration investigation equipment	Classroom and Lab



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LU5. Finalize site operations	Trainee will be able to: • Backfill or seal any excavation • Reinstate surfaces disturbed by sampling or testing • Clean all equipment (and vehicle, as necessary) • Check all equipment and materials prior to re-stowing them for safe transport • Handle and transport samples • Notify appropriate site personnel on completion of investigations and prior to leaving site • Check serviceability of test equipment before storage on return to base	• Explain backfilling of excavation • Define reinstate surfaces • Enlist equipment used • Explain method to handle transport samples • Describe site investigation techniques Practical activity • Backfill the excavated area, clean all the equipment and safely transport equipment and materials to re-stowing them.	Theory-1Hrs Practice-03Hrs Total- 4Hrs	PPEs Site exploration tools Site Exploration investigation equipment	Classroom and site area
LU6. Maintain Records	Trainee will be able to: • Maintain equipment records • Complete site safety plans, equipment logs and test reports • Maintain confidentiality of workplace information.	• Explain site safety points • Explain procedure to maintain workplace Practical activity • Maintain Records of complete site safety plans and logs.	Theory-1Hrs Practice-03Hrs Total- 4 Hrs	PPEs Site exploration tools Site Exploration investigation equipment	Classroom and site area



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LU7. Maintain a safe work environment.	Trainee will be able to: • Use safe work procedures and PPE to ensure personal safety and that of others • Minimize environmental impacts of testing/sampling and generation of waste • Collect and/or dispose of all waste in accordance with workplace procedures	• Enlist PPE'S • Explain methods to collect and dispose waste Practical activity • Maintain a safe work environment on site	Theory-1Hrs Practice-3Hrs Total- 4Hrs	PPEs Site exploration tools Site Exploration investigation equipment	Classroom and site area
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11.19.2 Supervise sampling, inspections and field testing at construction sites

Objective: This module covers the skills and knowledge required to Prepare for on-site operations, Establish on-site operations, Supervise materials placement, Analyze project data and report to client, Promote a safe work environment.

Duration: 38 Hours

Theory: 11 Hours

Practice: 27 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Prepare for on-site operations	Trainee will be able to: - Identify the job. - Select equipment and materials - Identify site hazards and the personal protective equipment (PPE) and safety procedures specified for job - Organize site induction for self and support personnel - Record description of the job to be undertaken, compare with specification and resolve any variations - Select suitable transport for site access - Brief support personnel on job-	- Explain principles of planning and project management - Explain procedure for the selection of equipment and materials required for the job - Enlist site hazards Practical activity Obtain information including drawings and specifications and record description of job with specification and resolve any variations on site	Theory-1Hrs Practice-3 Hrs Total- 4 Hrs	Notepad Pencil Eraser Sharpener Site exploration tools Site Exploration investigation equipment	Class room and site area



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	specific requirements				
LU2. Establish on-site operations	Trainee will be able to: - Determine methods of communication, roles, responsibilities and expectations of each party, including identification of potential site problems and conflicts - Set up facilities for supervision, testing and sample storage. - Inspect the site to determine the characteristics of the project, including survey control points - Design inspection, sampling and testing program in accordance with specifications	- Explain procedure to determine methods of communication roles, responsibilities and expectation of each party including site problems. - Explain engineering properties of civil construction materials - Techniques and plant and equipment used in civil construction relevant to job role Practical activity Perform surveying using theodolite on site. Collect, label and store the sample for laboratory testing	Theory-3 Hrs Practice-6 Hrs Total- 9 Hrs	PPEs Site exploration tools Site Exploration investigation equipment	Class room and site area
LU3. Supervise materials placement	Trainee will be able to: - Conduct inspection and direct sampling and testing - Direct site superintendent based on test results and	- Explain in situ and laboratory test methods for construction materials relevant to job. - Explain roles and responsibilities for	Theory-03Hrs Practice-06Hrs Total- 9 Hrs	PPEs Site exploration tools Site	Class room and site area



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	observations - Record test data and observations - Send samples to the base laboratory for testing - Ensure cleaning of equipment - Supervise the removal of equipment and materials from site	different levels of site supervision Practical activity Conduct site sampling and send to the laboratory for testing Inspect the cleaning of equipment and supervise the removal of equipment and materials from site		Exploration investigation equipment	
LU4. Analyze project data and report to client	Trainee will be able to: - Document site results - Maintain security and confidentiality of information - Report test results to site superintendent - Prepare and issue a final project report	- Explain typical site problems and recommended corrective actions. Practical activity - Analyze the tests results of lab to the supervisor and prepare final project report by adding tables and test results	Theory-03 Hrs Practice-06 Hrs Total- 9Hrs	PPEs Site exploration tools Site Exploration investigation equipment	Class room and Lab
LU5. Promote a safe work environment	Trainee will be able to: - Promote the use of safe work procedures and protective equipment - Minimise environmental impacts of testing/sampling and	- Explain environmental sustainability issues as they relate to the work task. - Explain legal, ethical and work health and safety (WHS) requirements specific to the work task including	Theory-1Hrs Practice- 6Hrs Total- 7 Hrs	PPEs Site exploration tools Site Exploration investigation	Class room and site area



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	generation of waste Promote the collection and disposal of all waste	traceability, confidentiality and security requirements of all client information, and laboratory data and records Practical activity Promote a safe work environment on site		equipment	
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11.19.3 Plan & conduct the inspection of construction materials, products & processes.

Objective: This module covers the skills and knowledge required to prepare plan for conducting inspection, Perform onsite inspection & sampling and prepare the inspection report.

Duration: 44 Hours

Theory: 8 Hours

Practice: 36 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Prepare plan for conducting inspection.	Trainee will be able to: - Identify the content or type of information to be collected during the inspection - Identify the need of needs of sampling and field testing. - Identify the set of equipment & tool - Identify potential site hazards - Prepare the inspection checklists - Submit the inspection document to relevant parties for consultation. - Determine the sequence of inspection operations	- Describe the inspection procedures - Enlist the specifications of product / process to be inspected and the production system - Identify the content or type of information to be collected during the inspection. - Describe the information relevant to inspection activities and work document preparation for recoding inspection results.	Theory-01Hrs Practice-09Hrs Total- 10Hrs	PPEs Site exploration tools Site Exploration investigation equipment	Class room and site area



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		Practical activity • Prepare plan on paper and conduct site inspection by site visit • Prepare site inspection checklists			
LU2. Perform on-site inspection & sampling.	Trainee will be able to: • Conduct physical inspection of processes & materials in accordance with the inspection plan. • Identify the defects and deficiencies in product & processes and record with evidence. • Perform test as per standard procedure for determining the physical properties of materials and product. • Collect the samples of materials & products for lab testing as per sampling procedure & rules. • Take photos/snaps of test sites and samples. • Record the results of tests in the sampling	• Describe the documentation and record system of the inspection body. • Describe different types of defect for inspection activities. • Explain the sampling plan and equipment requirements. Practical activity Perform physical test on soil including color, texture, structure, porosity, density, consistency and	Theory-05Hrs Practice-21Hrs Total- 26Hrs	PPEs Site exploration tools Site Exploration investigation equipment	Class room and site area



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	document - Record sample appearance, environmental conditions and any other factors that may impact on sample integrity - Pack and seal the sample & sub-samples in the presence of witnesses according to sampling rule and procedure - Label samples in accordance with traceability requirements. - Complete the sampling document; fill in the sample date, time, and weight/volume, sample ID, preservative used, sample location and sampler name etc. - Ensure activities at site are as per approved method statement such as material storage, tools & plants conditions, workmanship and safety measures etc. - Check the actions taken for rectification of snag list. - Record the non-compliance and expected breaches of contract in accordance with the policy of inspection body.	temperature. Collect label and store soil sample for lab testing. Take photographs of site and soil sample. Complete the sampling document; fill in the sample date, time, and weight/volume, sample ID, preservative used, sample location and sampler name. Record and preserve the obtained data.			
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	Record observation at site and preserve all data.				
LU3. Prepare the inspection report.	Trainee will be able to: - Ensure evidence of inspection observations and findings - Check calculations and data transfer accurately to ensure error-free in inspection results. - Verify the integrity of information supplied by other party as a part of the inspection process. - Apply appropriate statistical techniques to check the validity of inspection results - Collect and review the information relevant to inspection activities for recoding inspection results - Suggest the necessary corrective actions for tackling the identified problems and procedures for monitoring inspection results	- Explain statistical sampling techniques. - Explain the traceability requirements of inspection items and samples. - Describe different handling methods for inspection items and samples and procedures for monitoring inspection results. Practical activity Prepare the inspection report and submit it to supervisor.	Theory-2Hrs Practice-6Hrs Total- 8Hrs	PPEs Site exploration tools Site Exploration investigation equipment	Class room and site area



11.19.4 Assess construction faults in buildings

Objective: This module covers the skills and knowledge required to Identify and analyze construction faults on building sites up to three story's, Identify construction techniques, methods and materials nominated in relevant legislation in the Building codes and standard, Resolve construction faults in construction techniques and methods, Resolve construction faults using alternative construction methods and Resolve common on-site faults with building materials.

Duration: 16 Hours

Theory: 4 Hours

Practice: 12 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Identify construction faults on building sites	Trainee will be able to: - Collect information relating to the specific building construction problem. - Identify construction problem for the type of construction - Communicate construction faults to appropriate personnel and document it. - identify typical faults and problems and action to rectify is deemed to be in accordance with the Building codes.	- Explain specific building construction faults - Describe problem solving techniques Practical activity - Identify faulty doors, roof failure and foundation displacement with remedial measures on building sites up to three storeys.	Theory-01Hrs Practice-03 Hrs Total- 4 Hrs	PPEs Site exploration tools Site Exploration investigation equipment	Class room and site area



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LU2. Identify construction techniques, methods and materials for correcting faults.	Trainee will be able to: • Use building terminology accurately in the communication of issues. • Identify existing construction problems • Identify alternative methods and materials to correct construction faults. • Prepare detailed sketches of available alternative methods and materials available to meet	• Describe design and construction principles of buildings • Define building terminology Practical activity • Examine Pre-cast foundation technique and Insulating concrete form work technique on site. • Examine working drawings and specifications.	Theory-01Hrs Practice-03Hrs Total-4Hrs	PPEs Site exploration tools Site Exploration investigation equipment	Class room and site area
LU3. Correct construction faults in construction techniques and methods	Trainee will be able to: • Evaluate project working drawings and specifications identifying existing construction problems. • Prepare report identifying available alternative methods and materials to correct faults. • Prepare detailed sketches of available alternative methods and materials available	• Explain nature of materials and effect on performance Practical activity • Rectify construction faults by applying alternative methods on construction site • Prepare sketches of bricks, aggregates, wood and rocks on site	Theory-01Hrs Practice-03Hrs Total- 4Hrs	PPEs Site exploration tools Site Exploration investigation equipment	Class room and site area



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LU4. Correct on-site faults with building materials.	Trainee will be able to: • Evaluate commonly occurring on-site problems with building materials and their causes. • Identify and implement corrective and preventative measures	• Describe processes for the administration and preparation of documentation • Describe processes for the interpretation of reports, working drawings and specifications • Explain relevant federal, state or territory legislation and local government policy and procedures Practical activity • Evaluate chemical reaction, shrinkage and vegetation on site. • Implement corrective measures by providing dense concrete, use minimum water for mixing cement concrete mortar, and removal of any saplings in or near the walls of the building.	Theory-01Hrs Practice-3Hrs Total- 4 Hrs	PPEs Site exploration tools Site Exploration investigation equipment	Class room and site area
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11.19.5 Develop maintenance plan for roads

Objective: This module covers the skills and knowledge required to identify the defects in road and draft a management plan for road maintenance

Duration: 1 Hours

Theory: 7 Hours

Practice: 9 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Identify defects in road	Trainee will be able to: • Enlist defects in roads • Analyze causes of road defects • Draw sketches of defects in roads	• Explain defects liable to occur in road- corrugations, ruts, pot holes etc. Practical activity • Select a portion of a road and analyze pot holes, cracking, crazing and edge failure in roads on site	Theory-3 Hrs Practice-03 Hrs Total- 6 Hrs	Drafting Table, Drawing Tools Drawing Sheets	Class room and site area
LU2. Draft a management plan for road maintenance	Trainee will be able to: • Identify road location, design and construction requirements. • Check timeframe for use of the road and weather conditions. • Schedule personnel, material and equipment required for the construction • Prepare plan of operational procedures for roads. • Prepare plan for formal road	• Describe the causes of defects in concrete roadside-pot holes, corrugations and ruts. • Explain the remedial measures for defects- scraping of existing layers, patch repair, replacing with reinforced layers, resurfacing etc. • Describe the repair of defects of	Theory-4 Hrs Practice-06 Hrs Total- 10 Hrs	Drafting Table, Drawing Tools Drawing Sheets	Class room and Lab



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	construction/maintenance plan. • Identify roles of individuals in maintenance of roads • Propose positions for different roles • Draft hierarchy of organization • Propose roles according to positions for maintenance of roads	concrete road. • Describe recycling procedure for road used materials Practical activity • Draft road structure including earth formation, road pavement, road surface, road drainage, road formation, road signs and constructed pathways in lab.			
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11.20. Hydraulics Engineering

11.20.1 Determine Hydrostatic pressure

Objective: This module covers the skills and knowledge required to find pressure by pressure gauges, Hydrostatic pressure and center of pressure of vertically immersed surface.

Duration: 42 Hours

Theory: 15 Hours

Practice: 27 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Find pressure by Piezometer	Trainee will be able to: - Identify pressure gauges - Measure pressure by Piezometer	- Define density, specific weight, specific volume, specific gravity, surface tension, viscosity compressibility, cohesion, and adhesion. - State pressure, intensity of pressure, pressure head, Pascal's law and its simple applications. - Distinguish among atmospheric pressure, gauge pressure and absolute pressure. - Explain Piezometer gauge. Practical Activity: - Measure pressure by Piezometer.	Theory-4 Hrs Practice-6 Hrs Total- 10 Hrs	Pencil Rubber Sharpener Practical book Calculator Piezometer	Class + Lab



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LU2. Find pressure by manometer	Trainee will be able to: - Identify pressure gauge - Measure pressure by Manometer	- Define pressure gauges - Explain manometer gauge. Practical Activity: - Measure pressure by manometer.	Theory-2 Hrs Practice-3 Hrs Total- 5 Hrs	Pencil Rubber Sharpener Practical book Calculator manometer	Class + Lab
LU3. Find out Hydrostatic pressure and center of pressure on vertically Immersed surface.	Trainee will be able to: - Identify the apparatus - Immerse the apparatus in water tank - Apply the formulae for hydrostatic pressure and center of pressure. - Find the area of immersed surface - Find moment of inertia of the figure - Calculate hydrostatic pressure on surface - Find position of center of pressure	- Explain Hydrostatic pressure and center of pressure on vertically Immersed surface. - Define Hydrostatics - State pressure on immersed surface. - Define center of pressure and resultant pressure. - Define moment of inertia of the figure Practical Activity: - Calculate hydrostatic pressure on surface. - Find position of center of pressure.	Theory-3 Hrs Practice-6 Hrs Total- 9 Hrs	Pencil Rubber Sharpener Practical book Calculator Hydrostatic apparatus.	Class + Lab



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LU4. Find out discharge through a pipe with Pitot tube	Trainee will be able to: - Identify the instrument - Fix the Pitot tube with pipe - Measure height of liquid in the tube - Find the velocity by using formula. - Find the discharge by using formula	- Define Pitot tube - Explain the method of finding velocity by Pitot tube - Explain discharge through a pipe with Pitot tube. Practical Activity: - Find the velocity by using formula from given data - Find the discharge by using formula from given data	Theory-3 Hrs Practice-6 Hrs Total- 9 Hrs	Pencil Rubber Sharpener Practical book Calculator Water tank. Pilot tube.	Class + Lab
LU5. Find the Metacentric height of a floating body in Lab.	Trainee will be able to: - Identify the apparatus. - Put apparatus in water tank. - Place jokey weight to make the ship symmetrical. - Place the ship in water and adjust the plumb to zero mark. - Move jokey weight across deck to a specified distance. - Measure the angle of inclination.	- Define the terms, buoyancy, floatation, buoyant force and center of buoyancy - Define metacenter and metacentric height. - State the kinds of equilibrium of a floating body. - Explain Metacentric height of a floating body in Lab. Practical Activity: - Calculate the metacentric height of ship by formula.	Theory-3 Hrs Practice-6 Hrs Total- 9 Hrs	Pencil Rubber Sharpener Practical book Calculator Metacentric height apparatus Hydraulic bench	Class + Lab



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	• Calculate the metacentric height of ship by formula.	• Calculate the metacentric height of ship model in lab			
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11.20.2 Apply Hydro kinematic Principles

Objective: This module covers the skills and knowledge required to determine coefficient of discharge using venture meter, to calculate energy losses in pipe flow Determine hydraulic Co-efficient for circular orifices Calculate hydraulic and energy gradient for pipelines. Calculate flow in open channels. Calculate flows through notch Calculate flows through weirs.

Duration: 54 Hours

Theory: 21 Hours

Practice: 33 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Determine coefficient of discharge using venturi meter.	Trainee will be able to: - Check dimensions of venturi meter and water tank. - Observe piezometric readings at inlet and throat - Open inlet valve and take piezometer readings - Measure the head. - Calculate actual discharge. - Calculate theoretical discharge. - Calculate the coefficient of discharge using formulae.	- Define hydro kinematics - State discharge and equation of continuity of a liquid flow. - Distinguish the type of flow in pipes i.e. steady and unsteady flow, uniform and non-uniform flow, turbulent flow. - State the term thermodynamics - Describe Bernolli,s theorm - Describe method of finding coefficient of discharge using venturi meter. Practical Activity: - Measure the head. - Calculate actual discharge.	Theory-3 Hrs Practice-6 Hrs Total- 9 Hrs	Pencil Rubber Sharpener Practical book Calculator Venturi meter	Class + Lab



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		• Calculate theoretical discharge. • Calculate the coefficient of discharge using formulae.			
LU2. Calculate energy losses in pipe flow.	Trainee will be able to: • Identify the apparatus. • Open valve and pass water through pipe. • Check piezometric readings • Draw hydraulic grade line.	• State the energies of liquid in motion. • State the total head of flowing liquid and total energy. • Describe energy losses in pipe flow. • Explain the major and minor losses of head of water flowing through pipes. Practical Activity: • Calculate energy losses in pipe flow.	Theory- 3 Hrs Practice-6 Hrs Total- 9 Hrs	Pencil Rubber Sharpener Practical book Calculator Friction in pipes apparatus.	Class + Lab
LU3. Determine hydraulic Co-efficient for circular orifices	Trainee will be able to: • Identify the orifice and adjust with the apparatus • Set constant head in the tank • Measure horizontal and vertical coordinates • Find actual discharge by	• Define orifice • State types of orifices • Explain method of Determining hydraulic Co-efficient for circular orifices. • Derive formulae for discharge through orifices • Differentiate between orifice and	Theory-3 Hrs Practice-6 Hrs Total- 9 Hrs	Pencil Rubber Sharpener Practical book Calculator Orifices	Class + Lab



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	using a container and stop watch • Use formulae to calculate coefficient of velocity and discharge	mouth piece. Practical Activity: • Determine hydraulic Co-efficient for circular orifices			
LU4. Calculate hydraulic and energy gradient for pipe lines.	Trainee will be able to: • Prepare pipeline design charts using standard formulae. • Identify the limitations of formulae. • Identify variations in roughness coefficients. • Calculate the pressure in pipeline systems using the hydraulic gradient line. • Calculate the pipe discharge from reservoirs.	• Explain Bernoulli's theorem with its formula, limitations and practical application i.e., venture meter & Pitot tube. • Understand the Flow Through Pipes. • State and explain difference between flow through pipes and open channel flow • Explain method of Determining hydraulic and energy gradient for pipe lines. Practical Activity: • Determine hydraulic and energy gradient for pipe lines.	Theory-3 Hrs Practice-6 Hrs Total- 9 Hrs	Pencil Rubber Sharpener Practical book Calculator Hydraulic bench	Class + Lab



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LU5. Calculate flow in open channels.	Trainee will be able to: - Identify methods used for measuring flows in open channels. - Identify instruments to be used - Use formulae for calculating flows in open channels. - Find the velocity by current meter and velocity rod - Find discharge.	- State Chezy's, Manning & s Bazin's formulae for discharge through open channel. - State most economical section of channel and condition for maximum discharge through channel. Practical Activity: - Calculate flow in open channels.	Theory-3 Hrs Practice-3 Hrs Total- 6 Hrs	Pencil Rubber Sharpener Practical book Calculator Hydraulic bench	Class + Lab
LU6. Calculate flows through Vee and Trapezoidal Notch.	Trainee will be able to: - Identify the methods used for measuring flows in notches. - Calculate area of notch. - Measure head of water over the notch. - Use the formulae for calculating flow in notches.	- Define notch - State types of notches - State the discharge formulae for notches. - State discharge through rectangular & trapezoidal channel section and their formulae. - State the flow through open channels. Practical Activity: - Calculate flows through Vee and	Theory-3 Hrs Practice-3 Hrs Total- 6 Hrs	Pencil Rubber Sharpener Practical book Calculator Vee and trapezoidal notches Hydraulic bench	Class + Lab



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		Trapezoidal Notch.			
LU7. Calculate flows through weirs	Trainee will be able to: - Identify the methods used for measuring flows in notches. - Calculate area of weirs - Measure head of water over the weirs - Use the formulae for calculating flow in weirs	- Define weir - State types of weirs - Differentiate sharp crested and broad crested weirs. - State the discharge formulae for weirs. Practical Activity: - Calculate flows through weirs	Theory-3 Hrs Practice-3 Hrs Total- 6 Hrs	Pencil Rubber Sharpener Practical book Calculator weirs Hydraulic bench	Class + Lab



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11.21. Lab Management

11.21.1 Plan and organize the laboratory work.

Objective: This module covers the skills and knowledge required to carry out Pre-planning phase pertaining to Laboratories Works, Work in a team environment, Plan work activities to achieve desired results, organize work to meet the expected outcome, Maintain the Lab documents.

Duration: 28 Hours

Theory: 10 Hours

Practice: 18 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Pre-planning phase pertaining to Laboratories Works	Trainee will be able to: - Identify the Scope of Laboratory works - Identify the ISO Quality standards - Recognize Quality goals of lab - Identify the Quality Standards for the particular tests within the Scope of Lab works. - Recognize the requirements stipulated within the standards to perform the test, Like Equipment,	- Explain the Quality - Explain the Scope of work of Laboratory - Define the ISO, Quality Standards - Explain the Quality objectives - Formulate Policies, procedures and work targets set by superiors	Theory-02Hrs Practice-03Hrs Total- 05Hrs	specific lab sheet/ document	Class Room and Lab



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	personals, lab facilities, Storage capacity and report writing. • Prepare SOP's in accordance with the identified requirements. • Prepare the process flow diagram in order to achieve Quality outcome.	Practical Activity Prepare a complete plan as per standards to perform the test - lab facilities, equipment personal and storage capacity.			
LU2. Work in a team environment	• Congregate the appropriate technical and administrative team as per the identified requirements. • Communicate the Standards and requirements to the team members. • Arrange the facilities of team member's Capacity development and training. • Organize all obligatory facilities in lab, Equipment, storage area and Calibration of equipment as per the required standards. • Provide guidance to the subordinates to obtain desired outcome. • Cooperate with team members to negotiate and achieve agreed outcomes, timelines and priorities	• Formulate Policies, procedures and work targets set by superiors. • Assign Roles and responsibilities in executing the work for subordinates and self. • Explain Standard practices of work to be adopted for assigned task • Explain the Importance of effective communication and establishing strong working relationships with co-workers. Practical Activity • Make Calibration of equipment	Theory-02Hrs Practice-03Hrs Total- 05Hrs	specific lab sheet/ document	Class Room and Lab



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	- Recognize personal abilities and limitations when undertaking team tasks - Confirm personal role and responsibility within the team for particular outputs - Recognize the sensitivity to the diversity of other team members' backgrounds and beliefs.	as per the standard and develop a work sequence to achieve agreed outcomes.			
LU3. Plan work activities to achieve desired results	- Clarify allocated work targets and timelines set by superiors. - Prepare Break down work of activities into small achievable components and efficient sequences - list and arrange required resources prior to commencement of work - Identify the areas of work which could result in a delay of work, wastage of material or damage to tools. - Allocate appropriate responsibility to appropriate team member to avoid conflicts. - Review work plan in response to new	- Explain the usage of available resources in a judicious and appropriate manner to minimize wastages or damage. - Explain the Importance of effective communication and establishing strong working relationships with co-workers. Practical Activity - Prepare Work plan activities to achieve desired results.	Theory-02Hrs Practice-03Hrs Total- 05Hrs	Specific lab sheet/ document	Class Room and Lab



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	information, urgent requests, changed situations or instructions from appropriate personnel plan housekeeping activities prior to and post completion of work				
LU4. Organize work to meet the expected outcome.	- Select and check the working conditions of required tools and equipment for completion of desired work. - Follow prescribed and routine work-related sequences & procedures. - Use resources in an optimum manner to avoid any unnecessary wastage - Record completion of activities to confirm outputs in accordance with plan. - Seek assistance from relevant personnel when difficulties cannot be handled	- Access and Explain the Effects in case of failure relating to quality, timelines, safety, risks at the construction project site. - Explain the Importance and need of supporting co-workers facing problems for smooth functioning of work - Explain the laboratory's business goals, key performance indicators (KPIs), organizational structure, delegations and responsibilities Practical Activity Plan and organize the work activities to meet the expected out comes.	Theory-02Hrs Practice-03Hrs Total- 05Hrs	Specific lab sheet/ document	Class Room and Lab



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LU5. Maintain the Lab documents.	- Record data and observations in the specific lab sheet/document. - Prepare the technical/administrative records and test reports in the specified lab format/sheets in accordance with workplace procedures. - Perform coding of lab sheets/document. - Maintain the confidentiality of lab document in accordance with lab policy.	- Develop Standard operating procedures (SOPs) relevant to the laboratory's operations and scope of testing. - Importance of confidentiality of Lab documents. Practical Activity - Analyze and rectify the areas of work which could result in a delay of work, wastage of material or damage to tools and tackles	Theory-02Hrs Practice-06Hrs Total- 08Hrs	Specific lab sheet/document	Class Room and Lab
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11.21.2 Implement laboratory quality control procedures.

Objective: This module covers the skills and knowledge required to carry out **Satisfy quality control requirements in daily lab work**, Maintain quality control documents as per Quality Management System, Monitor the reliability & validity of tests results.

Duration: 48 Hours

Theory: 18 Hours

Practice: 30 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Satisfy quality control requirements in daily lab work	Trainee will be able to: • Ensure right test sample is selected for testing as per tagging/coding/numbering. • Ensure instrument, equipment used for tests are calibrated as per schedule of calibration. • Ensure all tools, apparatus, instrument and equipment are available in the laboratory and are in proper working condition. • Ensure test instrument attachments & gauges are adjusted and loads & load pausing are applied for required test as per manufacturer's guideline	• Explain the difference between Quality assurance and Quality Control. • Describe the first step in quality control. Practical Activity • Organize Implement quality control procedures by selecting monitoring methods. • Plan satisfy quality control requirements in daily lab work.	Theory-06Hrs Practice-12Hrs Total- 18Hrs	Standard test Performa Pencil Eraser Sharpner Calculator	



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	conforming to the standards for testing. • Ensure dial readings are recorded in a test register as shown by the test instruments in standard test Performa. • Ensure extracted test sample of soil and bitumen, concrete cubes casted in field are transferred undisturbed to site laboratory. • Carry out inspection and checking for all quality related procedures in the site and ensures activity at site are as per approved method statement and inspection test plan. • Conduct work in accordance with sustainable work practices. • Promote sustainability principles and standard work practices to other workers.				
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LU2. Maintain quality control documents as per Quality Management System	- Follow standard procedure for maintenance of Quality Control documents in laboratory. - Provide suitable codes and title to the documents file as per the site quality plan of documentation. - Maintain Quality Control documents such as method statements, standard testing procedures, site quality plans, site inspection checklist, sample register, test results, test certificates, inspection requests, non-compliance report and site instruction/observations etc. - Maintain document related to test equipment manual, ISO quality manual and equipment calibration reports etc. - Maintain current records providing factual evidence that required quality control activities and/or tests have been performed	- Describe concept and method of maintenance of register, documentation of method statements, quality plans inspection checklist, test report, bad workmanship in site. - Describe standard method for tagging/coding/numbering on test sample - Explain standard method for sampling and different types of field test for construction materials. Practical Activity Prepare documentation of method statements, quality plans inspection checklist and test.	Theory-06Hrs Practice-9Hrs Total- 15Hrs	Pencil Eraser Sharpner Calculator	
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LU3. Monitor the reliability & validity of tests results.	- Record quality control data in accordance with quality system. - Select monitoring methods appropriate for the type and volume of the work undertaken. - Detect the trends in testing activities by use of quality control procedures, such as: control charts, analyzing certified reference materials & repeatability from replicatetests etc. - Apply statistical techniques to determine data acceptability. - Identify potential causes for unacceptable results and nonconformities. - Suggest necessary actions to correct the problem and prevent incorrect results from being reported.	- Describe the implementation plan of the formulated quality control protocol. - Describe the procedure of accreditation and regulatory requirements relating to quality objectives. - Describe the Outline of statistical techniques for analyzing quality control data. Practical Activity - Collect and analyses all necessary data / documentation / records in quality control to identify unacceptable results and nonconformities by using statistical techniques for improving quality.	Theory-06Hrs Practice-9Hrs Total- 15Hrs	Pencil Eraser Sharpner Calculator	
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11.21.3 Analyze data and report results

Objective: This module covers the skills and knowledge required to carry out **Perform scientific calculations, analyze trends and relationships in data, Determine variation and/or uncertainty in data distributions, Assess the quality of data/results, Report results.**

Duration: 72 Hours

Theory: 27 Hours

Practice: 45 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Perform scientific calculations	Trainee will be able to: • Ensure test data are consistent with expectations and reasonable ranges • Calculate scientific quantities involving algebraic, power, exponential and/or logarithmic functions • Ensure calculated quantities are consistent with estimations • Present results using the appropriate units, uncertainties and number of significant figures	• Describe relevant scientific and technical terminology of data and observations to be interpreted. • Describe principles, application and mathematical equations of statistical calculations such as mean, median, mode, range, variance, standard deviation, measures of central tendency, dispersion, frequency and probability. Practical Activity Perform scientific calculations by Computing the standard deviation, variance, mean, sum, and error margin of a given data.	Theory-07Hrs Practice-09Hrs Total- 16Hrs	Pencil, Eraser, Sharpner, Calculator	



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LU2. Analyze trends and relationships in data	Trainee will be able to: • Determine linear and non-linear relationships between sets of data • Prepare control charts to determine if a process is in control. • Identify possible causes for out-of-control condition • Interpret the trends of test results by examining the control charts.	• Explain pareto diagram • Explain process flow diagram • Explain pie chart. • Explain Cause and effect diagram • Explain Cause and effect diagram • Explain Check sheets • Explain Scatter diagram • Explain Histogram Practical Activity Analyzes the frequency of problems or causes in a process by pareto chart / diagram from given test results.	Theory-05Hrs Practice-09Hrs Total- 14Hrs	Pencil, Eraser, Sharpner, Calculator	
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LU3. Determine variation and/or uncertainty in data distributions	Trainee will be able to: - Organise raw data into appropriate frequency distributions. - Calculate means, medians, modes, ranges and standard deviations for ungrouped and grouped data. - Interpret frequency distributions to determine the characteristics of the data. - Estimate the uncertainty in measurements using statistical analysis.	- Explain Normal Curve, Upper Control limit, Lower Control Limit. - Explain central deviation and central deviation formula - Explain and use graphical analysis of laboratory data; Practical Activity - Determine standard deviations and uncertainty in data distribution.	Theory-05Hrs Practice-09Hrs Total- 14Hrs	Pencil, Eraser, Sharpner, Calculator	
LU4. Assess the quality of data/results	Trainee will be able to: - Analyze data trends and results for blanks, duplicates and/or check samples to detect systematic uncertainties - Determine data acceptability using statistical tests and documented procedures. - Check that estimations of uncertainties are reasonable and	- Determination of linear, logarithmic, exponential and power relationships - Regression lines and interpretation of correlation coefficients - Preparation and interpretation of linear, semi-log and log-log graphs Practical Activity	Theory-05Hrs Practice-09Hrs Total- 14Hrs	Pencil, Eraser, Sharpner, Calculator	



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	• consistent with test method & specification requirements • Identify results that cannot be reconciled with technical records/normal ranges.. • Identify results that cannot be reconciled with sample, sample documentation and testing procedures. • Conclude valid test results by exercising appropriate judgment and evaluate the compliance of results against test standards, test methods or specifications.	Assess the quality of data / results and determine data acceptability using statistical tests and documented procedures.			
LU5. Report results	Trainee will be able to: • Use charts, tables and graphs to present results in the required format • Verify that entry of data and results are correct • Prepare reports and records in a format and style consistent with	• Preparation of frequency distributions for given data • Preparation of complex control charts. Practical Activity Prepare test results by exercising appropriate Interpret the trends of test results by examining the control charts judgment and evaluate the	Theory-05Hrs Practice-09Hrs Total- 14Hrs		



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	their intended use and workplace guidelines. • Communicate results within the specified time and in accordance with workplace confidentiality and security guidelines.	compliance of test results against relevant specifications of test standards.			
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11.21.4 Apply quality system and continuous improvement processes

Objective: This module covers the skills and knowledge required to Satisfy quality system requirements in daily work, Analyze opportunities for corrective and/or optimization action, Recommend corrective and/or optimization actions, Participate in the implementation of recommended actions and Participate in the development of continuous improvement strategies

Duration: 28 Hours

Theory: 10 Hours

Practice: 18 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Satisfy quality system requirements in daily work	Trainee will be able to: • Access information on quality system requirements for own job function • Record and report quality control data in accordance with quality system. • Follow quality control procedures to ensure products or data are of a defined quality as an aid to acceptance or rejection. • Recognize and report non-conformances or problems • Conduct work in accordance with sustainable work practices. • Promote sustainability principles and work practices to other workers.	• Explain the Quality PDCA Cycle diagram. (Plan, Do, Check and Act). • Explain Process improvement. • Explain fish bone diagram. • Describe, how systems and procedures support continuous improvement • Describe Adaptability of the improved process. • Explain the principles of continuous improvement • Explain the method to implement continuous improvement Practical Activity • Perform activity PDCA of a specific problem of a lab to Satisfy quality	Theory-02Hrs Practice-03Hrs Total- 05Hrs	Pencil Calculator paper	Class Room and Lab



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		system requirements in daily work			
LU2. Analyse opportunities for corrective and/or optimisation action	Trainee will be able to: - Compare current work practices, procedures and process or equipment performance with requirements and/or historical data or records - Recognise variances that indicate abnormal or sub-optimal performance - Collect and/or evaluate batch and/or historical records to determine possible causes for sub-optimal performance. - Use appropriate quality improvement techniques to rank the probabilities of possible causes.	- Explain the Importance of staff involvement and training to sustain the process - Identify external opportunity and threats and setting the bench mark to improve the internal process. - Identify external opportunity and threats and setting the bench mark to improve the internal process. Practical Activity - Prepare a comparative statement of current work practices, procedures and process or equipment performance with requirements and/or historical data or records. Recognize variances that indicate abnormal or sub-optimal performance.	Theory-02Hrs Practice-03Hrs Total- 05Hrs	Pencil Calculator paper	Class Room and Lab
LU3. Recommend corrective and/or optimisation actions	Trainee will be able to: Analyse causes to predict likely impacts of changes and decide on the	- Describe Language skills, Literacy skills, Numeracy skills - Explain Basics of statistics - State the importance of Employment	Theory-02Hrs Practice-03Hrs Total- 05Hrs	Pencil Calculator paper	Class Room and Lab



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	appropriate actions - Identify required changes to standards and procedures and training. - Report recommendations to designated personnel	skills enhancement that are essential to performance. Practical Activity Make recommendations corrective and/or optimisation actions by Analysing the causes to predict likely impact of changes and decide on the appropriate action sand to apply corrective actions to optimise procedures of lab for quality enhancement.			
LU4. Participate in the implementation of recommended actions	Trainee will be able to: - Implement approved actions and monitor performance following changes to evaluate results - Implement changes to systems and procedures to eliminate possible causes	- Explain Oral communication skills to interact effectively with others. - Explain the importance of senior leadership engagement and support to improve the Process Practical Activity Prepare an action Plan and Status of Implementation of Recommendations contained in the report of an external evaluation.	Theory-02Hrs Practice-03Hrs Total- 05Hrs	Pencil Calculator paper	Class Room and Lab



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LU5. Participate in the development of continuous improvement strategies	Trainee will be able to: • Review all relevant features of work practice to identify possible contributing factors leading to sub-optimal performance • Identify options for removing or controlling the risk of sub-optimal performance • Assess the adequacy of current controls, quality methods and systems • Identify opportunities to continuously improve performance • Develop recommendations for continual improvements of work practices, methods, procedures and equipment effectiveness • Consult with appropriate personnel to refine recommendations before implementation of approved continuous improvement strategies • Document outcomes of continuous improvement strategies and	• Explain Knowledge related to performance criteria. • Explain fish bone diagram to asses problem statement. Practical Activity Find out problem statement of a lab by using fish bone diagram and gap analysis of the problem statement.	Theory-02Hrs Practice-06Hrs Total- 8Hrs	Pencil Calculator paper	Class Room and Lab
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	communicate them to relevant personnel.				
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11.22. Inspection and Testing of Concrete Structures

11.22.1 Perform NDT by rebound hammer and Rebar Detector tests

Objective: This module covers the skills and knowledge required to Carry out initial preparatory activities, Perform non-destructive test by rebound hammer, Perform Rebar Detector test (NDT) for steel reinforcement and Maintain a safe work and environments

Duration: 15Hours

Theory: 3 Hours

Practice:12 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Carry out initial preparatory activities.	Trainee will be able to: - Interpret test request to confirm samples to be tested, the test method and equipment involved - Identify hazards associates with the sample preparation, test methods, reagents and equipment. - Collect required equipment and materials - Identify faulty or unsafe components and equipment and report to appropriate personnel - Check calibration status of instruments and report any out-of-	- Explain the factor influencing concrete properties - Describe non-destructive tests - Explain different methods of mix design, transportation of fresh concrete it's placing and compaction. - Define concrete reinforcement - Explain typical reinforcement of beam, columns and slab Practical activity Carry out initial preparatory activities for NDT in lab.	Theory-1Hrs Practice-3Hrs Total- 4Hrs	File	Class room and lab



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	calibration items to appropriate personnel. Plan task sequences for optimum efficiency				
LU2. Perform non-destructive test by rebound hammer	Trainee will be able to: - Calibrate rebound hammer. - Select smooth, clean and dry surface rub off the rough surface. - Locate the points of observation. (The point of impact should be at least 20 mm away from any edge or shape discontinuity.) - Set Rebound Hammer vertical to the surface. Conduct the test horizontally on vertical surfaces or vertically upwards or downwards on horizontal surfaces. - Push hammer on surface. - Release the hammer and record the rebound number. Take six readings of rebound indices at each point of observation, - Find the compressive strength from	- Description of use of rebound hammer. - Description of rebound number and strength. Practical activity Perform non-destructive test by rebound hammer on columns and roof slab in lab.	Theory-.5Hrs Practice-3Hrs Total-3.5Hrs	Rebound hammer. File set Safety glasses	Class room and lab



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	graph.				
LU3. Perform Rebar Detector test (NDT) for steel reinforcement	Trainee will be able to: • Select apparatus. • Operate the instrument on required surface. • Detect the steel its spacing and position.	• Explain the use of rebar detector. • Explain the test procedure Practical activity Perform Rebar Detector test (NDT) for steel reinforcement on roof slab in lab.	Theory-.5Hrs Practice-3Hrs Total-3.5Hrs	locator Thread/ rope Measureme nt tape File set Plumb bob Safety glasses	Class room and lab
LU4. Maintain a safe work and environments	Trainee will be able to: • Use PPEs and apply safe work practices • Rehabilitate sampling site and Minimize generation of wastes • Collect waste material • Dispose waste Material in accordance with environmental/ quarantine requirements and workplace procedures • Clean the equipment • Check serviceability of equipment before storage	Practical activity Maintain a safe work and environments in lab.	Theory-1Hrs Practice-3Hrs Total-4hrs	Cleaning tools	



11.22.2 Perform Ultrasonic pulse velocity and Penetration Tests (Windsor Probe)

Objective: This module covers the skills and knowledge required to Carry out initial preparatory activities, Perform Ultrasonic pulse velocity, Perform Penetration Test (Windsor Probe) and Maintain a safe work and environments

Duration: 14Hours

Theory: 3 Hours

Practice: 11 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Carry out initial preparatory activities.	Trainee will be able to: • Interpret test request to confirm samples to be tested, the test method and equipment involved • Identify hazards associates with the sample preparation, test methods, reagents and equipment. • Collect required equipment and materials • Identify faulty or unsafe components and equipment and report to appropriate personnel • Check calibration status of instruments and report any out-of-calibration items to appropriate personnel. • Plan task sequences for optimum efficiency	• Explain the factor influencing concrete properties • Describe non-destructive tests • Explain concrete reinforcement • Explain typical reinforcement of beam, columns and slab Practical activity Carry out initial preparatory activities in lab.	Theory-1Hrs Practice-3Hrs Total-4Hrs	File set	Class room and lab



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LU2. Perform Ultrasonic pulse velocity	Trainee will be able to: • Select apparatus. • Determine the most suitable test points on the material to be tested, make careful measurement of the path length 'L'. • Apply coolant to the surfaces of the transducers and press it hard onto the surface of the material. • Take the reading and do not move the transducers while a reading is being taken. (Continue holding the transducers onto the surface of the material until a consistent reading appears on the display) • Calculate pulse velocity through formula. • Interpret results to check quality of concrete	• Describe the Specifications for the test. • Introduction to ultrasonic pulse velocity meter • Describe the mechanism of test. Practical activity Perform Ultrasonic pulse velocity test on concrete samples (1:1:2) , (1:2:4) , (1:4:8) in lab.	Theory-1Hrs Practice-3Hrs Total-4Hrs	Ultrasonic pulse velocity meter Sand paper	Class room and lab
LU3. Perform Penetration Test (Windsor Probe)	Trainee will be able to: • Select the surface for test • Load the driver with a power load and probe suited for the type of concrete being examined. • Place the driver firmly on the actuating template and fire	• Describe the specification for the test. • Define penetration test. • Define windser probe Practical activity Perform Penetration Test (Windsor Probe) on	Theory-1Hrs Practice-3.5Hrs Total-4.5Hrs	Windse or probe Steel probes Measuring unit Safety glasses PPEs	Class room and lab



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	• Use locating template to locate the probes • Take three measurements • Compute the results	concrete samples (1:1:2), (1:2:4), (1:4:8) in lab.			
LU4. Maintain a safe work and environments	Trainee will be able to: • Use PPEs and apply safe work practices • Rehabilitate sampling site and Minimize generation of wastes • Collect waste material • Dispose waste Material in accordance with environmental/ quarantine requirements and workplace procedures • Clean the equipment • Check serviceability of equipment before storage	Practical activity Maintain a safe work and environments in lab.	Theory-0Hrs Practice-1.5Hrs Total-1Hrs	Cleaning tools	



11.22.3 Perform NDT Pull out Test and Profometer test

Objective: This module covers the skills and knowledge required to Carry out initial preparatory activities, Perform Pull out Test, Perform Profometer test and Maintain a safe work and environments.

Duration: 14Hours

Theory: 2 Hours

Practice: 12 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Carry out initial preparatory activities.	Trainee will be able to: - Interpret test request to confirm samples to be tested, the test method and equipment involved - Identify hazards associates with the sample preparation, test methods, reagents and equipment. - Collect required equipment and materials - Identify faulty or unsafe components and equipment and report to appropriate personnel - Check calibration status of instruments and report any out-of-calibration items to appropriate personnel. - Plan task sequences for optimum	- Explain the factor influencing concrete properties - Describe non-destructive tests - Explain different methods of mix design, transportation of fresh concrete it's placing and compaction. - Introduction to typical reinforcement of beam, columns and slab Practical activity Carry out initial preparatory activities in lab.	Theory-1Hrs Practice-3Hrs Total-4Hrs	PPEs File	Class room and lab



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	efficiency				
LU2. Perform Pull out Test	Trainee will be able to: • Select apparatus. • Select the surface for test • Fix the apparatus on the surface with inserts in it. (the inserts may be cast in place or drilled in groove) • Apply force of hydraulic jack to pull out embedded insert. • Perform four pull out test in each location. • Calculate the tensile strength. • Compute the compressive strength	• Explain Methods to put inserts for pull out test • Explain Use of hydraulic jack • Explain concrete reinforcement • Explain the test procedure for pull out test and specification Practical activity Perform Pull out Test on concrete samples (1:1:2), (1:2:4) , (1:4:8) in lab.	Theory-.5Hrs Practice-3Hrs Total-3.5Hrs	Hydraulic jack Inserts Pull out apparatus Measurement tape Safety glasses G. I. Tray File set	Class room and lab
LU3. Perform Profometer test	Trainee will be able to: • Select specimen • Select the testing equipment and accessories • Adjust the profometer tester • Determine steel bar location • Move the tester cables on the concrete surface for scanning of rebars measuring the spacing	• State Introduction to Profometer test and test procedure Practical activity Perform Profometer test concrete floor slab / concrete column in lab.	Theory-.5Hrs Practice-3Hrs Total-3.5Hrs	PPEs File Profometer Thread/rope Colour marker/ chalk	Class room and lab



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	• Measure bar diameter • Find the location of the rebar • Place the diameter probe on the bar parallel to the bar axis • Calculate the diameter of the bar by taking mean of four readings • Determine concrete cover • Use depth probe of the profometer to measure the cover • Place the depth probe above rebar • Observe the audio signal • Measure the concrete cover stored in memory				
LU4. Maintain a safe work and environments	Trainee will be able to: • Use PPEs and apply safe work practices • Rehabilitate sampling site and Minimize generation of wastes • Collect waste material • Dispose waste Material in accordance with environmental/ quarantine requirements and workplace	• Describe the maintenance of equipment Practical activity Maintain a safe work and environments in lab.	Theory-0Hrs Practice-3Hrs Total-3Hrs	Cleaning tools	Class room and lab



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	procedures • Clean the equipment • Check serviceability of equipment before storage				
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11.22.4 Perform NDT by rebound hammer and Rebar Detector on RCC bridges

Objective: This module covers the skills and knowledge required to Carry out initial preparatory activities, Perform non-destructive test by rebound hammer, Perform Rebar Detector test (NDT) for steel reinforcement and Maintain a safe work and environments

Duration: 12Hours

Theory: 2 Hours

Practice:10 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Carry out initial preparatory activities.	Trainee will be able to: - Interpret test request to confirm samples to be tested, the test method and equipment involved - Identify hazards associates with the sample preparation, test methods, reagents and equipment. - Collect required equipment and materials - Identify faulty or unsafe components and equipment and report to appropriate personnel - Check calibration status of instruments and report any out-of-calibration items to appropriate personnel.	- Explain the types of bridges. - Describe the bridge elements. - Explain the factor influencing concrete properties - Describe non-destructive tests - Explain different methods of mix design, transportation of fresh concrete it's placing and compaction. - Introduction to concrete reinforcement - Introduction to typical reinforcement of beam, columns and slab Practical activity	Theory-1Hrs Practice-2.5Hrs Total- 3.5Hrs	File	Class room and lab



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	Plan task sequences for optimum efficiency	Carry out initial preparatory activities for NDT in lab.			
LU2. Perform non-destructive test by rebound hammer	Trainee will be able to: - Calibrate rebound hammer. - Select smooth, clean and dry surface. - Rub off the rough surface. - Locate the points of observation. (The point of impact should be at least 20 mm away from any edge or shape discontinuity.) - Set Rebound Hammer vertical to the surface. Conduct the test horizontally on vertical surfaces or vertically upwards or downwards on horizontal surfaces. - Push hammer on surface. - Release the hammer and record the rebound number. Take six readings of rebound indices at each point of observation, - Find the Compressive strength from graph.	- Define compressive strength - Explain the relation between rebound number and strength - Enlist procedure for rebound hammer test - Enlist difference between rebound hammer test and rebar detector test Practical activity Perform non-destructive test by rebound hammer on rcc bridge.	Theory-0.5Hrs Practice-3Hrs Total-3.5Hrs	Rebound hammer. File set Safety glasses	Class room and lab



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LU3. Perform Rebar Detector test (NDT) for steel reinforcement	Trainee will be able to: - Identify the apparatus. - Operate the instrument on required bridge surface. - Detect the steel its spacing and position.	- Explain the use of rebar detector. - Explain procedure of rebar detector Practical activity Perform Rebar Detector test (NDT) for steel reinforcement on rcc bridge.	Theory-0.5Hrs Practice-3Hrs Total-3.5Hrs	Rebar locator Colour marker/ chalk Rope/ thread Measurement tape File set Plumb bob PPEs	Class room and lab
LU4. Maintain a safe work and environments	Trainee will be able to: - Use PPEs and apply safe work practices - Rehabilitate sampling site and Minimize generation of wastes - Collect waste material - Dispose waste Material in accordance with environmental/ quarantine requirements and workplace procedures - Clean the equipment - Check serviceability of equipment before storage	Practical activity Maintain a safe work and environments in lab.	Theory-0Hrs Practice-1.5Hrs Total-1.5hrs	Cleaning tools	



11.22.5 Perform Ultrasonic pulse velocity and Penetration Tests (Windsor Probe) on concrete bridges

Objective: This module covers the skills and knowledge required to Carry out initial preparatory activities, Perform Ultrasonic pulse velocity, Perform Penetration Test (Windsor Probe) and Maintain a safe work and environments

Duration: 12Hours

Theory: 3 Hours

Practice: 9 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Carry out initial preparatory activities.	Trainee will be able to: - Interpret test request to confirm samples to be tested, the test method and equipment involved - Identify hazards associates with the sample preparation, test methods, reagents and equipment. - Collect required equipment and materials - Identify faulty or unsafe components and equipment and report to appropriate personnel - Check calibration status of instruments and report any out-of-calibration items to appropriate personnel.	- Explain the types of bridges. - Describe the bridge elements - Explain the factor influencing concrete properties - Describe nondestructive testing. - Explain different methods of mix design, transportation of fresh concrete it's placing and compaction. - Introduction to typical reinforcement of beam, columns and slab Practical activity	Theory-2Hrs Practice-3Hrs Total-5Hrs	File set	Class room and lab



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	Plan task sequences for optimum efficiency	Carry out initial preparatory activities in lab.			
LU2. Perform Ultrasonic pulse velocity	Trainee will be able to: - Identify apparatus. - Calibrate the ultrasonic pulse velocity tester. - Determine the most suitable test points on the bridge to be tested, make careful measurement of the path length 'L'. - Apply couplant to the surfaces of the transducers and press it hard onto the surface of the bridge. - Take the reading and Do not move the transducers while a reading is being taken. (Continue holding the transducers onto the surface of the material until a consistent reading appears on the display) - Calculate pulse velocity through formula. - Interpret results to check quality of concrete	- Describe the Specifications for the test. - Define ultrasonic pulse velocity meter Practical activity Perform Ultrasonic pulse velocity on rcc bridges.	Theory-0.5Hrs Practice-3Hrs Total-3.5Hrs	Ultrasonic pulse velocity meter Sand paper	Class room and lab



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LU3. Perform Penetration Test (Windsor Probe)	Trainee will be able to: • Select the observation points on bridges. • Load the driver with a power load and probe suited for the type of concrete being examined. • Place the driver firmly on the actuating template and fire • Use locating template to locate the probes • Take three measurements • Compute the results	• Describe the specification for the test. • Define penetration test. • Introduction to Windsor probe Practical activity Perform Penetration Test (Windsor Probe) on RCC bridges.	Theory-.5Hrs Practice-1.5Hrs Total-2Hrs	Windsor probe Safety glasses PPEs	Classroom and lab
LU4. Maintain a safe work and environments	Trainee will be able to: • Use PPEs and apply safe work practices • Rehabilitate sampling site and Minimize generation of wastes • Collect waste material • Dispose waste Material in accordance with environmental/ quarantine requirements and workplace procedures • Clean the equipment • Check serviceability of equipment before storage	Practical activity Maintain a safe work and environments in lab.	Theory-0Hrs Practice-1.5Hrs Total-1.5Hrs	Cleaning tools	



11.22.6 Perform NDT Pull out Test and Profometer test on RCC bridges

Objective: This module covers the skills and knowledge required to Carry out initial preparatory activities, Perform Pull out Test, Perform Profometer test and Maintain a safe work and environments.

Duration: 13Hours

Theory: 3 Hours

Practice: 10 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Carry out initial preparatory activities.	Trainee will be able to: - Interpret test request to confirm samples to be tested, the test method and equipment involved - Identify hazards associates with the sample preparation, test methods, reagents and equipment. - Collect required equipment and materials - Identify faulty or unsafe components and equipment and report to appropriate personnel - Check calibration status of instruments and report any out-of-calibration items to appropriate personnel. - Plan task sequences for optimum efficiency	- Explain the types of bridges. - Describe the bridge elements - Explain the factor influencing concrete properties - Describe nondestructive testing. - Explain different methods of mix design, transportation of fresh concrete it's placing and compaction.	Theory-2Hrs Practice-3Hrs Total-5Hrs	PPEs File	Class room and lab



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		Explain Introduction to typical reinforcement of beam, columns and slab Practical activity Carry out initial preparatory activities in lab.			
LU2. Perform Pull out Test	Trainee will be able to: - Identify apparatus. - Select the observation points on brides. - Fix the apparatus on the bridge surface with inserts in it.(the inserts may be cast in place or drilled in groove) - Apply force of hydraulic jack to pull out embedded insert. - Perform four pull out test in each location. - Calculate the tensile strength. - Compute the compressive strength	- Explain Methods to put inserts for pull out test - Explain Use of hydraulic jack - Explain Introduction to concrete reinforcement - Explain the test procedure for pull out test and specification. Practical activity Perform Pull out Test on rcc bridge.	Theory-0.5Hrs Practice-2.5Hrs Total-3Hrs	Hydraulic jack Inserts Pull out test apparatus Spatula Measurement tape Safety glasses G. I. Tray File set	Class room and lab
LU3. Perform Profometer test	Trainee will be able to: - Identify the observation points on brides. - Identify the tester	Introduction to Profometer test and test procedure Practical activity	Theory-0.5Hrs Practice-3Hrs Total-3.5Hrs	PPEs File Profometer	Class room and lab



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	• Adjust the profometer tester • Move the tester cables on the concrete surface for scanning of rebars measuring the spacing • Find the location of the rebar • Place the diameter probe on the bar parallel to the bar axis • Calculate the diameter of the bar by taking mean of four readings • Use depth probe of the profometer to measure the cover • Place the depth probe above rebar • Observe the audio signal • Measure the concrete cover stored in memory	Perform Profometer test on RCC bridges.			
LU4. Maintain a safe work and environments	Trainee will be able to: • Use PPEs and apply safe work practices • Rehabilitate sampling site and Minimize generation of wastes • Collect waste material • Dispose waste Material in accordance with environmental/ quarantine requirements and workplace procedures • Clean the equipment	• Describe the maintenance of equipment. Practical activity Maintain a safe work and environments in lab.	Theory-0Hrs Practice-1.5Hrs Total-1.5Hrs	Cleaning tools	Class room and lab



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	• Check serviceability of equipment before storage				
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11.22.7 Perform Flat Jack Test and Impulse Radar Test

Objective: This module covers the skills and knowledge required to Carry out initial preparatory activities, Perform Pull out Test, Perform Profometer test and Maintain a safe work and environments.

Duration: 26Hours

Theory: 5 Hours

Practice: 21Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Carry out initial preparatory activities.	Trainee will be able to: • Interpret test request to confirm samples to be tested, the test method and equipment involved • Identify hazards associates with the sample preparation, test methods, reagents and equipment. • Collect required equipment and materials • Identify faulty or unsafe components and equipment and report to appropriate personnel • Check calibration status of instruments and report any out-of-calibration items to appropriate personnel. • Plan task sequences for optimum efficiency	• Introduction to masonry bridges • Use of masonry bridges • Types of masonry bridges • Elements of masonry bridges • Non-Destructive testing for masonry bridges Procedure for masonry bridges inspection Practical activity Carry out initial preparatory activities in lab.	Theory-1Hrs Practice-3Hrs Total-4Hrs	PPEs File	Class room and lab
LU2. Perform Flat Jack Test	Trainee will be able to: • Identify the bridge	• Introduction to concrete reinforcement	Theory-2Hrs Practice-9Hrs	Hydraulic pump	Class room and



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	• Select observatory areas • Identify the testing machine • Release stress in a small area of a structure by a plane cut perpendicular to its surface. • Load the flat jack in the cut • Increase the pressure gradually by hydraulic pump • Note the state of strain equal to the previous existing condition before the cut. • P8. Measure the reference points, glued about the cut, taken at various pressures • Increase the pressure in increments. • Observe the point of non-linearity in the load-strain curve to avoid damage in the structure.	• Explain the test procedure for flat jack test and specification. Practical activity Perform Flat Jack Test on masonry bridges.	Total-11Hrs	Flat jack apparatus Measuring tape Safety glasses G. I. Tray File set	lab
LU3. Perform Impulse Radar Test	Trainee will be able to: • Identify the inspection areas of the structure • Operate the impulse radar • Adjust the antenna of the tester on the surface so that electromagnetic half-sine wave is pulsed • Observe the pulse on a separate	• Introduction to impulse reader test and test procedure Practical activity Perform Impulse Radar Test on RCC bridges.	Theory-1.5Hrs Practice-6Hrs Total-7.5Hrs	PPEs File Impulse reader VDU meter	Class room and lab



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	receiving antenna • Record the data • Plot an analogue time domain trace • Observe the analogue signal displayed on a VDU meter				
LU4. Maintain a safe work and environments	Trainee will be able to: • Use PPEs and apply safe work practices • Rehabilitate sampling site and Minimize generation of wastes • Collect waste material • Dispose waste Material in accordance with environmental/ quarantine requirements and workplace procedures • Clean the equipment • Check serviceability of equipment before storage	• Describe the maintenance of equipment. Practical activity Maintain a safe work and environments in lab.	Theory-.5Hrs Practice-3Hrs Total-3.5Hrs	Cleaning tools	Class room and lab



11.22.8 Perform Stress rupture Test and Creep Test on pipes

Objective: This module covers the skills and knowledge required to Carry out initial preparatory activities, Perform stress rupture Test, Perform creep test and Maintain a safe work and environments.

Duration: 10Hours

Theory:3 Hours

Practice: 7Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Carry out initial preparatory activities.	Trainee will be able to: • Interpret test request to confirm samples to be tested, the test method and equipment involved • Identify hazards associates with the sample preparation, test methods, reagents and equipment. • Collect required equipment and materials • Identify faulty or unsafe components and equipment and report to appropriate personnel • Check calibration status of instruments and report any out-of-calibration items to appropriate personnel. • Plan task sequences for optimum efficiency	• Explain pipes • Explain types of pipes w.r.t materials • Describe different Properties of pipes • Explain Name of testing of pipes • State Procedure of pipes testing • State Importance of pipes • State Capacity of pipes • Describe Measuring tools and techniques • Explain Properties of types of pipes • Explain Enlist different	Theory-1Hrs Practice-2.5Hrs Total-3.5Hrs	PPEs File	Class room and lab



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		type of pipes • Explain mechanical joints Practical activity Carry out initial preparatory activities in lab.			
LU2. Perform Stress rupture Test	Trainee will be able to: • Select specimen • Identify the testing machine • Adjust the specimen in the stress rupture testing machine • Operate the machine • Apply constant load on the specimen • Note down the temperature • Observe the time of rupture	• State collar joints • Explain the procedure of rupture test. Practical activity Perform stress rupture test on grade 40 pvc pipes.	Theory-1Hrs Practice-1.5Hrs Total-2.5Hrs	PPEs File Stress rupture testing machine Pipe sample	Class room and lab
LU3. Perform Creep Test	Trainee will be able to: • Adjust the specimen in the creep testing machine • Operate the machine • Apply constant load on the specimen below its yield stress • Measure the dimensional changes to the specimen	• Enlist the function of creep testing machine • Define yield stress • Why extensometer is used in creep test • Enlist the function of full notch creep test • Define lever arm in full	Theory-1Hrs Practice-1.5Hrs Total-2.5Hrs	PPEs File Creep testing machine Pipe sample	Class room and lab



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	• Use extensometer to measure the deformation • Determine the time at which the specimen will deform at a given load and temperature • Use the readings to extrapolate time-to-failure for longer time periods	notch creep test Practical activity Perform creep test on grade 40 pvc pipes.			
LU4. Maintain a safe work and environments	Trainee will be able to: • Use PPEs and apply safe work practices • Rehabilitate sampling site and Minimize generation of wastes • Collect waste material • Dispose waste Material in accordance with environmental/ quarantine requirements and workplace procedures • Clean the equipment • Check serviceability of equipment before storage	Practical activity Maintain a safe work and environments in lab.	Theory-0Hrs Practice-1.5Hrs Total-1.5Hrs	Cleaning tools	Class room and lab



11.22.9 Perform Full Notch Creep Test and Small-scale steady-state test

Objective: This module covers the skills and knowledge required to Carry out initial preparatory activities, Perform stress rupture Test, Perform creep test and Maintain a safe work and environments.

Duration: 10Hours

Theory:3 Hours

Practice: 7Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Carry out initial preparatory activities.	Trainee will be able to: - Interpret test request to confirm samples to be tested, the test method and equipment involved - Identify hazards associates with the sample preparation, test methods, reagents and equipment. - Collect required equipment and materials - Identify faulty or unsafe components and equipment and report to appropriate personnel - Check calibration status of instruments and report any out-of-calibration items to appropriate personnel. - Plan task sequences for optimum	- Explain Introduction to pipes - Explain Properties of pipes - State Name of test on pipes - Explain Procedure of pipes testing - Define Importance of pipes - Explain Capacity of pipes - Describe Measuring tools and techniques - Explain Properties of types of pipes - Enlist different type of pipes - Explain mechanical joints Practical activity Carry out initial preparatory activities in lab.	Theory-1Hrs Practice-2.5Hrs Total-3.5Hrs	PPEs File	Class room and lab



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	efficiency				
LU2. Perform Full Notch Creep Test	Trainee will be able to: - Adjust the specimen in the full notch creep tester - Operate the tester - Apply constant stress on specimen via lever arm loading arrangement in a test fluid - Record the failing time of specimen - Assess the resistance to brittle or ductile failure of specimen - Draw a graph between stress and failure time	- Enlist the function of creep testing machine - Define yield stress - Enlist the function of full notch creep test - Define lever arm in full notch creep test Practical activity Perform stress rupture test on grade 40 pvc pipes.	Theory-1Hrs Practice-1.5Hrs Total-2.5Hrs	PPEs File Notch creep testing machine with arm, weights, bath and solution Pipe sample	Class room and lab
LU3. Perform Small-scale steady-state test	Trainee will be able to: - Adjust the specimen in the small-scale steady state tester - Operate the tester - Apply specified pressure along the longitudinal side of the specimen - Measure the temperature of the specimen - Examine the crack has appeared	Explain the procedure of small-scale steady state test Practical activity Perform Impulse creep test on grade 40 pvc pipes.	Theory-1Hrs Practice-1.5Hrs Total-2.5Hrs	PPEs File Steady state apparatus Pipe sample	Class room and lab



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	• Repeat the series of tests at different pressure but constant temperature • Repeat the series of tests at different temperature but constant pressure • Determine the critical pressure • Determine the critical temperature				
LU4. Maintain a safe work and environments	Trainee will be able to: • Use PPEs and apply safe work practices • Rehabilitate sampling site and Minimize generation of wastes • Collect waste material • Dispose waste Material in accordance with environmental/ quarantine requirements and workplace procedures • Clean the equipment • Check serviceability of equipment before storage	Practical activity Maintain a safe work and environments in lab.	Theory-0Hrs Practice-1.5Hrs Total-1.5Hrs	Cleaning tools	Class room and lab



11.22.10 Conduct Tensile Test, Compression Test and Leakage Detection Test

Objective: This module covers the skills and knowledge required to Carry out initial preparatory activities, conduct tensile Test, conduct compression test, conduct leakage detection test and Maintain a safe work and environments.

Duration: 9Hours

Theory:3 Hours

Practice: 6 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Carry out initial preparatory activities.	Trainee will be able to: • Interpret test request to confirm samples to be tested, the test method and equipment involved • Identify hazards associates with the sample preparation, test methods, reagents and equipment. • Collect required equipment and materials • Identify faulty or unsafe components and equipment and report to appropriate personnel • Check calibration status of instruments and report any out-of-calibration items to appropriate	• Enlist hazards for sampling for pipes testing • Enlist procedure for collecting required materials for pipes testing • Explain the adjustment of specimen in compression testing machine • State loading capacity of machine Practical activity Carry out initial preparatory activities in lab.	Theory-1Hrs Practice-1Hrs Total-2Hrs	PPEs File	Class room and lab



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	personnel. • Plan task sequences for optimum efficiency				
LU2. Conduct tensile Test	Trainee will be able to: • Identify UTM • Fix specimen in the apparatus • Apply load on the specimen until rupture • Check specific time • Observe the deformation/elongation of specimen • Repeat test as per standards • Take readings at yield point • Plot the graph • Record result according to SOP	• Define tensile test and its purpose. • Explain procedure of tensile test. Practical activity Perform tensile test on copper and galvanized iron pipes.	Theory-0.5Hrs Practice-1Hrs Total-1.5Hrs	PPEs File Pipe sample UTM	Class room and lab
LU3. Conduct compression test	Trainee will be able to: • Identify UTM • Fix specimen in the apparatus • Apply load on the specimen until rupture • Check specific time	• Define compressive strength. • Explain the test procedure of compression test. • Define yield stress • Explain Durability aspects of different types of pipes	Theory-0.5Hrs Practice-1Hrs Total-1.5Hrs	PPEs File UTM Pipe sample	Class room and lab



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	• Observe the deformation/compression of specimen • Repeat test as per standards • Take readings at yield point • Plot the graph • Record result according to SOP	Practical activity Perform compression test on grade 40 and grade 80 pvc pipes.			
LU4. Conduct leakage detection test	Trainee will be able to: • Identify the specimen • Identify leakage testing machine • Connect the displacement pump to the system along with pressure gauge • Measure the amount of water pumped • Close all other valves linked to the specimen • Fill the pipe with water • Remove all air in the specimen • Test the specimen by applying pressure for 2 hours • Measure the amount of water that	• Enlist the function of leakage detection test • Enlist difference between compression and leakage detection test Practical activity Conduct leakage detection test on grade 40 and grade 80 pvc pipes.	Theory-1Hrs Practice-2Hrs Total-3Hrs	Leakage detection tester Pipe samples PPEs File	



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	is pumped out • Evaluate the amount of leakage • Compare the obtained amount to the maximum allowable leakage in AWWA standard				
LU5. Maintain a safe work and environments	Trainee will be able to: • Use PPEs and apply safe work practices • Rehabilitate sampling site and Minimize generation of wastes • Collect waste material • Dispose waste Material in accordance with environmental/ quarantine requirements and workplace procedures • Clean the equipment • Check serviceability of equipment before storage	Practical activity Maintain a safe work and environments in lab.	Theory-0Hrs Practice-1Hrs Total-1Hrs	Cleaning tools	Class room and lab



11.22.11 Conduct hydraulic pressure test and 3 edge bearing test on RCC pipes

Objective: This module covers the skills and knowledge required to Carry out initial preparatory activities, conduct hydraulic pressure test, 3 edge bearing test and Maintain a safe work and environments.

Duration: 9 Hours

Theory:3 Hours

Practice: 6 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Carry out initial preparatory activities.	Trainee will be able to: • Interpret test request to confirm samples to be tested, the test method and equipment involved • Identify hazards associates with the sample preparation, test methods, reagents and equipment. • Collect required equipment and materials • Identify faulty or unsafe components and equipment and report to appropriate personnel • Check calibration status of instruments and report any out-of-calibration items to appropriate personnel. • Plan task sequences for optimum efficiency	• Define rcc pipes. • Enlist procedure for collecting required materials for pipes testing • Explain the use of pressure gauge and pump. • State the defects in concrete. • . Enlist the test on rcc pipes. Practical activity Carry out initial preparatory activities in lab.	Theory-1Hrs Practice-1Hrs Total-2Hrs	PPEs File	Class room and lab
LU2. Conduct	Trainee will be able to:	• Describe the adjustment of	Theory-1Hrs	PPEs	Class



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hydraulic pressure test	• Identify pump and pressure gauge. • Identify the pipe circuit. • Fill the circuit (slowly) with working fluid (water) at lowest location providing air release at highest point. • Connect the test pump to pressurize the line. • Pressure gauge is connected to the lowest possible point. • Calculate the the pressure including all head pressure. • Releasing the Pressure of the pipe circuit • Pressurize the return and drain line with greater pressure. • Take three readings • Record result according to SOP	specimen in 3 edge bearing test. • Explain procedure of 3 edge bearing test. Practical activity Perform hydraulic pressure test on RCC pipe.	Practice-2Hrs Total-3Hrs	File Pipe sample Pressure gauge Pressure pump Wrench set	room and lab
LU3. Conduct 3 edge bearing test	Trainee will be able to: • Identify jacks • Fix specimen in the apparatus • Apply load on the specimen until rupture • Check specific time • Observe the deformation of specimen	• Describe the precaution in hydraulic pressure test. • Define hydraulic pressure. • Explain the defects due to hydraulic pressure. • Explain the test procedure of	Theory-1Hrs Practice-2Hrs Total-3Hrs	PPEs File 3 edge bearing test apparatus Pipe sample	Class room and lab



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	• Repeat test as per standards • Take readings at yield point • Plot the graph • Record result according to SOP	hydraulic pressure test Practical activity Perform compression 3 edge bearing test on RCC PIPE.			
LU4. Maintain a safe work and environments	Trainee will be able to: • Use PPEs and apply safe work practices • Rehabilitate sampling site and Minimize generation of wastes • Collect waste material • Dispose waste Material in accordance with environmental/ quarantine requirements and workplace procedures • Clean the equipment • Check serviceability of equipment before storage	Practical activity Maintain a safe work and environments in lab.	Theory-0Hrs Practice-1Hrs Total-1 Hrs	Cleaning tools	Class room and lab



11.23. Inspection and Testing of Steel Structures

11.23.1 Perform Hardness Test on metals using Rockwell Method

Objective: This module covers the skills and knowledge required to find hardness of different metals i.e. Aluminum, copper, mild steel by using Rockwell Hardness test.

Duration:11 Hours

Theory: 3.5 Hours

Practice:7.5 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Prepare sample to conduct hardness test of metallic plate.	Trainee will be able to: - Identify material of metal sample. - Identify requirements of sample. - Prepare sample of required of given metallic plate. - Record the measurements of sample.	- Explain Hardness Test - Describe requirement of sampling. - Define Toughness and Brittleness? Practical Activity: - Prepare sample to conduct hardness test of metallic plate.	Theory-1Hrs Practice-1.5Hrs Total- 2.5Hrs	Pencil Rubber Sharpener Calculator Note book Sample Collect Equipment	Class + Lab
LU2. Set up apparatus to conduct hardness test of metallic plate by Rockwell method.	Trainee will be able to: - Identify Rockwell hardness test apparatus - Fix suitable indenter - Place specimen on the platform. - Raise the platform - Set position against the indenter	- Describe Rockwell method for Hardness Test of metallic plate. Practical Activity: - Set up apparatus to conduct hardness test of metallic plate by Rockwell method.	Theory- 1Hrs Practice-1.5Hrs Total- 2.5Hrs	Pencil Rubber Sharpener Calculator Note book Rockwell hardness testing Apparatus	Class + Lab



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LU3. Conduct hardness test of metallic plate by Rockwell method.	Trainee will be able to: • Apply the load by loading lever and wait for specified time • Repeat the test as per standards.	• Explain processes for Conduct hardness test of metallic plate by Rockwell method Practical Activity: • Conduct hardness test of metallic plate by Rockwell method.	Theory-0.5Hrs Practice-1.5Hrs Total- 2Hrs	Pencil Rubber Note book Rockwell hardness testing Apparatus	Class + Lab
LU4. Record the test observations and evaluate result for Rockwell method.	Trainee will be able to: • Record reading of pointer on the corresponding scale of the dial gauge. • Tabulate the readings. • Apply formula • Evaluate the result	• Define and explain hardness number? • Define Static Indentation, Dynamic Indentation? Practical Activity: • Record the test observations and evaluate result for Rockwell method.	Theory-0.5Hrs Practice-1.5Hrs Total- 2Hrs	Pencil Rubber Sharpener Calculator Note book	Class + Lab
LU5. Maintain safe work environment	Trainee will be able to: • Use safe work procedures and personal protective equipment (PPE) to ensure personal safety and that of other personnel • Clean work area and collect, recycle or dispose of all waste in accordance with workplace procedures • Clean and check serviceability of test equipment before storage.	• Enlist PPEs • Explain collection and disposal of waste material in accordance with environmental requirement and workplace procedures. Practical Activity: • Perform collection and disposal of waste material in accordance with environmental requirement and workplace procedures.	Theory-0.5Hrs Practice-1.5Hrs Total- 2Hrs	Shovel Wheel Barrow	Class + Lab



11.23.2. Perform Hardness Test on metals using Brinell Method

Objective: This module covers the skills and knowledge required to find hardness of different metals i.e. Aluminum, copper, mild steel by using Brinell's Hardness test and limitations of Brinell's hardness test.

Duration: 9 Hours

Theory: 2 Hours

Practice: 7 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Prepare sample to conduct hardness test of metallic plate.	Trainee will be able to: - Identify material of metal sample. - Identify requirements of sample. - Prepare sample of required of given metallic plate. - Record the measurements of sample.	- Explain Hardness Test - Describe requirement of sampling. - Define Toughness and Brittleness? Practical Activity: Prepare sample to conduct hardness test of metallic plate.	Theory-0.5Hrs Practice-1.5Hrs Total- 2Hrs	Pencil Rubber Sharpener Calculator Note book Sample Collect Equipment	Class + Lab
LU2. Set up apparatus to conduct hardness of metallic plate by Brinell method	Trainee will be able to: - Identify Brinell's Hardness test apparatus - Fix suitable indenter - Place specimen on the platform. - Raise the platform - Set position against the indenter	Describe Brinell method for Hardness Test of metallic plate. Practical Activity: Set up apparatus to conduct hardness test of metallic plate by Brinell method.	Theory-0Hrs Practice-1.5Hrs Total- 1.5Hrs	Pencil Rubber Sharpener Calculator Note Book Hardness Testing Apparatus	Class + Lab



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LU3. Conduct hardness test of metallic plate by Brinell method.	Trainee will be able to: • Apply the load by loading lever and wait for specified time • Repeat the test as per standards.	• Explain processes for Conduct hardness test of metallic plate by Brinell method Practical Activity: • Conduct hardness test of metallic plate by Brinell method.	Theory-0.5Hrs Practice-1.5Hrs Total- 2Hrs	Pencil Rubber Sharpener Calculator Note Book Hardness Testing Apparatus	Class + Lab
LU4. Record the test observations and evaluate result for Brinell method.	Trainee will be able to: • Record reading of pointer on the corresponding scale of the dial gauge. • Tabulate the readings. • Apply formula • Evaluate the result	• Define and explain hardness number? • Define Static Indentation, Dynamic Indentation? Practical Activity: • Record the test observations and evaluate result for Brinell method.	Theory-0.5Hrs Practice-1.5Hrs Total- 2Hrs	Pencil Rubber Sharpener Calculator Note Book	Class + Lab
LU5. Maintain safe work environment	Trainee will be able to: • Use safe work procedures and personal protective equipment (PPE) to ensure personal safety and that of other personnel • Clean work area and collect, recycle or dispose of all waste in accordance with workplace procedures • Clean and check serviceability of test equipment before storage.	• Enlist PPEs • Explain collection and disposal of waste material in accordance with environmental requirement and workplace procedures. Practical Activity: • Perform collection and disposal of waste material in accordance with environmental requirement and workplace procedures.	Theory-0.5Hrs Practice-1Hrs Total- 1.5Hrs	Shovel Wheel Barrow	Class + Lab



11.23.3. Conduct Impact test on metals

Objective: This module covers the skills and knowledge required to evaluate the impact energy / Impact strength/ Toughness and bending of a given test metal. This test measures the notch toughness of material under shock loading. It is providing a good way of comparing toughness of various materials or toughness of same material under different conditions.

Duration:12 Hours

Theory: 3 Hours

Practice: 9 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Perpare sample to conduct Impact strength of steel.	Trainee will be able to: - Identify material of metal sample. - Identify requirements of sample. - Prepare sample of required given metal specimen - Record the measurements of sample.	- Define and Explain Impact test. - Define Impact Load and Impact Energy - Explain Izod and Charpy specimen holder. - Define toughness, ductility and brittleness - Define deformation Practical Activity: - Perpare sample to conduct Impact strength of steel	Theory-0.5Hrs Practice-1.5Hrs Total- 2Hrs	Pencil Rubber Sharpener Calculator Note book Sample Collect Equipment	Class + Lab
LU2. Set up apparatus to conduct Impact strength of steel	Trainee will be able to: - Identify impact test machine - Place specimen as per standard - Identify the striking edge	Explain Setup of apparatus to conduct Impact strength of steel by Izod impact test. Practical Activity:	Theory-0.5Hrs Practice-1.5Hrs Total- 2Hrs	Pencil Rubber Sharpener Calculator Note book Izod Impact	Class + Lab



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by Izod impact test.	• Set Striking hammer in safe test position. • Fix specimen in impact testing machine. • Set Indicator of machine to zero.	• Perform Setup of apparatus to conduct Impact strength of steel by Izod impact test.		Test Apparatus	
LU3. Set up apparatus to conduct Impact strength of steel by Charpy impact test.	Trainee will be able to: • Identify impact test machine • Place specimen as per standard • Identify the striking edge. • Set Striking hammer in safe test position. • Fix specimen in impact testing machine. • Set Indicator of machine to zero.	Explain Setup of apparatus to conduct Impact strength of steel by Charpy impact test. Practical Activity: Perform Setup of apparatus to conduct Impact strength of steel by Charpy impact test.	Theory-0.5Hrs Practice-1.5Hrs Total- 2Hrs	Pencil Rubber Sharpener Calculator Note book Charpy impact test Apparatus	Class + Lab
LU4. Conduct Impact test of metals.	Trainee will be able to: • Identify testing machine • Stop oscillations of machine • Check Release hammer position • Repeat procedure • Striking hammer to its idle position • Check result & record.	• Explain Impact test of metals. Practical Activity: • Conduct Impact test of metals.	Theory-0.5Hrs Practice-1.5Hrs Total- 2Hrs	Pencil Rubber Sharpener Calculator Note book impact test Apparatus	Class + Lab



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LU5. Record the test observations and evaluate result of the Impact test of steel.	Trainee will be able to: - Record reading on dial gauge. - Record Tabular form - Apply Formula - Evaluate Results	- Numerical problems relating to Impact test of metals. Practical Activity: - Record the test observations and evaluate result of Torsion test of steel.	Theory-0.5Hrs Practice-1.5Hrs Total- 2Hrs	Pencil Rubber Sharpener Calculator Note book	Class + Lab
LU6. Maintain safe work environment	Trainee will be able to: - Use safe work procedures and personal protective equipment (PPE) to ensure personal safety and that of other personnel - Clean work area and collect, recycle or dispose of all waste in accordance with workplace procedures - Clean and check serviceability of test equipment before storage.	- Enlist PPEs - Explain collection and disposal of waste material in accordance with environmental requirement and workplace procedures. Practical Activity: - Perform collection and disposal of waste material in accordance with environmental requirement and workplace procedures.	Theory-0.5Hrs Practice-1.5Hrs Total- 2Hrs	Shovel Wheel Borrow	Class + Lab



11.23.4 Conduct bending test on metals

Objective: This module covers the skills and knowledge required to evaluate the impact energy / Impact strength/ Toughness and bending of a given test metal. This test measures the notch toughness of material under shock loading. It is providing a good way of comparing toughness of various materials or toughness of same material under different conditions.

Duration: 12 Hours

Theory: 4.5 Hours

Practice: 7.5 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Prepare sample to conduct Impact strength of steel.	Trainee will be able to: - Identify material of metal sample. - Identify requirements of sample. - Prepare sample of required given metal specimen - Record the measurements of sample.	- Define toughness, ductility and brittleness - Define deformation - Define Bending moment, bending equation - Define Neutral Axis - Define Section Modulus - Define Modulus of Rupture (bending) Practical Activity: - Prepare sample to conduct Bending test of mild steel bar & Young's modulus of elasticity.	Theory-1Hrs Practice-1.5Hrs Total- 2.5Hrs	Pencil Rubber Sharpener Calculator Note book Sample Collect Equipment	Class + Lab
LU2. Set up apparatus	Trainee will be able to:	Explain Setup of apparatus to	Theory-1Hrs	Pencil Rubber	Class +



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to conduct Bending test of mild steel bar & Young's modulus of elasticity	- Identify Universal testing machine - Fix dial gauge at zero - Fix Roller supports mounted on a rigid base. - Adjust roller support distance. - Fix bending tool with appropriate method - Fix a suitable span. - Set a proper range of loading - Check result & record.	conduct Bending test of mild steel bar & Young's modulus of elasticity. Practical Activity: Perform Setup of apparatus to conduct Bending test of mild steel bar & Young's modulus of elasticity.	Practice-1.5Hrs Total- 2.5Hrs	Sharpener Calculator Note book Bending test of mild steel bar & Young's modulus of elasticity Test Apparatus	Lab
LU3. Conduct Bending test of mild steel bar & Young's modulus of elasticity	Trainee will be able to: - Identify apparatus - Apply the load gradually up to failure - Check gauge - Apply formula - Evaluate Result	- Explain Bending test of mild steel bar & Young's modulus of elasticity. Practical Activity: - Conduct Bending test of mild steel bar & Young's modulus of elasticity.	Theory-1Hrs Practice-1.5Hrs Total- 2.5Hrs	Pencil Rubber Sharpener Calculator Note book Bending test of mild steel bar & Young's modulus of elasticity Test Apparatus	Class + Lab



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LU4. Record the test observations and evaluate result of the Bending test of mild steel bar & Young's modulus of elasticity	Trainee will be able to: - Identify apparatus - Record the Dial gauge reading. - Record Load at failure. - Apply formula - Evaluate Results	- Numerical problems relating to the Bending test of mild steel bar & Young's modulus of elasticity. Practical Activity: - Record the test observations and evaluate result of the Bending test of mild steel bar & Young's modulus of elasticity.	Theory-1Hrs Practice-1.5Hrs Total- 2.5Hrs	Pencil Rubber Sharpener Calculator Note book	Class + Lab
LU5. Maintain safe work environment	Trainee will be able to: - Use safe work procedures and personal protective equipment (PPE) to ensure personal safety and that of other personnel - Clean work area and collect, recycle or dispose of all waste in accordance with workplace procedures - Clean and check serviceability of test equipment before storage.	- Enlist PPEs - Explain collection and disposal of waste material in accordance with environmental requirement and workplace procedures. Practical Activity: - Perform collection and disposal of waste material in accordance with environmental requirement and workplace procedures.	Theory-0.5Hrs Practice-1.5Hrs Total- 2 Hrs	Shovel Wheel Barrow	Class + Lab



11.23.5 Conduct Tensile Test on Metals Using Young's Modulus Apparatus

Objective: This module covers the skills and knowledge required to evaluate relation between stress and strain of a copper wire, evaluate Young's modulus of the material of the wire, determine tensile strength of mild steel and plot a graph between stress and strain of mild steel.

Duration: 12 Hours

Theory: 4.5 Hours

Practice: 7.5 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Prepare sample to conduct Young's modulus test of metallic wire.	Trainee will be able to: - Identify material of metal sample. - Identify requirements of sample. - Prepare sample of required of given metallic wire. - Record sample measurements.	- Define and explain the terms stress, and its types (tensile, compressive and shear) - Define and explain strain, its types (linear, lateral and volumetric) and poison's ratio. - Define and explain Hook's Law. - State Young's modulus of elasticity, modulus of rigidity and bulk modulus. - Explain mechanical properties of materials like elasticity, plasticity, ductility, brittleness and hardness, etc.	Theory-1Hrs Practice-1.5Hrs Total- 2.5Hrs	Pencil Rubber Sharpener Calculator Note book Sample Collect Equipment	Class + Lab



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		Practical Activity: • Prepare sample to conduct Young's modulus test of metallic wire.			
LU2. Set up apparatus to conduct Young's modulus test of metallic wire by young's modulus apparatus.	Trainee will be able to: • Identify test apparatus • Fix suitable indenter • Fix specimen at apparatus.	• Explain Setup of apparatus to conduct Young's modulus test of metallic wire by young's modulus apparatus. Practical Activity: • Perform Setup of apparatus to conduct Young's modulus test of metallic wire by young's modulus apparatus.	Theory-1Hrs Practice-1.5Hrs Total- 2.5Hrs	Pencil Rubber Sharpener Calculator Note book young's modulus apparatus	Class + Lab
LU3. Conduct tensile test of wire by young's modulus method.	Trainee will be able to: • Apply load at specimen. • Check specified time • Check elongation • Repeat the test as per standards.	• Explain tensile test of wire by young's modulus method. Practical Activity: • Conduct tensile test of wire by young's modulus method.	Theory-1Hrs Practice-1.5Hrs Total- 2.5Hrs	Pencil Rubber Sharpener Calculator Note book young's modulus apparatus	Class + Lab
LU4. Record the test observations and evaluate result of the young's modulus test.	Trainee will be able to: • Record pointer reading of the gauge scale. • Tabulate the readings.	• Numerical problems relating to the Conduct tensile test of wire by young's modulus method. Practical Activity:	Theory-1Hrs Practice-1.5Hrs Total- 2.5Hrs	Pencil Rubber Sharpener Calculator Note book	Class + Lab



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	• Apply formula • Evaluate the result • Prepare graph • Record the result	• Record the test observations and evaluate result of tensile test of wire by young,s modulus method			
LU5. Maintain safe work environment	Trainee will be able to: • Use safe work procedures and personal protective equipment (PPE) to ensure personal safety and that of other personnel • Clean work area and collect, recycle or dispose of all waste in accordance with workplace procedures • Clean and check serviceability of test equipment before storage.	• Explain tensile test of wire by young,s modulus method. Practical Activity: • Conduct tensile test of wire by young,s modulus method.	Theory-0.5Hrs Practice-1.5Hrs Total- 2Hrs	Shovel Wheel Barrow	Class + Lab



11.23.6 Conduct Tensile Test on Metals Using UTM

Objective: This module covers the skills and knowledge required to evaluate relation between stress and strain of a copper wire, evaluate Young's modulus of the material of the wire, determine tensile strength of mild steel and plot a graph between stress and strain of mild steel.

Duration: 12 Hours

Theory: 4.5 Hours

Practice: 7.5 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Set up apparatus to conduct tensile test of steel bar by U.T.M.	Trainee will be able to: - Identify U.T.M. - Fix zero on gauge. - Fix specimen at U.T.M.	- Define and explain the terms stress, and its types (tensile, compressive and shear) - Define and explain strain, its types (linear, lateral and volumetric) and poison's ratio. - Define and explain Hook's Law. - State Young's modulus of elasticity, modulus of rigidity and bulk modulus. - Explain mechanical properties of materials like elasticity, plasticity, ductility, brittleness and hardness, etc.	Theory-1.5Hrs Practice-1.5Hrs Total- 3Hrs	- Pencil - Rubber - Sharpener - Calculator - Note book - U.T.M. apparatus	Class + Lab



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LU2.Conduct tensile test of steel bar by U.T.M.	Trainee will be able to: • Apply load until rupture. • Check specified time • Check elongation • Repeat test as per standards • Take reading at yield point. • Record Result	• Identify parts and attachments of U.T.M for tensile and compression tests. Also explain the salient points in stress strain curve for ductile material. Practical Activity: Perpare sample to coduct tensile test of steel bar by U.T.M.	Theory-1Hrs Practice-3Hrs Total- 4Hrs	• Pencil • Rubber • Sharpener • Calculator • Note book • U.T.M. apparatus	Class + Lab
LU3.Record the test observations and evalute result of the tensile test by U.T.M.	Trainee will be able to: • Record reading on pointer. • Tabulate the readings. • Apply formula • Evaluate the result • Prepare graph • Record the result	• Numerical problems relating to simple stress and strain. • Numerical problems relating to Poisson's ratio and Hook's Law Practical Activity: Record the test observations and evalute result of the tensile test by U.T.M.	Theory-1Hrs Practice-1.5Hrs Total- 2.5Hrs	• Pencil • Rubber • Sharpener • Calculator • Note book • U.T.M. apparatus	Class + Lab
LU4.Maintain safe work environment	Trainee will be able to: • Use safe work procedures and personal protective equipment (PPE) to ensure personal safety and that of other personnel • Clean work area and collect,	• Enlist PPEs • Explain collection and disposal of waste material in accordance with environmental requirement and workplace procedures. Practical Activity:	Theory-1Hrs Practice-1.5Hrs Total- 2.5Hrs	• Shovels • Wheel barrow	Class + Lab



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	recycle or dispose of all waste in accordance with workplace procedures • Clean and check serviceability of test equipment before storage.	• Perform collection and disposal of waste material in accordance with environmental requirement and workplace procedures.			
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11.23.7 Conduct Torsion Tests on metals

Objective: This module covers the skills and knowledge required to Evaluate the behavior of Mild steel when subjected to a gradually increasing torsional load and to determine the rigidity modulus & modulus of rupture (torsion).

Duration: 12 Hours

Theory: 4.5 Hours

Practice: 7.5 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Prepare sample to conduct modulus of rupture and modulus of rigidity.	Trainee will be able to: - Identify material of metal sample. - Identify requirements of sample. - Prepare sample of required of given metallic bar - Record the measurements of sample.	- Define Torque - Define Modulus of rigidity and Modulus of Rupture - Find the value of G for different materials - Define Modulus of Rupture - Define Polar Moment of Inertia - Numerical problems related to torsion. Practical Activity: - Prepare sample to conduct modulus of rupture and modulus of rigidity	Theory-1Hrs Practice-1.5Hrs Total- 2.5Hrs	- Pencil - Rubber - Sharpener - Calculator - Note book	Class + Lab



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LU2. Set up apparatus to conduct modulus of rigidity by torsion Test.	Trainee will be able to: • Identify Torsion test apparatus along with angle of twist measuring attachment • Clamp the specimen in the jaws of machine. • Adjust the length of specimen by means of sliding spindle • Set the Appropriate range by capacity change lever • Set the maximum load pointer to zero	Explain Setup of apparatus to conduct modulus of rigidity by torsion Test. Practical Activity: Perform Setup of apparatus to conduct modulus of rigidity by torsion Test.	Theory-1Hrs Practice-1.5Hrs Total- 2.5Hrs	• Pencil • Rubber • Sharpener • Calculator • Note book	Class + Lab
LU3. Conduct torsion test of Steel bar.	Trainee will be able to: • Identify test apparatus • Apply load at suitable increments. • Calculate Load at failure • Evaluate result	• Explain torsion test of Steel bar. Practical Activity: • Conduct torsion test of Steel bar.	Theory-1Hrs Practice-1.5Hrs Total- 2.5Hrs	• Pencil • Rubber • Sharpener • Calculator • Note book • Torsion Test	Class + Lab
LU4. Record the test observations and evaluate result of the Torsion test of steel.	Trainee will be able to: • Record the load increments. • Evaluate twisting angle. • Plot torque vs. angle of twist. • Evaluate the result	• Define Angle of Twist Practical Activity: • Record the test observations and evaluate result of Torsion test of steel.	Theory-1Hrs Practice-1.5Hrs Total- 2.5Hrs	• Pencil • Rubber • Sharpener • Calculator • Note book	Class + Lab



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LU5. Maintain safe work environment	Trainee will be able to: • Use safe work procedures and personal protective equipment (PPE) to ensure personal safety and that of other personnel • Clean work area and collect, recycle or dispose of all waste in accordance with workplace procedures • Clean and check serviceability of test equipment before storage.	• Enlist PPEs • Explain collection and disposal of waste material in accordance with environmental requirement and workplace procedures. Practical Activity: • Perform collection and disposal of waste material in accordance with environmental requirement and workplace procedures.	Theory-0.5Hrs Practice-1.5Hrs Total- 2Hrs	• Shovels • Wheel barrow	Class + Lab
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11.23.8 Perform Radiographic and Ultrasonic Testing on Steel Bridges

Objective: This module covers the skills and knowledge required to perform Strength test for steel bridges.

Duration: 12 Hours

Theory: 3 Hours

Practice: 9 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Carry out initial preparatory activities.	Trainee will be able to: - Access relevant job instructions from laboratory information management system (LIMS) - Interpret test request to confirm samples to be tested, the test method and equipment involved - Identify hazards to take sample - Prepare and workplace for task - Assemble / collect all required equipment and materials - Plan task / work sequences for optimum efficiency	- Introduction to Strength test for Steel bridge - Operations of Strength tests. - Types of Steel bridges and their properties. - Different materials of bridges - Measuring tools and techniques - Elements of steel bridges - Specifications as per requirements - Define ultrasonic testing - Define radiographic testing - Define Radiographs - Define hertz - Define ultra sound waves - Describe laboratory information management system (LIMS)	Theory-1Hrs Practice-1.5Hrs Total- 2.5Hrs	Pencil Rubber Sharpener Calculator Note book	Class + Lab



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		Practical Activity: Perform initial preparatory activities.			
LU2. Perform radiographic testing on steel bridges	Trainee will be able to: - Select observatory points - Examine carefully the specimen - Select thickness, density and wavelength of the material - Observe the images on identifying tube. - Observe the interpretation of radiograph - Observe the optimum time of exposure	Describe briefly on radiographic testing on steel bridges Practical Activity: Perform radiographic testing on steel bridges.	Theory-1Hrs Practice-3Hrs Total- 4Hrs	Pencil Rubber Sharpener Calculator Note book radiographic testing Apparatus	Class + Lab
LU3. Perform ultrasonic testing through transmission technique	Trainee will be able to: - Select observatory points - Examine carefully the specimen - Apply transmitter on one side and a receiver on the other side of the object to be tested - Observe the ultrasonic waves - Observe the sound energy, which has travelled from the transmitter to	Describe briefly on ultrasonic testing through transmission technique Practical Activity: Perform ultrasonic testing through transmission technique.	Theory-0.5Hrs Practice-3Hrs Total- 3.5Hrs	Pencil Rubber Sharpener Calculator Note book ultrasonic testing Apparatus	Class + Lab



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	the receiver Note down the signals with ordinary ultrasonic equipment				
LU4. Maintain a safe work environment	Trainee will be able to: - Use PPEs and apply safe work practices - Rehabilitate sampling site and Minimize generation of wastes - Collect waste material - Dispose waste Material in accordance with environmental/ quarantine requirements and workplace procedures - Clean the equipment - Check serviceability of equipment before storage	- Enlist PPEs - Explain collection and disposal of waste material in accordance with environmental requirement and workplace procedures. Practical Activity: Perform collection and disposal of waste material in accordance with environmental requirement and workplace procedures.	Theory-0.5Hrs Practice-1.5Hrs Total- 2Hrs	Shovels Wheelbarrow	Class + Lab



11.23.9 Perform Dye Penetrant Inspection or Liquid Penetrant Inspection (LPI) on Steel Bridges

Objective: This module covers the skills and knowledge required to perform Strength test for steel bridges.

Duration: 12 Hours

Theory: 3 Hours

Practice: 9 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Carry out initial preparatory activities.	Trainee will be able to: • Access relevant job instructions from laboratory information management system (LIMS) • Interpret test request to confirm samples to be tested, the test method and equipment involved • Identify hazards to take sample • Prepare and workplace for task • Assemble / collect all required equipment and materials • Plan task / work sequences for optimum efficiency	• Introduction to Strength test for Steel bridge • Operations of Strength tests. • Types of Steel bridges and their properties. • Different materials of bridges • Measuring tools and techniques • Elements of steel bridges • Specifications as per requirements • Define Liquid Penetrant Inspection (LPI) • Define porosity • Define laps seams • Describe laboratory information management system (LIMS)	Theory-1Hrs Practice-3Hrs Total- 4Hrs	Pencil Rubber Sharpener Calculator Note book	Class + Lab



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		Practical Activity: • Perform initial preparatory activities.			
LU2. Perform Dye Penetrant Inspection OR Liquid Penetrant Inspection (LPI)	Trainee will be able to: • Select observatory points • Prepare surface for the inspection (free from oil, grease, water or other contaminants) • Apply penetrant to the surface by spraying, brushing or immersing the parts in penetrant bath. • Dwell the penetrant • Apply developer to the surface by dusting, dipping or spraying. • Inspect surface under appropriate lighting • Clean the surface to remove developer	• Describe briefly on Dye Penetrant Inspection • Describe briefly on Liquid Penetrant Inspection (LPI) Practical Activity: • Perform Dye Penetrant Inspection on steel bridge. • Perform Liquid Penetrant Inspection (LPI) on steel bridge.	Theory-1Hrs Practice-3Hrs Total- 4Hrs	Pencil Rubber Sharpener Calculator Note book Penetrant Inspection Apparatus Liquid Penetrant Inspection (LPI) Apparatus	Class + Lab
LU3. Maintain a safe work environment	Trainee will be able to: • Use PPEs and apply safe work practices • Rehabilitate sampling site and Minimize generation of wastes	• Enlist PPEs • Explain collection and disposal of waste material in accordance with environmental requirement and workplace procedures.	Theory-1Hrs Practice-3Hrs Total- 4Hrs	Shovels Wheelbarrow	Class + Lab



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	• Collect waste material • Dispose waste Material in accordance with environmental/ quarantine requirements and workplace procedures • Clean the equipment • Check serviceability of equipment before storage	Practical Activity: • Perform collection and disposal of waste material in accordance with environmental requirement and workplace procedures.			
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11.23.10 Perform Magnetic Particle Inspection on Steel Bridges

Objective: This module covers the skills and knowledge required to perform Strength test for steel bridges.

Duration: 10 Hours

Theory: 4 Hours

Practice: 6 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Carry out initial preparatory activities.	Trainee will be able to: - Access relevant job instructions from laboratory information management system (LIMS) - Interpret test request to confirm samples to be tested, the test method and equipment involved - Identify hazards to take sample - Prepare and workplace for task - Assemble / collect all required equipment and materials - Plan task / work sequences for optimum efficiency	- Introduction to Strength test for Steel bridge - Operations of Strength tests. - Types of Steel bridges and their properties. - Different materials of bridges - Measuring tools and techniques - Elements of steel bridges - Specifications as per requirements - Define magnetic flux - Define magnetic particles - Enlist types of magnetic suspensions - Describe laboratory information management system (LIMS)	Theory-2Hrs Practice-1.5Hrs Total- 3.5Hrs	Pencil Rubber Sharpener Calculator Note book	Class + Lab



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		Practical Activity: Perform initial preparatory activities.			
LU2. Perform Magnetic Particle Inspection (MPI)	Trainee will be able to: - Select observatory points - Clean the surface before inspection - Apply the magnetizing force using permanent magnets, a electromagnetic yoke, prods, a coil or other means to establish the necessary magnetic flux - Dust on the light layer of magnetic particles with the magnetizing force still applied, remove the excess powder from the surface with few gentle puffs of dry air. (dry or wet magnetic suspension) - Inspect area carefully for finding out cluster of particles.	- Describe briefly on Magnetic Particle Inspection (MPI) Practical Activity: - Perform Magnetic Particle Inspection (MPI) on steel bridge.	Theory-1Hrs Practice-3Hrs Total- 4Hrs	Pencil Rubber Sharpener Calculator Note book Magnetic Particle Inspection (MPI) Apparatus	Class + Lab



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LU3. Maintain a safe work environment	Trainee will be able to: • Use PPEs and apply safe work practices • Rehabilitate sampling site and Minimize generation of wastes • Collect waste material • Dispose waste Material in accordance with environmental/ quarantine requirements and workplace procedures • Clean the equipment • Check serviceability of equipment before storage	• Enlist PPEs • Explain collection and disposal of waste material in accordance with environmental requirement and workplace procedures. Practical Activity: • Perform collection and disposal of waste material in accordance with environmental requirement and workplace procedures.	Theory-1Hrs Practice-1.5Hrs Total- 2.5Hrs	Shovels Wheelbarrow	Class + Lab
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11.23.11 Perform Eddy Current Testing on Steel Bridges

Objective: This module covers the skills and knowledge required to perform Strength test for steel bridges.

Duration: 7 Hours

Theory: 2.5 Hours

Practice: 4.5 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Carry out initial preparatory activities	Trainee will be able to: - Access relevant job instructions from laboratory information management system (LIMS) - Interpret test request to confirm samples to be tested, the test method and equipment involved - Identify hazards to take sample - Prepare and workplace for task - Assemble / collect all required equipment and materials - Plan task / work sequences for optimum efficiency	- Introduction to Strength test for Steel bridge - Operations of Strength tests. - Types of Steel bridges and their properties. - Different materials of bridges - Measuring tools and techniques - Elements of steel bridges - Specifications as per requirements - Define eddy current - Define NDT - Define coil - Define conductivity - Describe laboratory information management system (LIMS)	Theory-1Hrs Practice-1.5Hrs Total- 2.5Hrs	- Pencil - Rubber - Sharpener - Calculator - Note book	Class + Lab



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		Practical Activity: Perform initial preparatory activities.			
LU2.Perform Eddy Current Testing	Trainee will be able to: - Select observatory points - Connect the probe with the system - Select probe from Low. Mid and High - Press the MAIN key to proceed with test setup. - Adjust the frequency as required. - Adjust the phase angle as required - Adjust the horizontal gain and vertical gain as required - Place the probe on the specimen to be tested away from cracks - Slide the probe on the specimen smoothly - Store data as frozen, captured or waterfall data - Scan the probe over part of the surface in a pattern that will provide complete coverage of the	- Describe briefly on Eddy Current Testing. Practical Activity: - Perform Eddy Current Testing on steel bridge.	Theory-1Hrs Practice- 1.5Hrs Total- 2.5Hrs	- Pencil - Rubber - Sharpener - Calculator - Note book - Eddy Current Testing Apparatus	Class + Lab



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	area being inspected • Care must be taken to maintain the same probe to surface orientation as probe wobble can affect interpretation of the signal.				
LU3.Maintain a safe work environment	Trainee will be able to: • Use PPEs and apply safe work practices • Rehabilitate sampling site and Minimize generation of wastes • Collect waste material • Dispose waste Material in accordance with environmental/ quarantine requirements and workplace procedures • Clean the equipment • Check serviceability of equipment before storage	• Enlist PPEs • Explain collection and disposal of waste material in accordance with environmental requirement and workplace procedures. Practical Activity: • Perform collection and disposal of waste material in accordance with environmental requirement and workplace procedures.	Theory- 0.5Hrs Practice- 1.5Hrs Total- 2Hrs	• Shovels • Wheelbarrow	Class + Lab



11.23.12 Perform Visual Inspection on Steel Bridges

Objective: This module covers the skills and knowledge required to perform visual test for steel bridges.

Duration: 7 Hours

Theory: 2 Hours

Practice: 5 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Carry out initial preparatory activities.	Trainee will be able to: - Access relevant job instructions from laboratory information management system (LIMS) - Interpret test request to confirm samples to be tested, the test method and equipment involved - Identify hazards to take sample - Prepare and workplace for task - Assemble / collect all required equipment and materials - Plan task / work sequences for optimum efficiency	- Respond to the test request - Describe hazards in taking samples/ visual inspection. - Describe instruments for visual inspection Practical Activity: - Carryout preparatory activities and identify hazards in taking samples	Theory-1Hrs Practice-3Hrs Total- 4Hrs	Pencil Rubber Sharpener Calculator Note book	Class + Lab
LU2. Perform visual inspection on steel bridges	Trainee will be able to: - Identify any document alignment discontinuities. - Identify the foundation arrangement,	- Describe briefly Corrosion, Fatigue (low cycle and high cycle) - Cracks in elements and joints - Deficiencies in connections	Theory-0.5Hrs Practice- 1Hrs Total- 1.5Hrs	Pencil Rubber Sharpener Calculator Note book Identifying	Class + Lab



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	scour susceptibility, structure sensitivity to scour and the 'safe' scour level. • Check member and structure alignment for discontinuities • Check for scour at supports • Identify maintenance requirements • Verify 'Structural Inventory' data held in the Bridge Information System (BIS).	• Permanent Deformation (i.e. buckling, bending, etc.) • Alignment discontinuity and Scouring • Coating film diagnosis • Explain use of boroscope Practical Activity: • Perform visual inspection on steel bridge.		tube Note book Measurement tape Boroscope Videoscope Pipe camera system	
LU3. Maintain a safe work environment	Trainee will be able to: • Use PPEs and apply safe work practices • Rehabilitate sampling site and Minimize generation of wastes • Collect waste material • Dispose waste Material in accordance with environmental/ quarantine requirements and workplace procedures • Clean the equipment • Check serviceability of equipment before storage	• Enlist PPEs • Explain collection and disposal of waste material in accordance with environmental requirement and workplace procedures. Practical Activity: • Perform collection and disposal of waste material in accordance with environmental requirement and workplace procedures.	Theory- 0.5Hrs Practice- 1Hrs Total- 1.5Hrs	Shovels Wheelbarrow	Class + Lab



11.24 Entrepreneurial Skills

11.24.1 Investigate micro business opportunities

Objective: This module describes the performance outcomes, skills and knowledge required to develop business ideas, and to investigate market needs and factors affecting potential markets.

Duration: 15 Hours

Theory: 6 Hours

Practice: 9 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Identify business ideas	Trainee will be able to: - Gather information for business ideas from appropriate sources - List details of business ideas and opportunities - Research alternative business ideas in light of the resources available - Specify and list products and services to match business ideas - Identify and research potential customer information for business ideas	- Define entrepreneurship. - Explain the concept of entrepreneurship - Explain the various types of enterprise that exist in the community - Identify and interpret the terms and elements involved in the concept of enterprise - Appreciate that the advancement of individual and society in general when entrepreneurship is adopted - Explain various motivational factors	Theory-02 Hrs Practical-03 Hrs Total- 5 Hrs	Calculator Ruler Pencil Drawing lab equipment	Class Room



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	Identify and take into account financial, business and technical skills available when researching business opportunities	that entrepreneurs possess and utilize. - Exhibit the skills needed to assess and evaluate a risk Practical Activity - Prepare a list of four rewards and four risks of being an entrepreneur - Prepare a list of types of business found in your community - Prepare a list of each type of business - Designing - Manufacturing - Supply and distribution - Selling - Retailing - Repairing - Service industry			
LU2. Identify market needs	Trainee will be able to: - Collect information regarding market size and potential from appropriate sources - Investigate market trends and	- Describe the outline of small enterprise - Describe the creativity and innovation - Apply the techniques for developing	Theory-2 Hrs Practical-3 Hrs Total- 5 Hrs	Calculator Ruler Pencil Drawing lab equipment	Class Room



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	developments to identify market needs relative to business ideas • Gather market information from primary and secondary sources to identify possible market needs in relation to business ideas • Identify ethical and cultural requirements of the market and their impact on business ideas • Identify new and emerging markets and document their features • Identify and organize information on expected market growth or decline and associated risk factors	creative abilities • Explain the resources of business idea • Explain the collective and creative thinking • Explain how to generate a business idea • Appreciate the importance of, and possess techniques for identifying and assessing business opportunities. Practical Activity To succeed as a new small business owner, you do not necessarily need to invent something new or create something unique. You can find an unfilled service or commodity in your community and look for a business that fills this vacancy. In this activity you will answer the following questions about your business idea: • Draft the business idea you want to			
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		start. - List other businesses in your community who provide similar services or products: - Select the location where you will have the business. Will it be in a separate location or will it be in your home?			
LU3. Investigate factors affecting the market	Trainee must be able to: - Identify projected changes in population, economic activity and the labour force that may affect business ideas - Identify movements in prices and projected changes in availability of resources - Review trends and developments and identify their potential impact on business ideas	- Identify the various entrepreneurial characteristics - Access personal potential for becoming future entrepreneurs. - Identify leadership qualities which are essential to the success of entrepreneurs - Identify self- management skills and how they are important to be enterprising - Apply a rational approach to make personal and business decisions - Explain the steps for decision making and rating of decision-making skills - Apply the rules of negotiation for	Theory-02 Hrs Practical-03 Hrs Total- 5.0 Hrs	Calculator Ruler Pencil Drawing lab equipment	Class Room



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		resolving business issues Practical Activity Using your business idea, answer the following questions: • Prepare a list of interested (needs) customers of your product or service. Incorporate the answers the following questions: • Why do they like or dislike my product or service? Are they willing to buy it (give money or another product for it)? • Will they always want to buy the product regularly or seasonally (sustainable)? Or will they stop buying it completely (unsustainable)? • How many of my product or hours of my service will they need? • Where should the product be available (location of sales points)?			
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11.24.2 Develop a micro business proposal

Objective: This module describes the performance outcomes, skills and knowledge required to develop an identified business idea, to research the feasibility of the business opportunity and to present a business idea in formats that suit a range of stakeholders

Duration: 17 Hours

Theory: 08 Hours

Practice: 09 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Evaluate business opportunities	Trainee will be able to: - Identify and research key factors that influence viability of business ideas - Analyze business ideas in terms of personal or family needs and commitments - Evaluate impacts of emerging or changing technology, including e-commerce, on the business - Determine viability of business opportunity in line with perceived risks, resources available, financial returns and other outcomes sought Assess and	- factors that influence viability of business ideas - Analysis business ideas - Impacts of emerging or changing technology, including e-commerce, on the business - Assessment of business risks Practical Activity - Conduct a survey of businesses located in your community. - Divide the class into groups of 3 to 5 learners. Divide the community into geographical sections so that each group will have a specific area of the business community to survey and there will be no overlap. Depending on the size of the business community, have each group identify up to 10	Theory-03 Hrs Practical-03 Hrs Total- 06 Hrs	Calculator Ruler Pencil	Class Room



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	match personal skills/attributes against those perceived as necessary for a particular business opportunity • Identify and assess business risks according to resources available and personal preferences	businesses in their assigned area of the business community. Ask students to take note of the sex of the owners of the business and whether the owner had some observable type of disability. Each group should interview at least four business owners (not all of the same sex) to get an idea of what type of activities the business owners engaged in. • Discuss each form of classification in the class after survey. • Write on the board any significant differences between how women and men business owners answered in the questions. • Ask students to discuss those differences; stress the fact that these differences are often the result of gender stereotypes and not because of the capacities of the individual entrepreneur. Ask students to identify specific reasons why women and men should be encouraged to run any type of business independently of their gender.			
LU2. Detail the	Trainee will be able to:	• Difference between a business idea and a	Theory-02 Hrs	Calculator	Class Room



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business idea	Develop an accurate description of the business idea for key stakeholders Develop an accurate summary of the major products and/or services required to suit personal needs and requirements	business opportunity? • Creative-thinking techniques used to generate ideas. • Name four common ways of turning business ideas into opportunities. • Practical methods for determining the feasibility of a business idea. Practical Activity Imagine that you are planning to survey students at your school about a potential bookstore to be located on school grounds. The proposed store will be run by students with teachers' guidance. Profits will go to a charitable group chosen by the students. Working in a small group, develop a questionnaire for the survey with no more than 20 questions. Make sure the questions focus on the most important issues involved in this startup.	Practical-03 Hrs Total- 05 Hrs	Ruler Pencil	
LU3. Prepare the business overview to suit different stakeholders	Trainee must be able to: • Present an accurate list of key stakeholders and their information requirements	• Difference between limited and unlimited liability. • Sole proprietorship different from general partnership.	Theory-03 Hrs Practical-03 Hrs Total- 06 Hrs	Calculator Ruler Pencil	Class Room



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	• Determine an acceptable method of presentation of information for each stakeholder • Provide accurate customized information to target audiences	• Partnership agreement. • Advantages and disadvantages of a corporation over a sole proprietorship. Practical Activity • Each learner should write down the skills, experience, training and background that they have to start a business. Personal barriers to overcome should also be identified. Examples of specific skills might include: catering, welding, computer programming, or secretarial experience. • Divide the class into small groups based on the common hobbies/interests listed by the group members. Each group of learners must now choose one idea they wish to develop into a business. Group members are to negotiate on this choice between themselves. On a separate sheet of paper, the group should describe their best business idea, including the product or service in detail as well as whom the likely customers might be. Each group would have 15 minutes for this task, after which each group will be given 5 minutes			
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		to present their idea to the entire class.			
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11.24.3 Develop a marketing plan.

Objective: This module describes the performance outcomes, skills and knowledge required to research, develop and present a marketing plan for an entrepreneurship business

Duration: 18.0 Hours

Theory: 06.0 Hours

Practice: 12.0 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Devise marketing strategies	Trainee will be able to: - Evaluate marketing opportunity options that address organizational objectives, and evaluate their risks and returns in the selection process - Develop marketing strategies that address strengths and opportunities within the organization's projected capabilities and resources - Develop strategies which increase resources or organizational expertise where gaps exist between current capability and marketing objectives - Develop feasible marketing strategies and communicate reasons that justifies their selection	- Describe the market & marketing - Differentiate between sellers and buyers' market - Describe the five 'w' of market - Explain the procedure for assessing the market size and demand - Explain the major factors to be considered when selecting a location for a business Practical Activity - Divide the learners into groups and have them identify the "Five Ws" of a market for businesses such as auto repair, bakery, clothing, retail shop, bookstore, handicraft shop. Have each group of learners report their findings to the rest	Theory-02 Hrs Practical-04 Hrs Total- 06 Hrs	Calculator Ruler Pencil	Class Room



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	- Ensure strategies align with organization's strategic direction - Develop a marketing performance review strategy, incorporating appropriate marketing metrics to review of organizational performance against marketing objectives.	- of the class. - Create one group of learners for each of the five Ws and have learners discuss what factors are related to each W and what sources of information are needed for each factor? Each group presents their findings on the board.			
LU2. Plan marketing tactics	Trainee will be able to: - Detail tactics to implement each marketing strategy in terms of scheduling, costing, accountabilities and persons responsible - Identify coordination and monitoring mechanisms for scheduled activities - Ensure tactics are achievable within organization's projected capabilities and budget - Ensure tactics meeting legal and ethical requirements - Ensure tactics provide for ongoing review of performance against objectives and budgets, and allow	- Main elements in a marketing mix. - Define branding and explain its potential advantages. - Describe the three basic distribution strategies. - Basic strategies used to determine prices. Practical Activity - Divide learners into two groups and conduct a debate. One group would defend and the other groups would reject the following statement: LOCATION IS NOT IMPORTANT BECAUSE PEOPLE WILL GO OUT OF THEIR WAY FOR ANY GOOD, SERVICE OR PRODUCT THEY	Theory-02 Hrs Practical-04 Hrs Total- 06 Hrs	Calculator Ruler Pencil	Class Room



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	marketing targets to be adjusted if necessary	REALLY WANT. Divide the learners into groups. Each group would select a business to start (welding shop, grocery store, auto repair shop, bakery, beauty salon, etc.). Have each group conduct research in their town to determine the best location for that business. Have each group present their findings to the class. The group should give both positive and negative factors regarding the location.			
LU3. Prepare and present a marketing plan	Trainee must be able to: - Ensure marketing plan meets organizational, as well as marketing, objectives and incorporates marketing approaches and a strategic marketing mix - Ensure marketing plan contains a rationale for objectives and information that supports the choice of strategies and tactics - Present marketing plan for approval	- Present items - Marketing Plan Practical Activity: Prepare a marketing plan of your proposed idea	Theory-02 Hrs Practical-04 Hrs Total- 06 Hrs	Calculator Ruler Pencil	Class Room



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	in the required format and timeframe • Adjust marketing plan in response to feedback from key stakeholders and disseminate for implementation within the required timeframe				
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11.24.4 Develop and review a business plan.

Objective: This module covers the process of developing and reviewing business for a small business enterprise. It requires the application of knowledge and skills to determine the scope of the business plan, prepare a business plan, determine goals, trial systems, and document, monitor and review the business plan.

Duration: 18.0 Hours

Theory: 06.0 Hours

Practice: 12.0 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Determine scope of business	Trainee will be able to: - Determine scope of the business plan and determine associated system in consultation with specialist personnel. Access accurate information for inform business plan development Account for and incorporate trends and seasonal variations into the business plan. Account for strategic goals, targets and directions of the	- What is a business plan? - Main types of business plans. - Parts of a business plan - Questions do you need to consider early in the process of developing a business plan. Practical Activity - Working in groups of four, use the Internet to research three business plan models. Record the parts of each plan and the order in which the parts are presented. What are the differences between the plan in the text and the plans you researched? What are the similarities?	Theory-02 Hrs Practical-04 Hrs Total- 06 Hrs	Calculator Ruler Pencil	Class Room



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	enterprise in the development of the business plan				
	• Comply Legal obligations in developing the business plan.				
LU2. Prepare business plan	Trainee will be able to: • Develop operational goals and targets to meet the enterprise strategic plan. • Identify and incorporate supply chains into the business plan. • Identify risk management needs are within the business plan. • Incorporate trial systems in order to test budgetary impact and operational potential prior to full implementation of the business plan. • Set clear and measurable indicators of operational performance to allow for realistic analysis of performance.	• Define business • Define Business plan Practical Activity • Prepare a business plan of your proposed and finalized idea incorporating the following information's: • title page (name of your business, your name and contact address) • summary of business objectives • table of contents • structure of your proposed business • the product or service I intend to sell • marketing plan (based on a simple market survey) • financial plan • what you expect your business to earn • other supporting documents, such as letters of recommendation, certificates of	Theory-02 Hrs Practical-04 Hrs Total- 06 Hrs	Calculator Ruler Pencil	Class Room



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		education and training, community service documents, etc.			
LU3. Document and review business plan	Trainee must be able to: • Include fiscal and operational systems that enhance performance management and suit enterprise requirements. • Incorporate resource considerations the business plan. • Document accurately and clearly communicate business Plan to all relevant parties. • Monitor to identify strengths, weaknesses and areas for improvement performance against the business plan • Make recommendations to improve the business plan and associated systems as required.	• Business plan drivers • Things to remember while preparing a business plan • Perspectives to be considered in business plan preparation • Who should prepare the business plan Practical Activity • Prepare power point of your business plan and discuss in the class	Theory-02 Hrs Practical-04 Hrs Total- 06 Hrs	Calculator Ruler Pencil	Class Room



11.24.5 Organize finances for the micro business.

Objective: This module describes the performance outcomes, skills and knowledge required to investigate the financial capacity to enter into a micro business, to determine the projected cash flow, to source finances and to monitor the profitability of the business.

Duration: 18.0 Hours

Theory: 06.0 Hours

Practice: 12.0 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1. Ascertain own financial position and the ability to provide capital/equity for the business	Trainee will be able to: - Realistically detail personal, family or community financial situation in terms of funds available and commitments already incurred - Determine equity finance and assets available for micro business from personal, family or community sources	- Components of a start-up investment - Types of financial statements (Balance sheet, income statement, and cash flow statement) - Break-even analysis Practical Activity - Form two teams. The first will plan for a new business that sells bakery item like donuts (made at another location and purchased wholesale). The second team will plan for a new business that sells umbrellas (made at another location and purchased wholesale). Each team will determine the business's required start-up investment. Research costs on the	Theory-02 Hrs Practical-03 Hrs Total- 05 Hrs	Calculator Ruler Pencil	Class Room



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		Internet. Each team will present its analysis to the class.			
LU.2 Determine projected cash flow for the business	Trainee will be able to: - Determine the level of forecast business activity over a year and the business mix - Estimate establishment costs for the business and repayment schedule for borrowings - Calculate the monthly variable and fixed costs needed to conduct business activity over a year - Estimate personal drawings needed to be taken from the business - Estimate the monthly income generated by the business for a year based on price per unit item or hourly charge rate for labor - Develop a cash flow budget for the first year of business operation	- Define debt financing - Define equity financing - Four specialized sources of financing that may provide either debt or equity funding. - Effects of debt financing and equity financing on the balance sheet. - Define and explain cash flow statement. Practical Activity - Prepare a proposed balance sheet and Income statement of your proposed business	Theory-01 Hrs Practical-03 Hrs Total- 04 Hrs	Calculator Ruler Pencil	Class Room



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	Seek professional advice to estimate goods and services tax and operating finance required for the business				
LU.3 Source the required funds to establish the business	Trainee must be able to: - Estimate required funding to establish and run the business based on expected sales and activity levels, available finances and commitments - Investigate methods of accessing alternative sources of finance - Identify strategies for meeting financial obligations	- Funds required to establish and run the business - Sources of finance and their assessment - Strategies for meeting financial obligations Practical Activity - Form groups of three. Each group will investigate a different investment companies and Banks. Each will present a short presentation describing the selected company. Make sure to indicate the types of businesses in which the company invests and whether most of the investments are debt or equity financing.	Theory-02 Hrs Practical-03 Hrs Total- 05 Hrs	Calculator Ruler Pencil	Class Room
LU.4 Monitor profitability of the business	Trainee must be able to - Maintain and review monthly expenditure and income records - Compare equity at beginning and end of a year to estimate	- Financial analysis of statement Practical Activity - Prepare proforma financial statements of your business	Theory-01 Hrs Practical-03 Hrs Total- 04 Hrs	Calculator Ruler Pencil	Class Room



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	business performance • Assess the financial viability of the business after a year of operation • Seek professional advice on depreciation, insurance and tax implications of the business				
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11.24.6 Manage human resources.

Objective: This module covers the skills and knowledge required to manage human resources and to manage and develop human resources to achieve organization's operational objectives

Duration: 10.0 Hours

Theory: 04.0 Hours

Practice: 06.0 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Lead and motivate people	Trainee will be able to: - Establish goals for people and teams to optimize achievement in work tasks. - Take into account the capabilities of people and teams. - Provide advice and support sensitive to the individual's needs to people in the performance of their duties. - Undertake activities to achieve commitment to common goals. - Recognize and encourage initiative and innovation - Recognize and communicate achievements within the organization.	- Define Lead to the people - Motivation for purpose. Practical Activity - Manage a group and lead them for Recognize and encourage initiative to sale your product.	Theory-01 Hrs Practical-1.5Hrs Total- 02.5 Hrs	Calculator Ruler Pencil	Class Room



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LU2. Undertake human resource planning	Trainee will be able to: • <i>Determine human resource needs</i> within the anticipated operational needs and allocated budget. • <i>Analyze alternatives to staffing levels which clearly demonstrate returns to the organization.</i> • <i>Develop contingency plans for staffing which meet key provisions of the human resources plan.</i> • <i>Compare existing competencies of staff with the needs of the work group.</i> • <i>Plan staffing levels and negotiate with stakeholders within the organizational framework to achieve maximum efficiency of operations.</i>	• Human resources • Planning Practical Activity • <i>Develop a contingency plan for an organization staffing which meet key provisions to the human resources plan.</i>	Theory-01 Hrs Practical1.5Hrs Total- 02.5 Hrs	Calculator Ruler Pencil	Class Room
LU3. Prepare record for transfer of store.	Trainee must be able to: • Negotiate performance criteria individuals, teams and work groups. • Review performance criteria as circumstances change.	• Preparation of record • Transfer a record • Storage the record Practical Activity	Theory-01 Hrs Practical1.5Hrs Total- 02.5 Hrs	Calculator Ruler Pencil	Class Room



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	Conduct performance appraisal based on clearly established and agreed performance criteria. - Identify and propose the total performance development system strategies to rectify performance shortfalls and recognize success. - Address performance problems confidentially and in a constructive and timely manner, in line with relevant organizational procedures. - Make selections, transfers and promotions in accordance with organization policies and supported with documented information. - Develop and implement mechanisms for the identification of human resource development needs within the work group taking account of the strategic plan for the organization.	Prepare and Develop the implement mechanisms for the identification of human resource development needs within the work group taking account of the strategic plan for record and transfer of store matters for that organization.			
LU4.Prepare receipt record of tools & plants-	Trainee must be able to Make information on planned training	- Differentiate between receipt and receipt record - Define tools & Plants	Theory-01 Hrs Practical1.5Hrs Total- 02.5 Hrs	Calculator Ruler Pencil	Class Room



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supplies	events widely available throughout the organization. • Include training, education and development plans as part of individual/team performance plans. • Facilitate individual/team access to, and participation in, training, education and development opportunities. • Contribute coaching and mentoring effectively to the training, education and development of personnel in an environment of change. • Enhance training, education and development opportunities of individual, team and organizational performance. • Create workplace environment is which facilitates training, education and development	• Define supplies Practical Activity • Develop a group and guide them for the importance of tools and plants for an organization. • Manage a training session for an organization member showing importance of Different supplies and their methods.			
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11.24.7 Market products and services.

Objective: This module covers the knowledge and skills required to prepare record of store (stock) debited to suspense account, prepare record of store directly charged to work, prepare record for transfer of store & prepare receipt record of tools & plants- supplies.

Duration: 16.0 Hours

Theory: 04.0 Hours

Practice: 12.0 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Analyze market information	Trainee will be able to: - Identify, research and analyze existing or new markets for existing or new products or services using techniques to ensure reliable data - Analyze past trends and developments to determine market variability and associated risks - Develop gross margin budgets to account for market variability - Identify and evaluate competing products to determine strengths and weaknesses of own products - Monitor market environment to ensure information is current and	- Define Analyzing - Define market information Practical Activity Visit in market and collect information for rates, quality and quantity for desire items	Theory-01 Hrs Practical-03Hrs Total- 04 Hrs	Calculator Ruler Pencil	Class Room



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	reliable - Identify the legal, ethical and environmental constraints of the markets and their effect on the enterprise - Identify product specifications that suit market requirements and price advantage at the time - Present clear and concise information to the enterprise management team.				
LU2. Prepare record of store directly charged to work.	Trainee will be able to: - Identify stores debited to debit to final head of account-Tools & plants, road metals, materials charged to work. - Identify stock articles requiring no prior sanction- materials charged to work. - Identify stock articles requiring prior sanction- tools & plants. - Record sales Account on Form	- Define store - State directly charged item Practical Activity Prepare sales Account record for photo copier paper on Form DFR DW-10 for an entire area.	Theory-01 Hrs Practical-03Hrs Total- 04 Hrs	Calculator Ruler Pencil	Class Room



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	DFR DW-10				
LU3. Prepare record for transfer of store.	Trainee must be able to: • Get issued indent book (Form PFR-26). • Record items required for consumption on indent book. • Get approval of authority. • Receive store and record on consumable Stock registers. • Receive tools & plants and record on durable goods Stock register.	• Define store • Transfer of store items Practical Activity 1. Prepare Record for consumable and permanent items used in your computer sales office.	Theory-01 Hrs Practical-03Hrs Total- 04 Hrs	Calculator Ruler Pencil	Class Room
LU4. Prepare receipt record of tools & plants-supplies	Trainee must be able to • Record delivery of items-Inward gate pass, Goods Delivery challan • Get inspected store items- Technical Evaluation committee, Goods Inspection Report • Record accepted store items in register-Goods receiving Note, Stock Register. • Get prepared Stock Entry Certificate for store items	• Gate pass • Indent • Delivery challan • Record item register • Store item certification Practical Activity Prepare Record for delivery of items with Inward gate pass for your sports item production.	Theory-01 Hrs Practical-03Hrs Total- 04 Hrs	Calculator Ruler Pencil	Class Room



11.24.8 Monitor and review business performance.

Objective: This module covers the knowledge and skills required to prepare record of store (stock) debited to suspense account, prepare record of store directly charged to work, prepare record for transfer of store & prepare receipt record of tools & plants- supplies.

Duration: 16.0 Hours

Theory: 04.0 Hours

Practice: 12.0 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Evaluate commercial performance	Trainee will be able to: - Gather and analyze data relating to enterprise performance to identify historical and current performance. - Review and analyze operational structures to determine the suitability of organizational processes to enterprise objectives. - Evaluate enterprise strengths and weaknesses against market conditions to determine current and future capacities. - Evaluate enterprise objectives are to identify variations and scope for	- Financial analysis techniques, including: - benchmarking - cost benefit analysis 'what if?' analyses - time series and trend - expenditure and revenue ratios - break-even analysis - accounting standards - cash flow schedules Practical Activity Prepare Record for sale items which show commercial performance.	Theory-01 Hrs Practical-03Hrs Total- 04 Hrs	Calculator Ruler Pencil	Class Room



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	future development.				
LU2. Allocate and co-ordinate business resources	Trainee will be able to: - Identify and communicate roles and responsibilities of personnel. - Identify resource requirements for enterprise and cost them using standard financial analysis techniques. - Calculate costs of ensuring sustainability of enterprise operations and factor into business planning for the enterprise.	- resource requirements for enterprise - Costs of sustainability of enterprise operations and factor into business planning for the enterprise. - roles and responsibilities of personnel. Practical Activity Prepare coordinates for purchase and sale.	Theory-01 Hrs Practical-03Hrs Total- 04 Hrs	Calculator Ruler Pencil	Class Room
LU3. Identify performance requirements	Trainee must be able to: - Develop realistic performance indicators within available timeframes and resources - Identify and minimize factors inhibiting performance against objectives. - Monitor and assess market	- Performance indicators within available timeframes and resources - Monitoring and assessment of market conditions - Strategies and programs to promote the sustainability of operations - types of data to be analyzed to indicate business performance,	Theory-01 Hrs Practical-03Hrs Total- 04 Hrs	Calculator Ruler Pencil	Class Room



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	conditions based on relevant data. • Prepare and incorporate strategies and programs to promote the sustainability of operations into enterprise procedures.	including: • financial indicators • non-financial indicators Practical Activity Prepare performance indicators resources for your business.			
LU4. Review business performance	Trainee must be able to • Review regularly enterprise operations to identify opportunities for improvements in performance. • Monitor and anticipate impact of natural conditions on enterprise to assess sustainability of resource use. • Compare costs and estimates with resource allocation. • Determine operational plans to determine schedule of activities	• Define business • Type of business • Define enterprises • Cost estimate • Operational plans • Schedule for activities Practical Activity • Prepare report for business performance for house hold electrical items.	Theory-01 Hrs Practical-03Hrs Total- 04 Hrs	Calculator Ruler Pencil	Class Room



11.24.9 Negotiate for resolving business issues

Objective: This module covers the knowledge and skills required to prepare record of store (stock) debited to suspense account, prepare record of store directly charged to work, prepare record for transfer of store & prepare receipt record of tools & plants- supplies.

Duration: 16.0 Hours

Theory: 04.0 Hours

Practice: 12.00 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Develop and implement issue resolution and grievance procedures	Trainee will be able to: - Establish problem solving/issue resolution procedures within legislative requirements and organization's guidelines. - Manage grievances and complaints are in a timely and caring way to optimize likelihood of a favorable outcome for all parties and in line with organizational objectives and procedures. - Document and communicate individual's rights and obligations under industrial awards/agreements and	- Define negotiation - Importance of negotiation in business - Ways to prepare for negotiation - Techniques for conducting negotiation - Benefits of negotiated agreements - Relationship of values with negotiation - Negotiation with people from other cultures Practical Activity - With a partner, write a dialog between two parties negotiating for a large purchase to be delivered by the end of the month. Specify other details of the negotiation to make it more realistic. One partner should repeatedly act uncooperative or confrontational, while	Theory-02 Hrs Practical-06Hrs Total- 08 Hrs	Calculator Ruler Pencil	Class Room



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	legislation are in a clear and concise manner and in appropriate language. • Conduct hearings, interviews and meetings within the principles of industrial democracy and participative, consultative processes. • Identify and invite all relevant industrial parties to participate in the resolution process.	the other tries to keep the process moving forward. Perform your dialog for the class.			
LU2. Manage disciplinary matters	Trainee will be able to: • <i>Implement disciplinary matters in accordance with organization's procedures.</i> • <i>Conduct investigations in a caring and confidential manner to maintain performance and morale.</i> • <i>Provide feedback promptly.</i> • <i>Institute appeals processes in accordance with organizational</i>	• behavior of people in conflict situations, • incident management techniques using negotiation • indicators of neglect and abuse particularly in young people • instructions and procedures for responding to security risk situations • legal provisions relating to duty of care of self and others • limits of own responsibility and authority • observation and monitoring techniques	Theory-02 Hrs Practical-06Hrs Total- 08 Hrs	Calculator Ruler Pencil	Class Room



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	<i>procedures.</i> • <i>Recognize and recommend deficiencies in procedures for changes made</i>	• operational functions and procedures for the use of communications, security and personal protection equipment • principles of effective communication including techniques • procedures and requirements for documenting security incidents • reporting structure and processes Practical Activity • Write a dialog between two parties negotiating <i>Implement disciplinary matters</i> in accordance with organization's procedures to <i>investigations in a caring and confidential manners.</i>			
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12. List of Tools, Equipment and Consumable

Inspection and Testing of Steel Structures			
S#	Tools and Equipment	S#	Consumable Material
1.	Calculator	1.	Graph Paper
2.	Rockwell hardness testing machine with accessories,	2.	Lead Pencil
3.	Brinell's hardness tester with accessories	3.	Rubber
4.	Allen key,	4.	Specimen metallic plates.
5.	Indenter.	5.	Steel bars.
6.	Universal testing machine,	6.	Metallic wires.
7.	Vernier calipers,		
8.	Mild Steel Rod of given dimension		
9.	Steel rule.		
10.	Strain gauge		
11.	Young Modulus apparatus along with accessories		

Hydraulics Engineering

S#	Tools and Equipment	S#	Consumable Material
1.	Piezometer.	1.	Drawing sheet
2.	Water tank.	2.	Eraser
3.	Hydraulic Bench	3.	HB, H, 2H, 3H Pencils
4.	Metacentric Height Measuring Apparatus:	4.	Scotch tape
5.	Hydrostatic Pressure App.		
6.	Venturi meter App.		
7.	Manometer (U-Tube)		
8.	Flow Over Weir Apparatus		



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9.	Pitot Tube		
10.	Energy Losses In Pipe Apparatus		
11.	Current Velocity Meter		
12.	Friction in pipes apparatus.		
13.	Orifices.		
14.	Vee and trapezoidal notches.		
15.	Weirs		
16.	Drawing board		
17.	T square		
18.	Pair of Set squares		
19.	Drawing Box (Compasses, divider, protractor, rule)		
20.	Sharpener/ Sand paper		

Entrepreneurial Skills

S#	Tools and Equipment	S#	Consumable Material
1	Calculator	1.	Pencil
2	Ruler	2.	Eraser
3			



13. Members of Curriculum Development Committee

The following members participated in the Curriculum development Committee:

S#	Name	Designation	Organization
1	Engr. Azhar Iqbal Shad	Chief Instructor (Civil)	GCT Raiwnd Road, LHR
2	Mr. Imtiaz Ahmed Awan	Sr. Instructor (Civil)	GCT Rasul (Mandi Bahauddin)
3	Mr. Muhammad Amjad Rafique	Sr. Instructor (Civil)	GCT Rasul (Mandi Bahauddin)
4	Mr. Nadeem Zaigham	Sr. Instructor (Civil)	GCT Raiwnd Road, LHR
5	Mr. Tahir Mahmood	Sr. Instructor (Civil)	GTTI Mughalpura Lahore
6	Engr. Norheen Amina	Consultant	Allied Engineering Services Lahore
7	Engr. Hira Ishtiaq	Consultant.	Allied Engineering Services Lahore
8	Engr. Habiba Mohsin	Design Engineer	JERS Engineering Consultants Lahore
9	Engr. Rebab Maria Mahmood	Site Engineer	IMC Lahore/ Industry
10	Engr. Arsalan Hameed Khan	Assistant Manager (Project)	Planning & Project department Lahore Waste Management Company.
11	Engr. Muhammad Usamn Hayder	Project Manager	Muzaffar Sons Construction Private Lahore
12	Engr. Inayat-ur-Rehman	DACUM, Facilitator	Peshawar
13	Mr. Muhammad Ishaq	Director HR	NAVTTTC, Islamabad